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Establishing Visibility across Value Chain of a Beverage Giant by Implementing Flexible Systems

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Abstract

Globalization has brought in enough complexity in today's business. It requires business to become more cosmopolitan. As a result, the supply chain has become a vastly complex network of vendors, distributors and complementors. It is imperative that Visibility across the value chain is a challenge and needs to be addressed. The complexity and chaos has led to emergence of unavoidable paradoxes that a business house needs to balance. The successful companies in today's world strive to excel by balancing the paradoxes by implementing flexible systems. Every system has three dimensions – people, process and technology. It is a major concern as companies seek affectivity in their global operations. Most of the supply chain managers struggle with getting accurate and timely information to run their global operations at a time when the free flow of the information is readily available to the most of the world through the internet. The objective of this article is to identify measures taken in three dimensions of management system to come out with a solution to address challenges in visibility across the value chain.

Introduction

Today's businesses are getting complex day by day. Businesses are no longer limited to single geography or single territory but businesses are getting spread in multiple geographies. If we take the case of country like India, which looks like a commonwealth of states with distinct identities and culture, the businesses need to think differently. As Ruchir Sharma says "Brand managers need to think of India as a United States of Europe and deal accordingly with the problem of selling goods in a nation where even the dates and names of holiday season-as well as the peak seasons for brand advertising-shift state by state". (Sharma, 2012) In order to serve customer better and to meet local needs businesses are trying to use differential pricing across territories, so same product is sold to different distributers at different price point. Price discrimination or price differentiation exists when sales of identical goods or services are transacted at different prices from the same provider. Differential pricing have lot of embedded problems with it. The moment the seller tries to sell the same good at different prices, the buyer at the lower price can arbitrage by selling to the consumer buying at the higher price but with a tiny discount. If we take the case of Soft drinks in India then companies use differential pricing at the level of distributer keeping the retail price same. This leads to cross territory infiltration. In order to prevent that material traceability is must.

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Apart from infiltration, in recent years the increased demand for material traceability has been driven by competitive pressures for improving product quality and to meet certain regulatory guidelines especially in Food and Beverage items. In Europe requirements set down in Article 17 of the Framework Regulation (Regulation (EC) No 1935/2004) on materials and articles in contact with food is one such example.

The most internationally recognized definition of traceability defines it as the "ability to trace the history, application or location of an entity by means of recorded identifications" (ISO 8402). There are however other definitions, such as the one contained in the General Food Law - Council Regulation (EC) No. 178/2002 and the one established by the Codex Alimentarius Commission.[1]

This paper addresses the business objective of physical tracking of finished goods material through use of technology across the supply chain in Beverage Industry and also the challenges in implementation of the said solution. The solution enumerated in this concept note has been built considering the tracking of material across primary channel for the pilot phase. However the solution gives a framework to further extend it across the supply chain.

This paper also points out to current state of business processes, problems in current state and the future state of business process. We have also tried to create generic procedures for implementing the solution. This would help researchers and organization to create similar solutions in other places.

This study and solution is carried out in Varun Beverages Ltd (VBL).

The Relevance of Material Traceability in Varun Beverages Ltd.

Varun Beverages Ltd (VBL) is the largest Pepsi Bottler in South East Asia. Apart from operating in India VBL also operates the Pepsi bottling business in Sri Lanka, Nepal, Mozambique, Morocco and Zambia.VBL has been bottling Pepsi products in India since 1991. Currently the brand portfolio of products manufactured by VBL includes refreshment brands Pepsi, Diet Pepsi, 7 UP, Miranda and Mountain Dew, Everess Soda, in hydrating and nutritional beverages such as Aquafina drinking water, Juice based drinks – Tropicana, Tropicana Twister, Slice, and Nimbooz lemon drink. VBL has selling & distribution rights in territories of East Delhi, Western U.P., part of M.P., half of Haryana, whole of Rajasthan, Goa, 3 districts of Maharashtra, North East, West Bengal, and the entire countries of Sri Lanka, Nepal, Mozambique, Morocco and Zambia. The group has in total 10 bottling & manufacturing plants globally, and is responsible for producing and marketing 40% of Pepsi's beverage business in India.VBL needs to do a differential pricing across territories to promote sales and counter competition. This is normally administrated by giving some free products along with the main product. This concept is called ***scheme*** in business slang language. So a ***two bottle scheme*** would mean that for one carton of any particular brand/pack of soft drink distributer would get two bottles of the same brand or some other brand free. Sometime this leads to infiltration from one territory to another territory. Normally all the distributers are bound by some code of conduct and they are not supposed sell the product to any other territory but since tracing of material is quite difficult this happens in some territories. This cross territory movements can lead to financial loss and incorrect volume (sales) reporting.

Apart for preventing cross territory movements this exercise have other business drivers also as shown in figure 1.

Figure 1: Key Drivers for Material traceability in Supply Chain

Literature Survey

Flexible Management Systems

Flexibility is one of the most talked subjects in today's word in the context of an organization. In this section we would review the flexibility concept and would elaborate on SAP-LAP frameworks proposed by Sushil (Sushil, Concept of Systemic Flexibility, 2000).

As per Wikipedia "Flexibility is used as an attribute of various types of systems. In the field of engineering systems design, it refers to designs that can adapt when external changes occur. Flexibility has been defined differently in many fields of engineering, architecture, biology, economics, etc. In the context of engineering design one can define flexibility as the ability of a system to respond to potential internal or external changes affecting its value delivery, in a timely and cost-effective manner. Thus, flexibility for an engineering system is the ease with which the system can respond to uncertainty in a manner to sustain or increase its value delivery. Uncertainty is a key element in the definition of flexibility. Uncertainty can create both risks and opportunities in a system, and it is with the existence of uncertainty that flexibility becomes valuable." (Wikipedia, 2012)

In Webster's Collegiate Dictionary, flexibility is defined as the quality of being capable of, responding to or conforming to changing or new situations. (Upton, 1994) defines flexibility as "the ability to change or react with little penalty in time, effort, cost and performance".

According to (Bahrami, 1992), flexibility is "a multidimensional concept demanding agility and versatility, associated with change, innovation, and novelty, coupled with robustness and resilience, implying stability, sustainable advantage and capabilities that may evolve over time".

All these definition suggests that flexibility is something which is desired in positive context. According to (Sushil, Concept of Systemic Flexibility, 2000), flexibility has various meanings as per the context. Some of the important ones are: adaptive to the changes in environment, adjustment to situation, agility in action, amiability in relationships, autonomy in functioning, balance in competing opposites, broadening of mind, compromising for betterment, contingency

in planning etc. This is only a partial list. Besides, there are various types of flexibilities in an enterprise, such as strategic flexibility, organizational flexibility, manufacturing flexibility, information systems flexibility, operational flexibility, technology management flexibility, supply chain flexibility etc.

So the concept of flexibility is multi-dimensional in nature. Sushil uses the concept of paradox to further elaborate this multi-dimensionality of flexibility. A paradox is in the form of a pair of polar opposites: a thesis and an antithesis, forming a continuum from thesis to antithesis. In the organizational context, some leading paradoxes are centralization-decentralization, continuity-change, and stability dynamism and so on. He argues that simply by moving from the thesis to the anti-thesis, one does not necessarily bring in flexibility; rather the system may lose its identity if pushed to anti-thesis. For example, if an organization with high degree of centralization opts for extreme decentralization, it may lead to disintegration or fragmentation of the organization. A flexible organization would be a collective bimodal or multi-modal organization having centralization and decentralization at the same time and changing their degree over time as per the requirement.

From the above elaboration, Sushil defines flexibility as “the exercise of free will or freedom of choice on the continuum to synthesize the dynamic interplay of thesis and anti-thesis in an interactive and innovative manner, capturing the ambiguity in systems and expanding the continuum with minimum time & efforts.”

(Sushil, SAP-LAP Framework, 2001)has developed a Flexible methodology to analyze a particular organization. This methodology or framework is used by various researchers in past. This methodology envisages a SAP-LAP framework. The SAP (Situation – Actor - Process) analysis first maps these three components, namely, “situation”, “actor” and “process” out of the existing organizational state to define the dynamic interplay of reality. “Situation” is the present status, potential for growth or decay and present and future state-of-the-art etc. The participants who influence the situation and alter it by their actions or inaction are termed as “actors”. The procedural steps taken by the “actors” who alter the “situation” are termed as the “process”. Any dynamic behavior that alters the “situation” has the potential of being a “process”. The situation, actor and process and their interplay comprise the SAP framework, where the freedom of choice lies with the actors. If the actors have more freedom, the processes will become flexible and adaptive to cope with the changing situation.

The SAP analysis leads to the second phase of the analysis called LAP synthesis, which has three components, namely, “learning issues”, “actions” and “performance”. Learning issues emphasize the typicality of the situation as well as some features of its uniqueness. One has to learn about the situation, actor and process and bring out key learning issues of interest. Based on the learning, action is to be taken on the fronts of the situation, actor or process or the relevant interfaces. Depending upon the effectiveness of actions, performance is generated in terms of improved processes/ actors and better situational parameters. In a business situation, the performance parameters could be market share, profitability, quality, productivity, competitive advantage, core competence etc.

Approach

The name of the Studied Organization is Varun Beverages Ltd (VBL). Following approach is followed while devising a solution strategy for the said organization.

Key Stakeholder Identification and Perception Capturing

- As part of this exercise, key business function stakeholders were identified and project background and initiative was discussed.

- All relevant CXO level was interviewed and their vision was captured for future state of business. This helped in understanding the future outlook of organization.
- An understanding of the business function was gathered and how the function shall influence the solution or how the function shall get influenced as a result of the solution was discussed. Identification of Business Requirements and Pain Points was done.
- During these discussions, perceptions of each of the stakeholders about the possible solution was identified and discussed in detail as the same needs consideration while designing a solution.

Feasible Solution Option Evaluation

- Concept of Flexibility understood and SAP-LAP framework is applied to analyses the problem.
- Existing solution in traceability area are studied and different approaches to achieve the same were discussed with Key Stakeholders and users.
- Different feasible solution options were considered and evaluated and discussed.

Base Line Study

- Base Line study majorly emphasizing on the aspects of 'Time and Motion" study of the different warehouse operations to identify trends, patterns, pain points as well as time estimation at low level.

Conceptual Solution Socialization

- Based on the discussions and base line study, Conceptual Solution was socialized amongst stakeholders

Finding Key Business Drivers / Objectives

- As a result of these discussions, the Key Business Drivers and Objectives of the Project emerged and have been detailed and shared with all the stakeholders.
- A solution prototype was developed and shown to users and their feedback is incorporated in design of final solution.
- Field Device demo was conducted at selected line and plant with representative hardware devices to validate the conceptual design

Base Line Study: Current Business Process

Distribution Channel

We have studied the existing distribution channels of VBL. The material movement takes place as per figure 6.

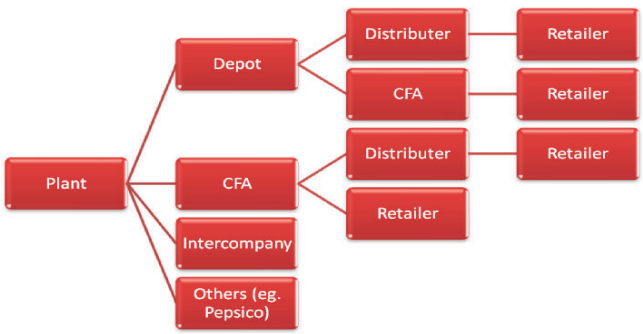


Figure 6: Different Distribution Channels of VBL

VBL has its own depot at different places to facilitate the distribution. Company also uses C&F Agents for the same. All distributers and CFA are bound by the code of conduct that they would not indulge in cross territory movement. In case they are found to do the infiltration their distribution rights may cease to exist. Our objective is to track the material found in other territory and to determine the original distributer whom this material was sold. Many time in order to hide the identity of carton/case, cartons are destroyed by infiltrating party and VBL gets only the bottle at the site. So any solution should be able to track the individual bottle.

We have studied the business processes and production processes of one Plant (Kosi) in VBL.VBL uses SAP ECC 6.0 as a business application which supports production, dispatch and sales process. With the interaction with various stakeholders we came to know that cross territory movement (Infiltration) problem is limited to PET bottles. In RGB (Returnable Glass Bottle) this problem does not exist as with every truck load of purchase by distributer, he has to return the empty glass bottles back to VBL.

In Kosi plant the fastest line is of 600 BPM (Bottle Per Minute). With 90% of efficiency this line produces 32400 cases/day, which turns out to be around 23 cases/min. We have focused our attention to this line as any solution working with this high speed line is bound to work for other slow lines (200 BPM).

Production Line

The production process starts with bottling of beverage in PET bottles. The time of bottling along with MRP details are printed on each bottle. The sealed bottles are then put in cartons/ shrink packs by automatic process.Once sealed, the cartons/shrink packs move towards the unloading area. Here workers lift this case/carton and put it on the pallet. They have to be very fast as they receive a new case every three seconds. Normally three pallets are filled simultaneously.

Pallet movement takes place using a Forklift. In case of Hot loading the Pallet created on the line is directly moved to the Loading Area / Truck, else the Pallet is moved to a designated Storage Area in the Warehouse.Figure 7 depicts the current process.

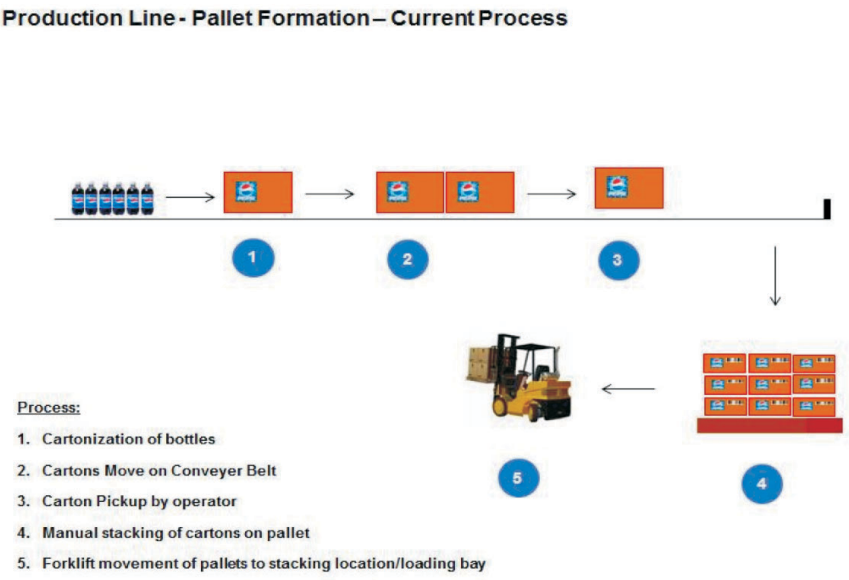


Figure 7: Existing process at Production Line- Pallet Formation

Batch: Current State

Currently only one type of batch is being maintained (offline and also in SAP) by Quality department which is called a Production Batch. This batch is a unique id allocated to the flavor concentrate of designated units to be produced across production line(s) of a given plant.

The production batch is a unique 4-digit sequence prefixed with "B", for each plant (all production lines) which is refreshed every new calendar year. This batch along with other information is printed on each and every individual bottle in laser print or continuous inkjet print or both. A sample indicative format of this information printed on the bottle is as below:

B0220 L1 RS 540
12/05/2011 11:13a

where,

B0220	:	represents the unique batch id designate to the concentrate prior to commencement of production.
L1	:	Production Line-ID. This value is unique for a given plant.
RS 540	:	Maximum Retail Price of the carton/case depending upon the SKU
12/05/2011	:	Date of Production (Filling)
11:13a	:	Time of labeling the bottle after filling and capping. Usually there is a static time difference between the time of filling and time of labeling batch info.

Batch Monitoring

The production batch is monitored at periodic intervals by the quality department for measuring variations in quality parameters. This interval currently is approximately 1 hour and the beverage within this duration is considered as homogeneous in terms of quality. This is the lowest level at which the product quality is considered as static for any changes in the quality parameters from tracking purpose.

Apart from scheduled checks, ad hoc quality checks are also performed based on issue reported on the line as and when they occur. Feedbacks (measurements, specific instructions, reasons of occurrence of the issue, reporting time, duration of stoppage etc.) for all the scheduled and unscheduled checks are logged in an offline register for reference purposes in case of a requirement for tracking the product quality as and when needed.

Warehouse

The pallets are moved from the production line to the storage bays by the Forklift and stored there. At the time of dispatch, the pallets are picked from respective storage bays by the Forklift operators and moved to pre-designated loading bays as per dispatch instructions. Within warehouse, sometimes pallet to pallet transfer of cartons also occurs. In case there is shortage of space or shortage of pallets then pallets are first de-palletized and stored in warehouse. As the time of loading, cartons are manually palletized then transferred to loading bays.

Dispatch Area

The Dispatch process begins by creating an outbound delivery against the sales order in SAP ECC 6.0. Based on this a loading slip is generated & handed over to the to the Forklift driver for picking operation. Forklift moves to the respective storage bay and the entire process of

Warehouse-out operation is followed based on where the stock is kept.

Once the picking operation is complete the Forklift moves from the picking location to the Loading area. The pallet is directly staged on to the Truck Floor by a Fork Lift. This is followed by manual stacking of Cartons onto the truck floor. Once the truck is completely loaded, the loading is confirmed by the checker. Documents viz. gate pass and invoice is handed over to the transporter and the truck moves out of the Warehouse / Yard.

Dispatch Scenarios

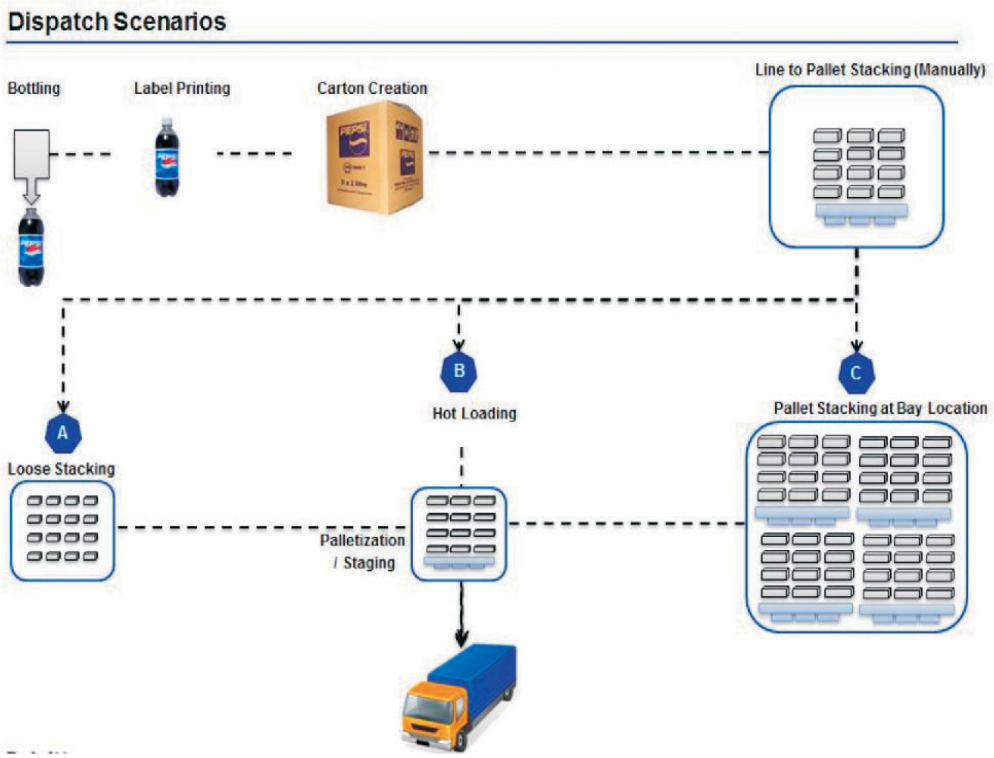
We found that there are three kinds of dispatch scenarios for transferring the material to loading bays. We will call them as A, B and C Scenario.

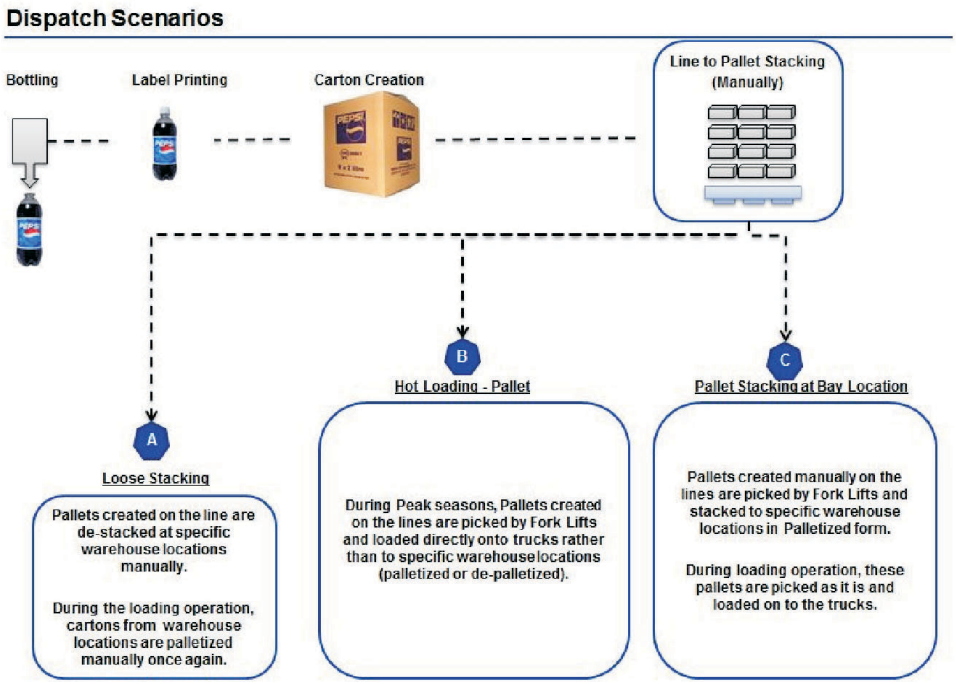
A. Loose Stacking: Pallets created on production line are de-stacked at specific warehouse location manually. During the loading process carton from warehouse locations are palletized manually once again and transferred to loading bays.

B. Hot Loading : During peak seasons, pallets created on production line are picked by fork lifts and loaded directly into trucks rather than to specific warehouse locations. So there is no need of any storage, stacking or de-stacking.

C. Pallet Stacking : Pallets created manually on the lines are picked by Fork Lifts and stacked to specific warehouse locations in Palletized form. During loading operation, these pallets are picked as it is and loaded on to the trucks.

All three scenarios are depicted in figure 8 and 9. Proposed solution should be able to cater all threescenarios.





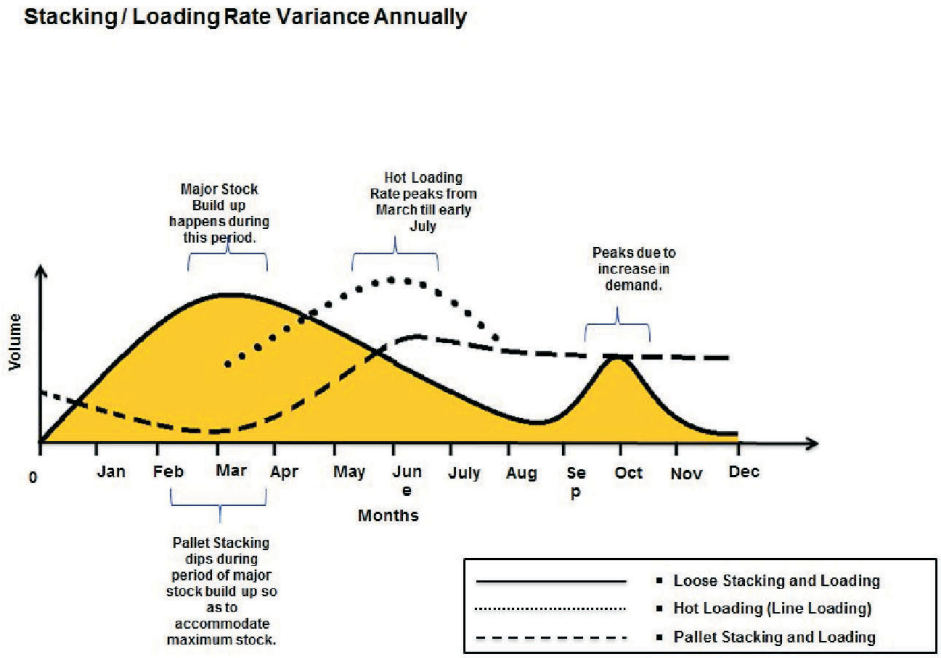


Figure 11 and Figure 12 depicts the graph of production rate and loading rate at different time.

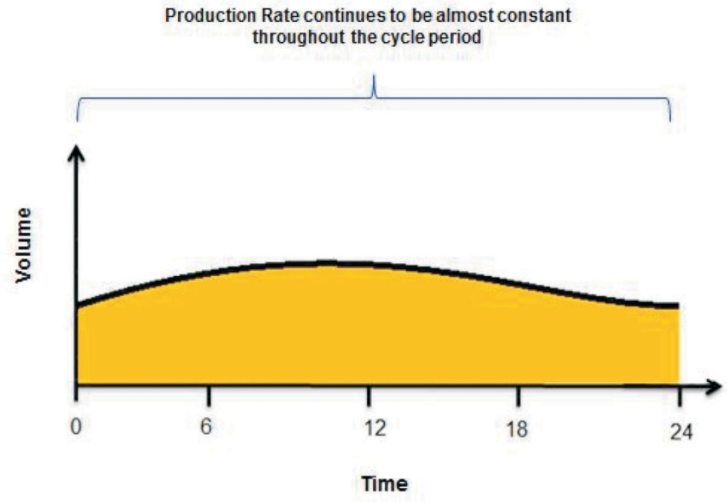
Soft rink is a seasonal industry. Maximum sales of soft drinks in India happen during the summer period and in order to cater that sale VBL prebuilds the stock of certain SKUs. This

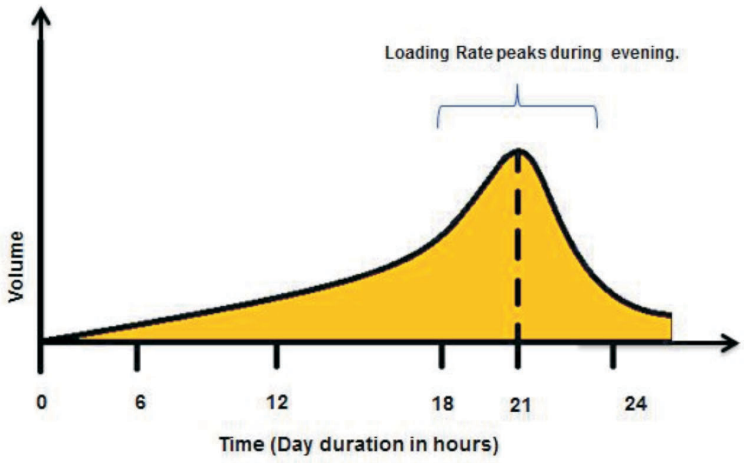
affects the dispatch scenarios across months. Figure 10 depicts the graph of different dispatch scenarios in different months.

Production Rate versus Loading Rate

During our study we found that during peak season production line runs 24 hours in a day and clocks an efficiency of 85-90% for a single flavor. Theoretically dispatch department also works 24 hours so loading of trucks and dispatch should happen throughout and uniformly but practically dispatch rate is different at different time period and it normally peaks during evening hours and comes to nearly zero in morning hours.

During season in order to cater very high volume of dispatch multiple bays of truck loading are used. The peak volume of dispatch from one plant can touch to 1.2 lac physical cases/day, which roughly turns out to be 120-130 trucks/day.





Time and Motion Study

Following processes were studied and detailed Time and Motion study was carried out

- Truck Load Time
- Carton Stacking times (De-palletization on truck)
- Forklift Turnaround times

Some of the results of the same are attached in Appendix -1. Some of the observations after Time and Motion study are as follows.

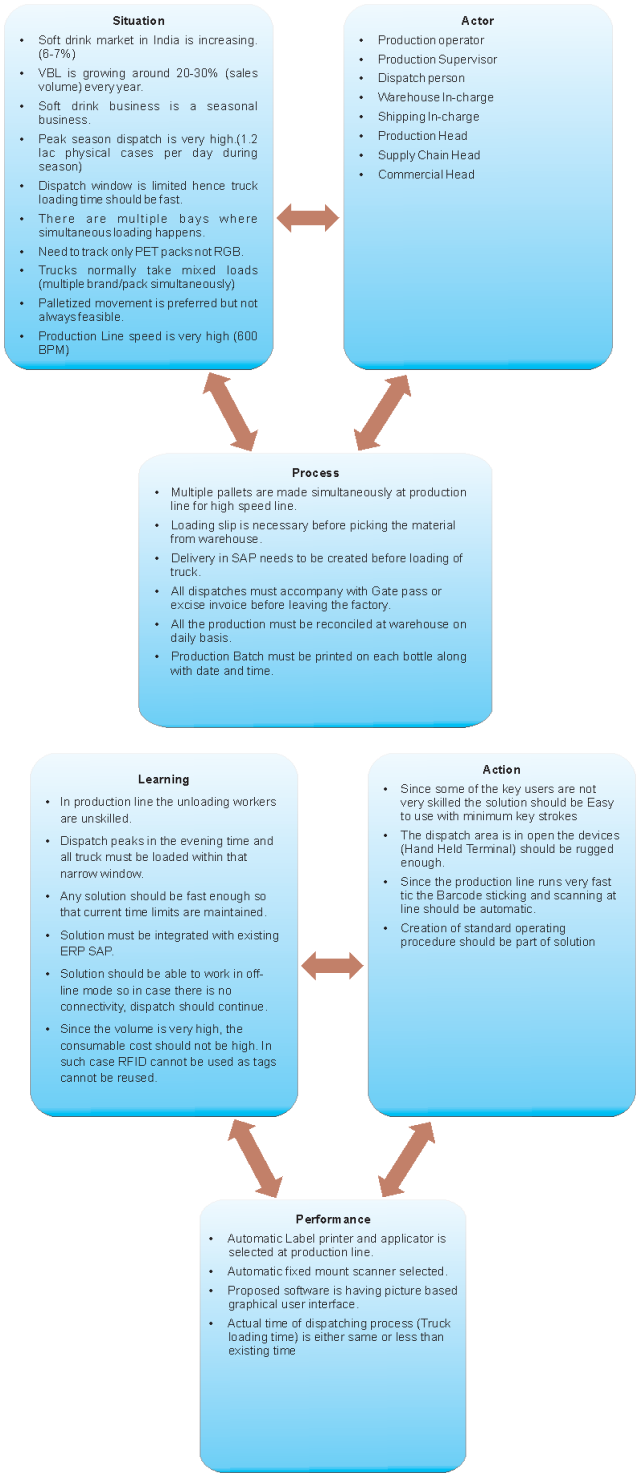
Average Truck loading time is around 2 hour with a maximum of 2 hours 40 min and minimum at 1 hour 45 minutes. If there is only one product is to be loaded on the truck then truck loading time reduces while it increases for mixed load (multiple SKU) trucks. Truck loading time is function of three main activities. Forklift turnaround time, Carton Stacking time and carton counting time.

Average fork lift turnaround time is 115 seconds or 1.9 minutes while Average Carton Stacking time for one palate is around 2.65 minutes. So for big truck in which 33 pallets are being loaded this would come to around 2 hours 30 min. We assume that carton counting time would overlap with forklift turnaround time. The proposed solution should not increase the Truck load time so any activity of identification (like scanning) must overlap with existing time lines.

So if we assume scanning for the identification purpose then scanning time per carton would be 1 sec/carton. The total working on peak load would be as follows.

Sl #	Activity	Transaction Value	Transaction Unit
A	Total Dispatches (Boxes)	120000	Per Day
B	Avg. Truck Load	1000	Cartons
C: A/B	# of Trucks	120	Per Day
D	# of Bays	10	Number
E: C/D	Avg. Truck Load Per Bay	12	Number
E1	Avg. Pallet Load	30	No. of Cartons
E2	Avg. No. of Pallets per Truck	33	No. of Pallets
F	Scanning Time (Per Carton)	1	seconds
G	Carton Orientation Time	2	seconds
H	Loading Time (Per Carton)	5	seconds
I: (F+G)	Total Scanning Time	3	seconds (Per Carton)
J	E1*I	90	seconds (Per Pallet)
K	B*I	3000	seconds (Per Truck)
L: (J/K)%	Non-Overlap Time (%)	3%	
M: K*L	Non-Overlap Time (Seconds)	90	
N: K*E	Total Scanning Time	30000	Seconds (Per Bay)
O: N/60		8.33	Hours (Per Bay)

SAP-LAP Analysis of Existing Process



Solution

This section details about the future state process and the technological architecture of the

proposed solution.The solution envisages individual tracking of both sales and handling units in the system. Sales unit in our case is a carton or shrink wrap and handling unit is pallet. Sales units will be tracked using unique ten digit alpha numeric code. The ten digit code will contain the complete information of the carton. All pallets would be uniquely identified with a permanent ten digit barcoded id. During the production one unique barcode would be placed on each carton or shrink-wrap. During unloading from conveyer an association would be built between a pallet and cartons which are loaded in that particular pallet.

During the process of pallet building on the production line technological solutions will allow tracking of the cartons which constitute the pallet. This information will be stored in the system. During dispatch, technology will be used to track the pallet which is being shipped against the given delivery.

The solution will store information of each carton and the delivery against which it was shipped out of the plant. The information that is stored for each carton will also have the time slot during which the bottling was done. This will enable the system to establish a link between the time of bottling and the carton. The solution enabled using bar code will bring about complete visibility of movement of physical material and will enable reverse tracking of the same at the time of market visits.

Detail Design

The purpose of this section is to synthesize the information gathered during interview phase and transpire that knowledge into a detailed designs document for implementation. The analysis was done keeping in mind the concept of flexibility. The objective was to increase visibility across value chain by implementing Flexible management system.

Scope

Part of the project solution involves three functional areas:

1. Production Line Activities
2. Warehousing Activities
3. Dispatch related Activities

Production Line - The scope of solution includes generating and printing of bar code labels on the cartons automatically using LPA (Label Printer Applicator), scanning carton labels using Fixed Mount Scanners and forming carton id-pallet id associations at the end of the production line using a hand-held scanner to scan the pallet bar code labels.

Warehouse- The solution covers activities related to transferring associations within:

a. Pallet to Virtual Pallet

b. Pallet to Pallet

c. Allocation/De-allocation of Carton IDs to/from Pallets/Virtual Pallets

Dispatch: The activities will briefly cover following areas:

a. Dispatch confirmation from Pallet (Physical as well as Virtual)

b. Dispatch confirmation from Cartons

c. Allocation/De-allocation of Carton IDs to/from Pallets

Assumptions

- The solution is being designed assuming that PET line of business will be covered in the first phase.

- Only primary dispatches are being considered from the plant.

This section will explain the indicative future state business process post implementation of the material tracking solution. Due to high dynamics involved in the beverage business, the design may evolve further in order to ensure better alignment with organization needs.

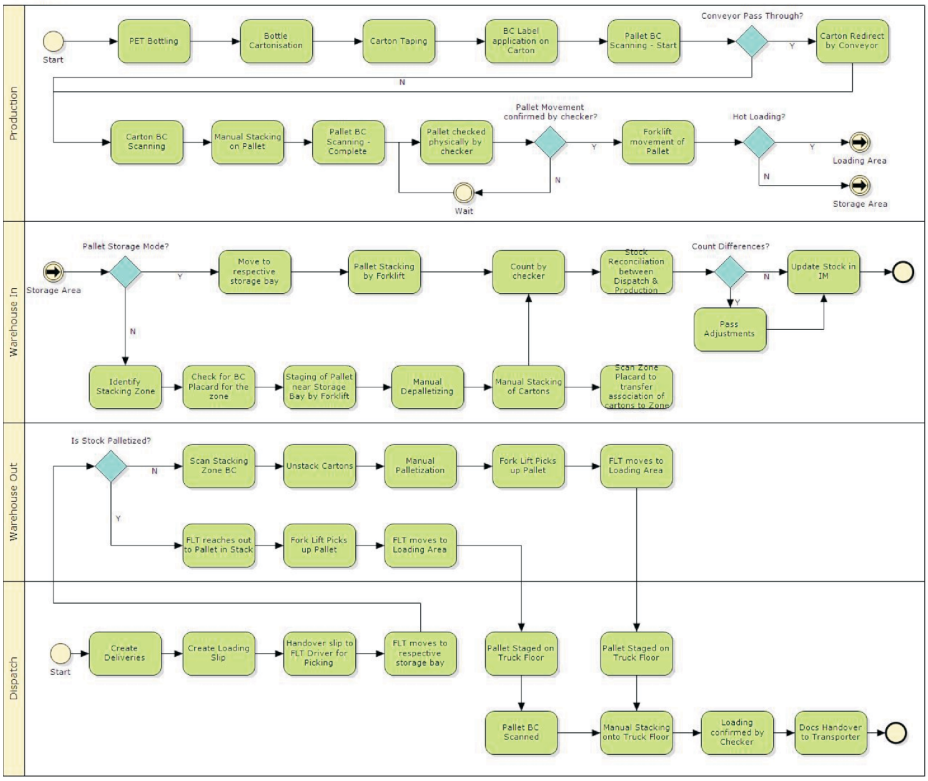


Figure 13: Future State Process

Future State Processes -An indicative illustration of the same is given in figure 13.

The above flow is divided broadly across 4 swim lanes across which the activities are occurring namely Production, Warehouse Inbound, Warehouse Outbound and Dispatch. The flow provides indicatives sequence of activities with key decision points.

Detailed flow of each of the above swim lanes is as below:

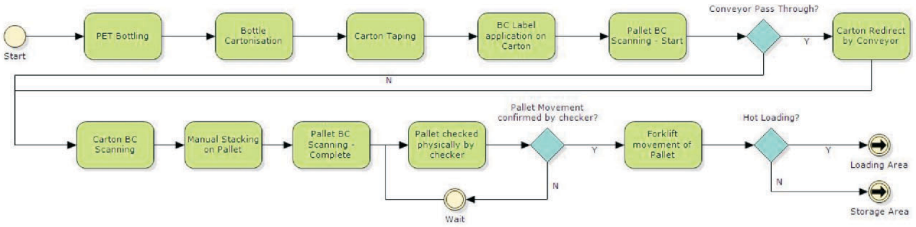


Figure 14: Future State of Process in Production Area

Production Line

Figure 14 shows the future state of process in production area.

Process Flow

The process starts with bottling of PET bottles. These bottles then move forward over the conveyer belts towards the bottle labeling point. At this point a label consisting of Batch, Line, Date, Time, MRP and Price is printed on to the bottles using a laser printer or an ink jet printer or sometimes both. Post the labeling, the bottles move towards the carton makingor shrink-wrapping point on the conveyer belts. These bottles are then picked up by sleeves in bunches, depending upon the SKU per carton combination. At the carton making point, multiple cartons are created at the same time, where the number of cartons created in parallel may vary.

Cartons/Shrink-wraps then move towards the Barcode application point on the line. At this point a Barcode is applied on the Carton using a Barcode Printer and Applicator (LPA) machine. At the end of the line, the pallet building begins by firstly scanning the empty pallet barcode thus triggering the transaction to start association of Cartons to Pallet i.e. all cartons scanned after the empty pallet scan shall be associated with this Pallet. Each carton to be stacked on the pallet is scanned individually by a fixed barcode scanner on the line and is manually stacked on the Pallet. Once the Palletis complete, the next pallet barcode is scanned to start next pallet making and this closes the transaction for association of the cartons to the first pallet. Pallet is then physically checked by a checker and only upon his confirmation the Pallet movement takes place using a Forklift. In case of Hot loading the Pallet created on the line is directly moved to the Loading Area / Truck, else the Pallet is moved to a designated Storage Area in the Warehouse.

The complete process is depicted graphically in Figure 15.

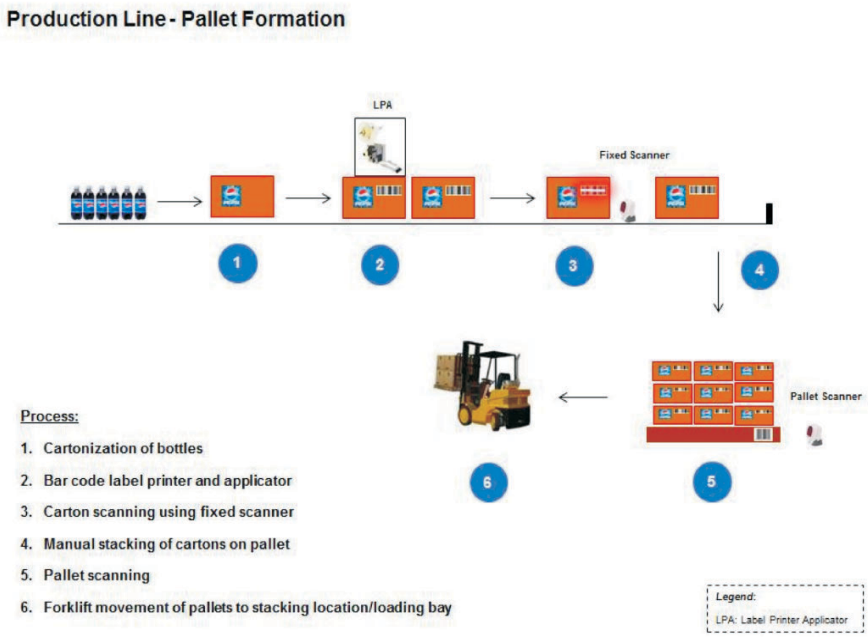


Figure 15: Future Pallet Formation and scanning process at production line

Warehouse In

Figure 16 shows the future state of process in warehouse-in.

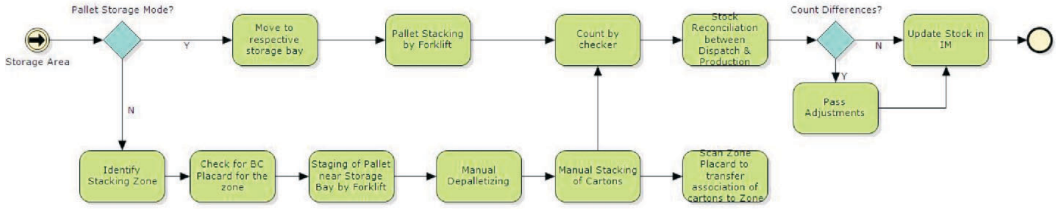


Figure 16: Future State Process of Warehouse -IN

Process Flow - During the Warehouse-in operation stock can be moved from the line to either

a. Storage Bays

Here the stock is stacked in Palletized form. The Pallet is moved from the production line to the respective Storage Bay and is stacked in the Palletized form using a Fork Lift.Once stacked, a count check is done by the Checker and a stock reconciliation is done between Dispatch & Production. In case of any differences, adjustments are passed else the stock is updated in the Inventory Management. Complete process is as per Figure 17.

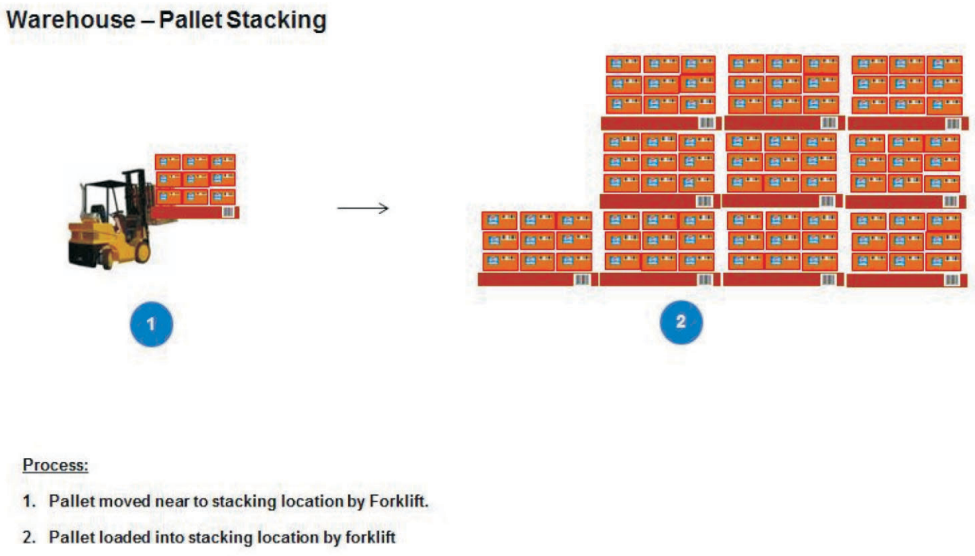


Figure 17: Pallet stacking at warehouse

b. Demarcated Stacking Zones or Virtual Pallet

Here the stock is stacked in de-palletized form with each stacking zone physically demarcated and identified by a Zone Placard consisting of a Barcode that determines the details of that Stacking Zone and the stock held by it. Pallet is moved from the line to the identified stacking zone using a forklift. Barcode placard of the Stacking Zone is checked to confirm the right stacking location. Pallet is staged near the stacking zone using a forklift.Cartons are manually de-palletized and stacked in the stacking zone.

Once the cartons have been stacked, Barcodes of Pallet and Stacking Zone Placard are scanned so that all the Cartons of the particular pallet are now associated to the particular Stacking Zone or virtual pallet and dissociated from the existing Pallets.

Once stacked, a count check is done by the Checker and a stock reconciliation is done between Dispatch & Production. In case of any differences, adjustments are passed else the stock is updated in the Inventory Management. Complete process is as per Figure 18.

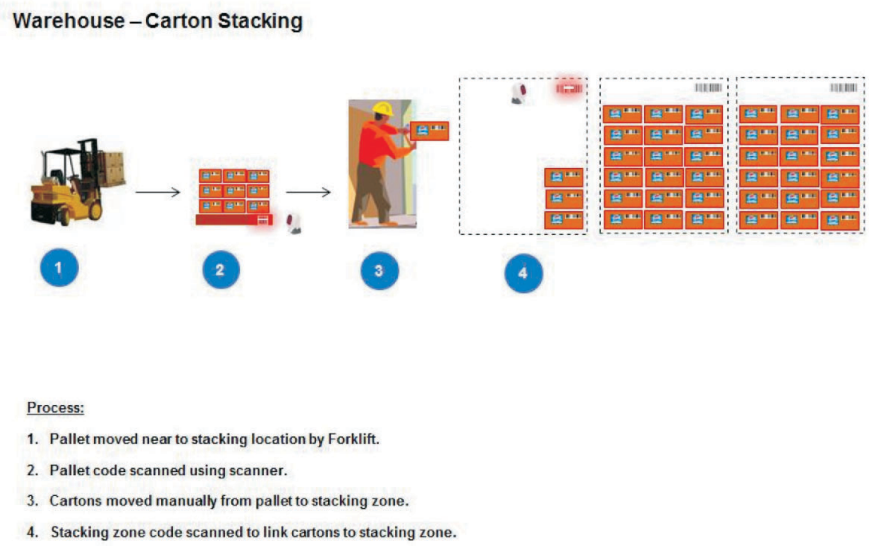


Figure 18: Virtual Pallet stacking or carton stacking at warehouse

Warehouse Out

Figure 19 shows the future state of process in warehouse-out.

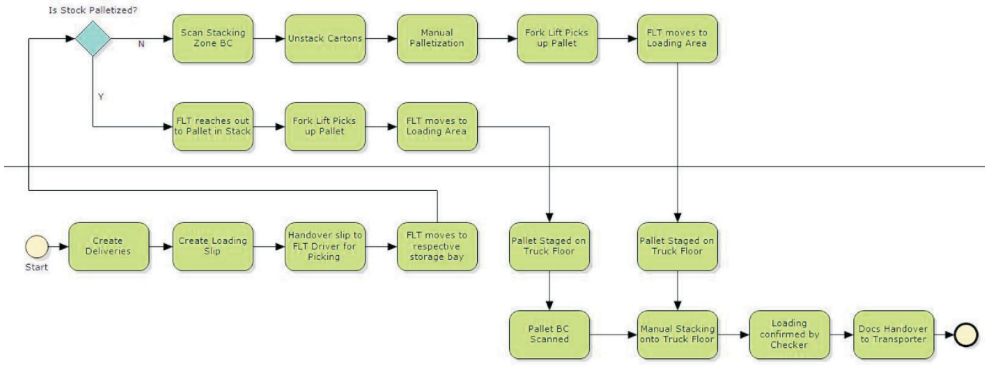


Figure 19: Future State Process of Warehouse –IN

Process Flow: During the Warehouse-out operation:

If the stock is in Palletized form, based on the Loading slip details, the forklift reaches the respective storage bay, picks the pallet and moves towards the loading area. Activities at the loading area have been described in the Dispatch section.

If the stock is in non-palletized form i.e. in visually demarcated stacking zones or virtual pallets, then the Stacking Zone Placard is scanned which associates all the cartons in that zone to the respective loading slip. Cartons are then un-stacked and manually palletized.

Forklift picks up this pallet and moves towards the Loading area. Activities at the loading area have been described in the Dispatch section.

Dispatch

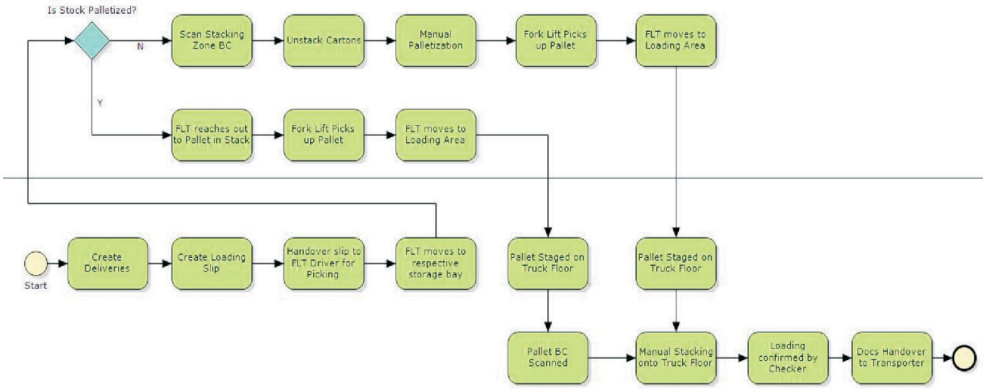


Figure 20: Future State Process of Dispatch

Process Flow:

The Dispatch process begins by creating an outbound delivery against the sales order in SAP. Based on this a loading slip is generated which details the quantity and flavor of stock to be loaded onto a particular truck.

The loading slip is handed over to the to the Forklift driver for picking operation. Forklift moves to the respective storage bay and the entire process of Warehouse-out operation is followed based on whether the stock is kept in Palletized form or in De-palletized form (i.e. in virtual pallets).

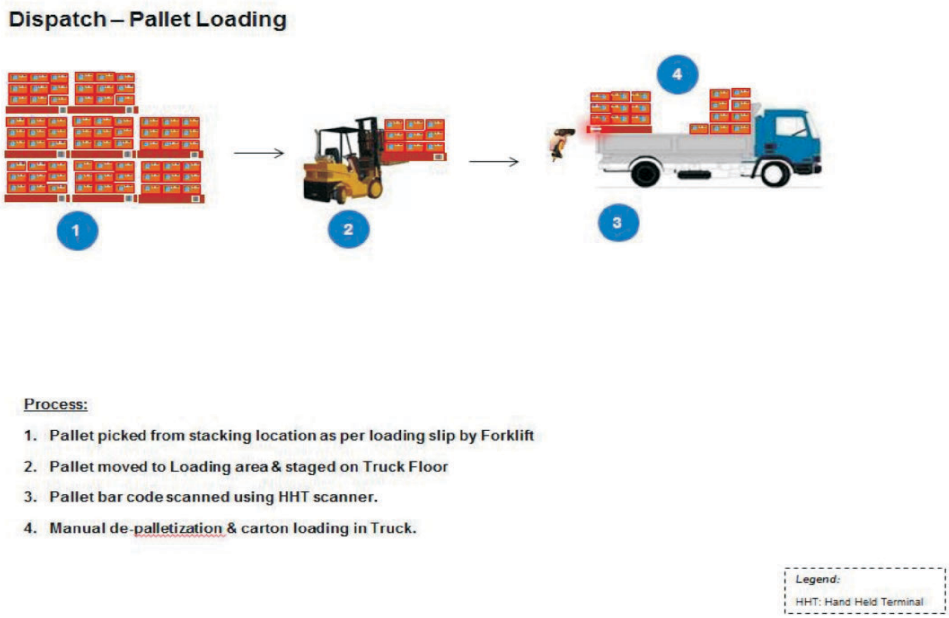


Figure 21: Dispatch through pallet loading

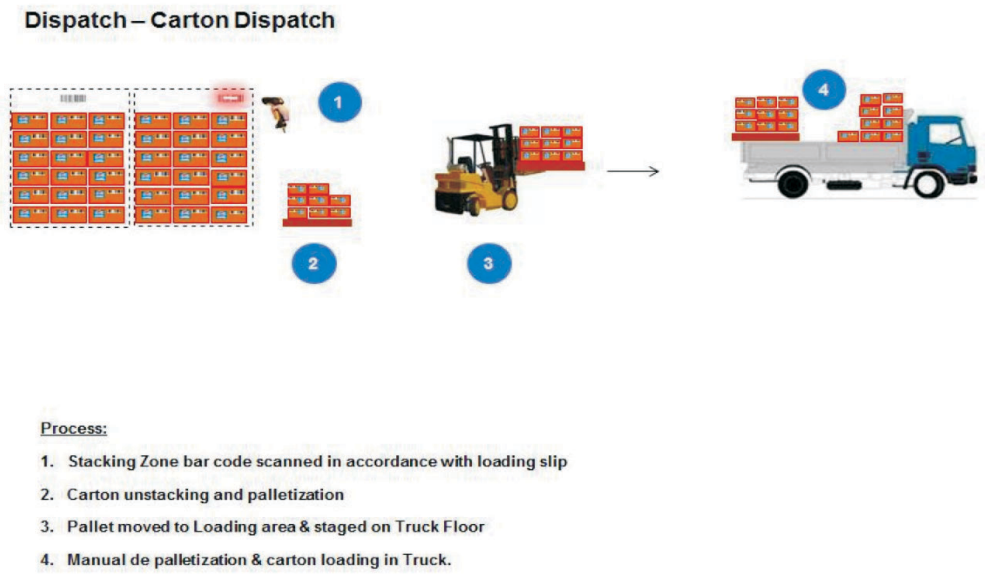


Figure 22: Dispatch through carton loading

Once the picking operation is complete the Forklift moves from the picking location to the Loading area. How the loading operation proceeds from here depends upon the location of the picking operation:

If pallet picking operation was done from a Stacking Zone, the pallet is directly staged on to the Truck Floor by a Fork Lift, followed by manual stacking of Cartons onto the truck floor.

Once the truck is completely loaded, the loading is confirmed by the checker. If there is a case of hot loading then pallet moves directly from production zone to dispatch zone.

All three processes are shown in Figure 21, 22, 23

Documents viz. gate pass and invoice are handed over to the transporter and the truck moves out of the Warehouse / Yard. If pallet picking operation was done from a Palletized Zone, the pallet is directly staged on to the Truck Floor by a Fork Lift. Here the Pallet Barcode is scanned so that all cartons are dissociated from the particular pallet and are associated to the respective loading slip.This is followed by manual stacking of Cartons onto the truck floor. Once the truck is completely loaded, the loading is confirmed by the checker.

Batch: Future Process

To enable physical tracking of the product at the lowest possible level (Quality Batch Slot*), it is proposed to create a sales batch which has a consistent correlation with the production batch. Also this batch will be unique across all plants/lines within Varun Beverages. This sales batch with a unique serial number will be imprinted on every carton being produced.

** A quality batch slot is the lowest consistent time interval at which quality related measurements of the beverage are taken by the quality department. It is suggested to streamline this interval across all plants to a consistent value (E.g. 1 hour) so that more accurate sales batch alignment with production batch is achieved.*

The sales batch will be a unique 10-digit code with static and dynamic information. This information

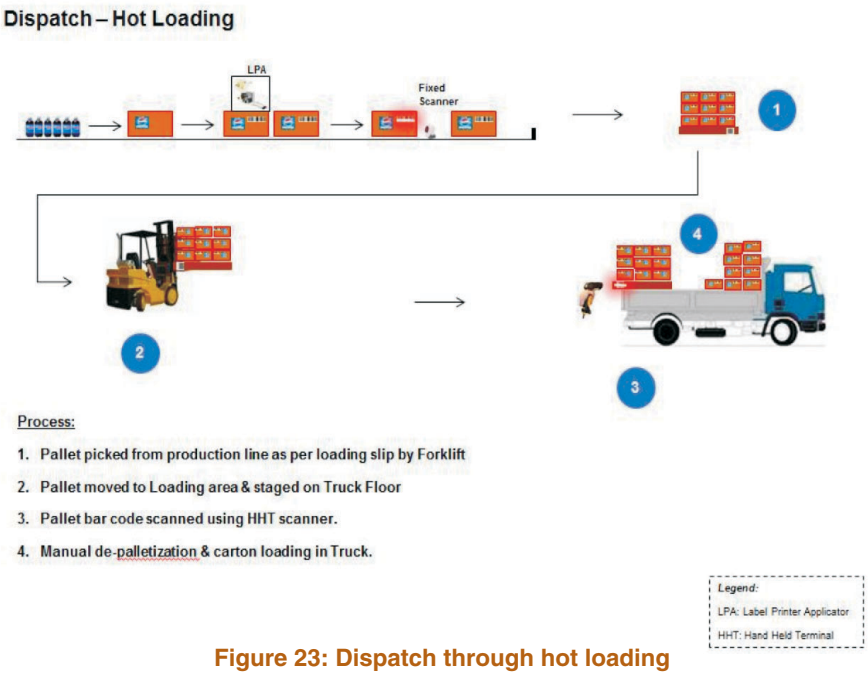


Figure 23: Dispatch through hot loading

will be maintained in the custom application and will be printed as a bar code on each individual carton/case. The description of each of the digits from left-to-right is given below:

Digits Position	No. of Digits	Field Name	Field Description	Data Format	Unique Range	Sample Value
1-2	2	Plant/Line Combo	Unique combination of production plant and production line.	Alphanumeric	1296	A1
3-6	4	Production Batch	As given by Quality Department	Numeric	9999	0221
7	1	Quality Slot	A day split across 24 slots	Alphanumeric	36	B
8-10	3	Serial Number	Unique serial number for every quality slot	Alphanumeric	46656	A01

Code: A10221BA01

A1: Plant-Production Line Combo

0221: Production Batch

B: Quality Slot

A01: Serial Number

Unique Range column provides the number of unique ids that can be created for a given field.

Batch Information Dynamics

The information related to Plant/Line Combo is static for a given plant and line at all times and is least susceptible to change under given circumstances.

Production Batch information is static for a particular batch of beverage.

Quality Slot is the unique slot in the day during which measurements were taken. Example: 0000 hours – 0100 hours designated as Slot A. Similarly 0100 hours – 0200 hours designated as Slot B.

Serial Number is unique for every individual case created during a given slot. Serial Numbers are recycled for every slot.

People, Process and Technology

People

The role of people is very important in implementing the solution. In this solution following persons would require to work differently in future state of process.

1. Unloading Operator
2. Production Checker
3. Warehouse Checker
4. Dispatch Operator
5. Purchase Manger
6. IT Assistant

All persons need to be trained in the proposed system and proper handholding is required for some days. They would be told about the exceptions and the about the ways to handle them. Change management process would be monitored by a change management board. In case of any problem one help desk with clear escalation matrix is proposed.

Process

Standard operating procedure can be developed to help users to understand the entire process. Some of the proposed standard operating procedures are made in next pages.

Technology

The technical solution will comprise of developing the bar coding application and integrating the same with SAP ECC 6.0 for exchanging Delivery related information. Additionally the application will also integrate with multiple warehouse devices viz. Hand Held Terminals, Fixed Mount Scanners etc. via LAN/WiFi. This integration will enable capture of real world information into the application on a near real time basis.

The proposed approach will involve conducting a pilot solution development on one of the production lines at Kosi plant which will act as a prototype for subsequent roll-outs to other lines within that plant and other plants.

Conclusion and Future Scope

This traceability solution would help in making one part of supply chain more flexible. The next step is to achieve full supply chain traceability. As per (GS1, 2005)the main requirements for handling product withdrawals[2] and recalls[3] across the supply chain are having reliable data, the possibility to exchange the data and properly mapped business processes. A good internal

Prepare Batch Process Symbols: NEXT = BUTTON ● = TIP ✚ = CAUTION ◆ = CHECK ★ = SPECIFIC		Owner	Quality
		This activity is conducted by quality prior to commencement of physical pallet making of the cases on the production line.	
No	**Steps**	**Owner**	**Key Points**
1	Create Batch record in SAP	Quality	This activity will be conducted after physical recording of batch details in the batch log maintained manually by Quality department.
2	Create Production Batch record in proposed solution	Quality	✚The batch id for this record will be exactly the same as the SAP Batch ID.
3	Create Production Job in proposed solution	Quality	Production Job will be created for every combination of a SKU/Batch/Line/Date. The output of this record will be case barcode format (static portion)
4	Execute LPA Command	Quality	Using LPA (Label Printer & Applicator) Software, send the command to LPA which contains the static portion of case barcode which includes: - Plant/Line Combo - Batch (proposed solution) - SKU (proposed solution)
5	Confirm Production Job in proposed solution	Quality	●Once the pallet building is complete for a specific production job, the job needs to be closed so that no further pallet making activities be linked to this job.
Pallet making Symbols: NEXT = BUTTON ● = TIP ✚ = CAUTION ◆ = CHECK ★ = SPECIFIC		Owner	Production
		This activity constitutes printing and scanning of barcode labels on the cases followed by stacking them on pallets.	
No	**Steps**	**Owner**	**Key Points**
1	Barcode printed on Case	Production	This activity is done by LPA.
2	Barcode scanned by FMS-1 at Loading Station-1	Production	As soon as the FMS-1 sensor senses an incoming case, it sends a pulse to FMS-1 to activate and read the barcode. FMS-1 after reading and decoding the barcode sends it to proposed solution Database over Ethernet.
3	Loader picks the case and places it on the pallet in directed stacking profile (Row, Orientation, Layers)	Production	★The loader will pick the case from the conveyor from the picking zone only and not anywhere else. ●The picking zone is the conveyor area after FMS -1 and before next FMS (if any) which is not secured by guiding rails. ★In case of line stoppage, the loader has to pick the cases in FIFO orde r.

traceability system is a prerequisite to a chain traceability system. The investments in an internal traceability system will not be wasted in moving towards chain traceability. All good supply chain traceability software should be able to integrate seamlessly to any internal system.

Since most of the proposed system is automatic in terms of capturing the data it would help in getting the reliable data. We have tried to integrate the proposed system with existing internal system SAP.

The proposed system would help in achieving.

- By capturing the barcode of a carton/case the entire movement of that case can be tracked. Like at what time the material was produced? What was the quality batch? etc.
- Material can be tracked backed to Raw material which would help in case there is a quality

problem in some batch.

- In case of cross territory movement the dealer who is indulged in that practice can be identified. Even in the case of carton being destroyed, hence no barcode, system would be able to track the offending distributer through the date time printed on the individual bottle. This information may not be 100% correct but this would help in narrow down the distributer search.
- Proposed system would help in Withdrawal and recall of the products.

As of now proposed solution takes care of only primary dispatch i.e. dispatch from manufacturing plan to either own depot or to distributer. This would bring the visibility only on that part of Supply Chain. In future the same solution can be extended to Secondary Dispatches i.e. dispatches happening from depot to distributer and to tertiary dispatches i.e. dispatches happening from distributer to retailer.

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Appendix – 1

Time and Motion Study - Carton Composition on Truck & Truck Load Time

Kosi Plant

Bay #	Truck#	Truck Type	Capacity	SKU Flavor	SKU Unit	Rows	Columns	Layers	Total Cartons	Orientation of Carton	Start Time	End Time	Total Time
						11	6	17		Parallel to Truck Wall			
							43			Random on Top			
3.2	4849	Trailer	20 Ton	Slice	500 ml Carton	11	1	25	1440	Perpendicular to Truck Wall			1:45
						11	6	17		Parallel to Truck Wall			
							43			Random on Top			
3.1	4939	Trailer	20 Ton	Slice	500 ml Carton	11	1	25	1440	Perpendicular to Truck Wall			1:45
						7	6	11		Parallel to Truck Wall			
						7	1	16		Perpendicular to Truck Wall	6:45 PM (LT)	9:25 PM (LST)	
	9425	Canter 112	9 Ton	Soda	24x600 ml Carton		26		600	Random on top			2:40
				Pepsi		7	7	20		Square Carton Stacking	7:45 PM (AT)		
				Mountain Dew					400+		8:05 (LT)		
		Trailer 2213		Marinda			20		300+				
3.2	6995	10 Tyre	18 Ton	Orange	9x2L				300	Random on Top			2:00
		Trailer 2518									8:20 (AT)		
2.2	3175	10 Tyre	18 Ton	Mountain Dew	9x2L	7	7	22	1078	Square Carton Stacking	8:30 (LT)		2:30

Kosi Plant Carton Composition

Truck Type	Capacity	SKU Flavor	SKU Unit	Rows	Columns	Layers	Layer Line Orientation	Total Cartons
Trailer	16 Ton	Pepsi	9x2L	7	7	20	Square Carton Stacking	980
Trailer	18 Ton	Aquafina	1L	8	8	19	Parallel to Truck Wall	
				8	6	1	Perpendicular to Truck Wall ("Dunda")	1264

Carton Stacking times (De-palletized process on truck):

Carton - Pallet Composition	27 (9 x 2 litre) boxes on 1 Pallet

Sl. No.	Labor Count	Carton Breakages	Time (seconds)
1	1	0	172
2	2	0	77
3	2	0	120
4	2	1	152
5	2	4	238
6	2	1	195

Fork Lift Turnaround Time:

Carton - Pallet Composition	27 (9 x 2 litre) boxes on 1 Pallet

Sl. No.	Complete trip Time (seconds)
1	90
2	220
3	107
4	77
5	50
6	133