# PART 01

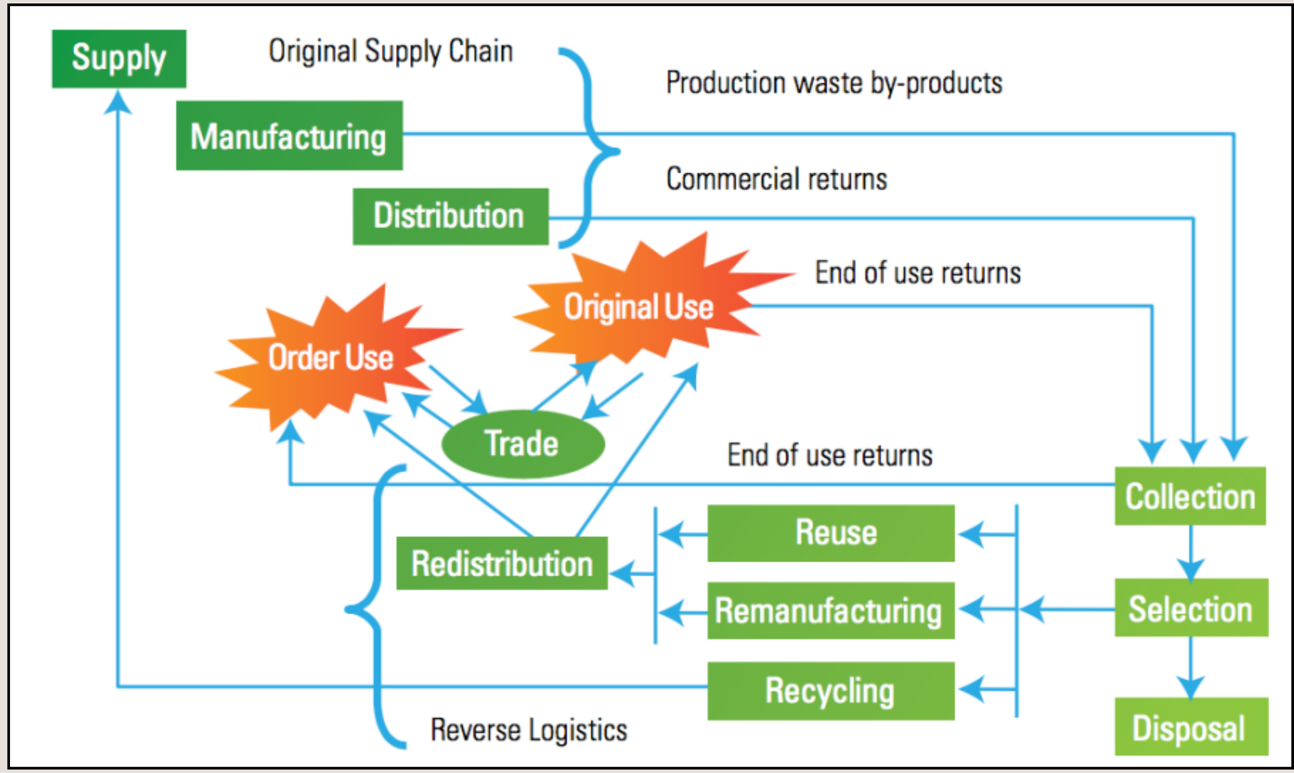
## WMS’ Effect on Return Goods Process

# Literature Review

## WMS' Effect on Return Goods Process

### Returns Process

- Product returns can be classified into two types (Stock et al., 2006):
  - Controllable returns, which can be avoided or eliminated by some actions
  - Uncontrollable returns, which cannot be avoided in the short time
- For automotive component suppliers, returns are in the form of recycling, repairing, refurbishing, and remanufacturing parts.



# Return Goods Process

## Common Problems

- Poor layout and working space.
- Processes are highly manual and inability to identify reasons for returns.
- Lack of real time tracking which reduces efficiency in identifying dispositions, put away, and cross docking processes.
- Lack of process integration which does not allow warehouse members to either put product back into inventory or ship it back to the customer.

## WMS Solutions

- Separating physical inventory process from the accounting process.
- Ability to distinguish between reasons for returns and dispositions
  - The reasons provide us the basic cause of returns
  - Dispositions provide us the physical location of the product
  - Each of this process calls for distinctive management and operative intervention
- Process of returns could be controlled through a Return Authorization Platform.
- Identification of saleable and non-saleable parts in the returns and identification of an appropriate location either as scrap or remanufacturing.
- According to Material Handling Management Institute, a WMS could potentially reduce the cost of the returns process by up to 67%.

# Literature Review

## WMS' Effect on Return Goods Process

### Returns Policy

- Returns policy can vary from different contracts with different customers.
- For example, Ford Parts, accept returns or exchanges within 30 days of customer's receipt and will credit the customer within 30 days.
- The returns policy usually results in costs as well as benefits.
- A more generous return policy increases the probability of returns (Davis et al., 1998).
- Thus, a return policy has become an important competitive strength for most businesses.

# PART 02

# Dock to Stock Improvements Using a WMS

# Literature Review

## Dock to Stock Improvements Using a WMS

### Definition and Benchmarks

- Dock-to-stock may be defined as “The total receiving time it takes a product to move through the receiving process into storage as inventory without the need to perform complete inspection”
- The Warehousing Educational and Research Council, in its 2016 conference released a set of benchmark parameters for warehouse operations

| Customer Metric | Opportunity | Disadvantage | Typical | Advantage | Best in class | Median |
|---|---|---|---|---|---|---|
| On time shipments | Less than 95% | >=95 % and <98% | >=98% and <99% | >=99% and < 99.8% | >= 99.8% | 98.3% |
| Internal order cycle time | Greater than 26.6 hrs | >=15.8 and <26.6 hrs | >=7.88 and <15.8 hrs | >=3.1 and <7.88 hrs | <3.1 hrs | 11.4 hrs |
| **Operations** | **Opportunity** | **Disadvantage** | **Typical** | **Advantage** | **Best in class** | **Median** |
| Dock to Stock cycle time | Greater than 21.5 hrs | >=8 and <21.5 hrs | >=4 and <8 hrs | >=2 and < 4 hrs | < 2 hrs | 6 hrs |

# Literature Review

## Dock to Stock Improvements Using a WMS

### Technologies

To achieve a target of being best in class, Dock to Stock cycle time could be improved by using some of the following technologies:

- **Radio Frequency Identification (RFID)**: Used by most retailers, RFID's are un-powered microchips which transmit information using wireless transmitters when placed in a field by a reader.
  - Early adopters of RFID were companies such as Wal-Mart, Tesco, US Department of Defense
  - As of 2015, 57% of retailers they use RFID technology to track, receive and position inventory.
  - A study by Pidding who simulated a warehouse using RFID identified time savings of 90.8% over a barcode system.

# Literature Review

## Dock to Stock Improvements Using a WMS

### Technologies

To achieve a target of being best in class, Dock to Stock cycle time could be improved by using some of the following technologies:

- **Quick Response Codes (QR)**:Two-dimensional graphic matrix codes which can store vital information in a small space. This will reduce the need to have multiple paperwork on and in the carton.
  - QR codes can store large and vital information such as part number, quantity, pallet information, location, priority details, packing slip information etc.
  - QR's are easy to implement and provide quick turnaround time

# Literature Review

## Dock to Stock Improvements Using a WMS

- The dock to stock improvements are focused on hardware and auxiliary improvements.
- These improvements could easily feed into a WMS had a WMS been implemented, hence the hardware technology intervention can either be done before or after the implementation of a WMS.
- On the hindsight, with the changing business model  (Aron, 1998) suggested that, WMS was a necessity in the automotive sector, but its applicability could vary in labor intensive sectors such as apparel.
- In essence, WMS will ensure improved labor productivity of 20-30%, which means that existing labor shall be redeployed to perform other critical tasks such as assessing quality, returns etc.

# PART 03

# Overall Labor Utilization

# Literature Review

## Overall Labor Utilization

- A warehouse management system is essentially a real time organization system that incorporates technology to monitor and run a warehouse in an efficient manner (Richards, 2014).
- An LMS system is similar to a WMS but focuses on just labor utilization rather than the entire warehousing system. It is capable of collecting information about labor activity, comparing it to past data and creating standards to live by.
- Companies often times seeing increases over 18% in efficiency within a year when implementing an LMS or WMS (Bond, 2014)

# Literature Review

## Overall Labor Utilization

- Direct labor costs (fixed): warehouse operators, supervisors and administrators:
  - Wages including on-costs
  - Personnel insurance
  - Safety wear (PPE)
  - Welfare
  - Training

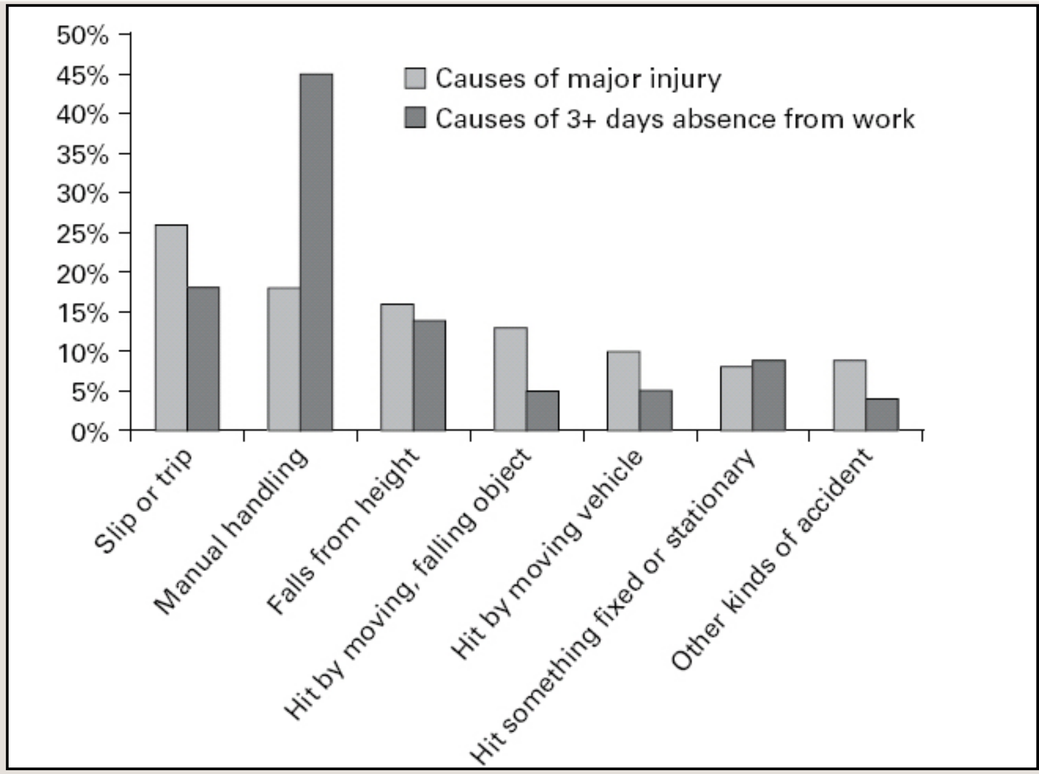
- Labor costs (variable):
  - Overtime, bonuses

# Literature Review

## Overall Labor Utilization

### Time due to Injury

- Overexertion (poor lifting, etc) – 45 percent
- Contact with equipment – 31 percent
- Falls and trips – 19 percent
- Transport related – 3 percent
- Harmful substances – 1 percent



# PART 04

## Maximizing Warehouse Space Utilization

# Literature Review

## Maximizing Warehouse Space Utilization

- A high-quality warehousing cannot operate smoothly without a reasonable layout design (Karasek, 2013).

- 4 Critical Factors on warehouse layout optimization (Gu et al, 2010):
  - Determining the overall warehouse structure
  - Sizing and dimensioning the warehouse and its departments
  - Determining the detailed layout with in each department
  - Selecting warehouse equipment

- Design of the aisle, travel time and flow routing also influence the general warehouse space utilization (Min Zhang, 2009)

- Data Mining-based Storage Assignment (DMSA) (David Ming-huang Chiang et al, 2011)
  - Cut down the time of picking items and number of stops - optimize the limited space

- WMS directs and optimizes stock based on real-time information about the status of bin utilization (Ramaa.A et al, 2012).
  - Auto ID Data Capture (AIDC)