# International Journal of Operations Management

**Volume No. 12**

**Issue No. 2**

**May - August 2024**

**ENRICHED PUBLICATIONS PVT.LTD**

**JE - 18,Gupta Colony, Khirki Extn,**
**Malviya Nagar, New Delhi - 110017.**
**E- Mail: info@enrichedpublication.com**
**Phone :- +91-8877340707**

# International Journal of Operations Management

## Aims and Scope

The aim of the International Journal of Operations Management is to provide academically robust papers, research, critical reviews and opinions on the organisational, social and management issues associated with significant information-based technologies. It is designed to be read by academics, scholars, advanced students, reflective practitioners, and those seeking an update on current experience and future prospects in relation to contemporary information and communications technology themes.

# International Journal of Operations Management

# International Journal of Operations Management

**(Volume No. 12, Issue No. 2, May - August 2024)**

## Contents

# Econmy Operations of Mechanized Dry Bulk Cargo Handling Berth in Paradip Port

**[1]Subas Chandra Mahapatra, [2]Mrutynjaya Dash**

[1]Dr. Subas Chandra Mahapatra, Asst. Professor, Operations and Information Management, Asian School of Business Management, Bhubaneswar-12, Odisha-754012,
Cell: +91-9959802338, Mail: mahapatrasc11@gmail.com

[2]Dr. Mrutynjaya Dash, Associate. Professor, Asian School of Business Management, Bhubaneswar

## A B S T R A C T

*A dry bulk handling system is an organization, normally situated in a harbour environment, offering a total package of activities and services to handle, store and control dry bulk to and from transportation modes with a balance in handling and services to the transportation modes against minimized costs.Dry bulk operations are used worldwide as a buffer between an incoming flow and an outgoing flow of bulk solid materials, referred to as respectively the import flow and the export flow. For the rapid growth and development of port it is fully depends on the mechanized berth operation. The purpose of the study was to present a scenario of supply chain management of the mechanized berth at Paradip Port Trust. So, this study is based on to understand the parameters influencing mechanized berth operation of ports, to study the cargo handling of Paradip port during the April and May months of the year 2017 and also to study the principal total productivity of the cargo loaded during the two months are studied.*

***Key Words: Bulk Cargo, Mechanized, Berth, Mechanized Conveyor, Spiramatic, Quay,berthday output.***

## INTRODUCTION

Mechanization or mechanisation is the process of changing from working largely or exclusively by hand or with animals to doing that work with machinery. Every machine is constructed for the purpose of performing certain mechanical operations, each of which supposes the existence of two other things besides the machine in question, namely, a moving power, and an object subject to the operation, which may be termed the work to be done.

The most important and the fastest Handling System for Dry Bulk Cargo is the mechanical bulk material handling system or mechanized system for Dry Bulk Cargo. In last 2 decades, the volume of Dry Bulk Cargo Traffic has increased worldwide to a remarkable extent. This becomes clear when one considers the increase in production figure for steel, aluminium, fertilizer and all forms of energy from basic fuel.

The economical exploitation of overseas and coastal raw materials was made possible only by a far-reaching rationalized means of transportation.

The handling functions required for the transportation of Dry Bulk Cargo consist from the mining stage to the receiver of Raw Material of the following stages:

**A. Mining of Raw Material:**

Stacking and reclaiming at the Mine Pit Head Stock Pile&Loading of Railway Wagons

**B. Port of Despatch:**

(i) Unloading of Wagons in the Port (Wagon Tipplers – Rotaside/Rotary/Bottom Discharge). (i) Transportation to Stock pile & Stacking and Reclaiming in the Port through Mechanised Conveyor System, Stackers/ Reclaimers etc.(iii)Loading of Sea going Vessels through Mechanised Conveyor System, Ship loaders etc.

Port of Destination:(i)Unloading of Sea going Vessels by Ship Unloaders - Continuous Type Screw/ Chain/ Bucket type/Clamshell type Spiramatic. (ii)Transportation to Stock Pile & Stacking & Reclaiming in the Port's Stock Pile through mechanized Conveyor System, Trippers, Stackers / Reclaimers etc. (iii)Loading of Inland Transport (Barge, Rail Wagons, Conveyor, Truck etc.) through mechanized Conveyor System, Barge Loaders, Stacker/ Reclaimers, Pay Loaders, Open Wagon Loading System, Hoppers/Bins & Bagging/Stitching Machines etc.

**Factor required while creating a Dry Bulk Cargo Terminal**

For a Port, adequate size of Entrance Channel, Tuning Basin, Approach Channel, Navigable Draft and draft at the handling berth to be maintained. The handling berth should be sufficiently longer to accommodate large vessels and to negotiate all working hatches. Must have Storage Space of adequate capacity to prevent possible interruption in shipping for dispatch. Suitable equipment for unloading/loading the rolling stocks. Suitable equipment for loading/unloading vessels. Stacking & reclaiming equipment of suitable capacity to match the rates of unloading and loading. Suitable mechanized Conveyor System to transport the cargo from Ship/rolling Stock to Stock Pile & Stock Pile to Ship / Rolling stock, matching with the rate of loading/unloading Stacking/reclaiming.The layout should be simple & streamlined. The selected equipment should be constructed with indigenous components as much as possible with service and spare parts availability locally and should be of sturdy and simple construction for trouble free maintenance.

## PORT OPERATION

For managing a Port, the primary corporate objective is to maximize availability and utilization of the installed capacity as well as the cargo prospect along with the types of cargo likely to be handled. No capacity should remain idle/unutilized/under-utilized and the possibility of absolution should also be considered. For planning a Port, the following points may be kept:

Capital Construction Costs; Operation&Maintenance Costs; Cargo type to be handled; No. of berths to be accommodated; type of vessels to be accommodated; Multiple use of the equipment selected; Scope for future expansion; Location relative to adjacent Ports; Trend of the Trade and Prospect of future developments in Hinterland; Nature of development activities in the adjacent ports.

### Documentation in Port Operation

For Mechanized Cargo Handling Operation in PPT, for Coastal Trade there are standard procedures which are recorded in writing or documented properly in approved formats and kept in record for future references. This is essentially required because of the fact that a number of contracts, transactions, clearance of Port Trust, and clearance of Statutory Authorities etc. are required. In this process, a number of agencies are involved and those are Port Trust, Despatcher, Receiver, Shipper, Customs, Charterer, Agents of Despatcher, Clearing & Forwarding Agency, Logistics Agency, Stevedores, Agents of Charterer, Agents of Receiver, Agents of Shippers, Insurance Agency, Surveyors etc.

### Mechanized Berth

There are four mechanized berths for handling dry bulk material at Pradip Port Trust. All the mechanized berth is used for export purpose at PPT. In IOB mainly thermal coal, iron ore and iron pallets are handled in this berth.

**1. Iron Ore Berth(IOB)**

| | |
|---|---|
| Jetty length | 210 mtrs. |
| Jetty Width | 13.75 mtrs. |
| Distance between Dolphin to Dolphin | 320 mtrs. |
| Maximum LOA of Vessels accepted | 260 mtrs. |
| Maximum Beam of Vessels accepted | 38 mtrs. |
| Draught | 13.00 mtrs. |
| Rated Capacity of Ship loader | 3200 Hr |

**2.Coal Berths of Mechanised Coal Handling Plant**

| | | |
|---|---|---|
| | Jetty length | 520 mtrs. |
| CB-I | Draught | 14.00 mtrs. |
| CB-II | Draught | 14.50 mtrs. |
| | Rated Capacity of Ship Loader | 4000 MT/Hr (2 nos.) |

**Operational Equipment**

The process system that runs on the mechanized berth are unloading system, conveyor system, feeding system, stacking system, magnetic separator/metal detector, bin/chute vibratory system, coal weighment, coal sampling, firefighting system, dust suppression system, dust extraction system.

**Conveyor belt**

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyor belts, work by using two pulleys that continually loop over the material that rotates over them. This is done with endless procession of hooks, gears, buckets, and a wide rubber belt. The belt is then supported by a series of rollers along the path.

**Paddle Feeders**

The Paddle Feeders feed the coal on the conveyor belt from the Track hopper at a controlled rate. The paddle blades projected in the hopper slot scoop the coal from hoppers and discharge it on the conveyor belt running below.

**Stacker Reclaimer**

A stacker is a large machine used in bulk material handling applications A stacker usually operates on a rail- like structure with movable wheels, but the main operation is performed on a fixed place. The Stacker Reclaimer is provided to stack the excess coal from the plant and to reclaim the coal, as and when required.

**Waggon Tippler**

The rotary tippler designed for unloading broad-gauge open railway by inverting the wagon by inverting on its own centre of gravity through an angle of 170 degrees, thereby discharging its contents into hopper below rail. Tipplers are provided on coalbunkers to receive coal from the conveyors and feed it to the cargo vessels.

**Ship Loader**

A Ship loader is a huge machine used for loading bulk solid materials like iron ore coal, fertilizers, grains into marine vessels for transportation by sea. Ship loaders are a very common sight in ports and jetties from where bulk materials are exported.

## Operational Procedure

The basic difference between IOHP and MCHP berths is that MCHP are loading berths with various Conveyor Systems, Crusher, Paddle Feeder, Open Stack Yard, Stacker cum-Reclaimers, various Transfer Towers and the Ship loaders while IOHP is having all the above systems but with extra systems like with Wagon Tipplers, Post-Tippling Railway Tracks for holding and clearing the empty wagons.

Rakes carrying coal are brought by the Marshalling Beetles & Charging beetles the Tippler House and are tippled one by one by 2 Rota side tipplers over the fixed grizzly, fall on paddle Feeder which carries them to the Crusher & then the same is reduced to size by the Crusher and mixed with the sized stream of coal and is taken out of the Tippler Pit by the underground inclined conveyors and transported to the Stock Pile area. Long Yard Conveyors carrying coal over the entire length of the Stock Piles, extend upto the nearest Transfer Towers of the Intermediate Conveyors &up to the loading area of the Plant. Stacker-cum-Reclaimers, the combined units, are mounted on each of the 2 Yard Conveyors. During direct ship loading from tippling, the coal is straight away carried to the Ship loader by the Yard Conveyor, when receiving and loading coal matches.

## Need for the Study

How Paradip Port Trust has been playing a key role in mobilizing resources not only in Odisha but also in India.Being bulk cargo handling port, 77% (84 MMTPA) of capacity has been mechanized and expected to achieve 93% by 2019, which would facilitate handling of cargo in eco-friendly manner. Port has achieved 100% utilization of installed capacity of 21 MMTPA of the Mechanized Coal Handling Plant during 2014-15.Around 95% of India's trading by volume and 70% by value is done through maritime transport (Ministry of Shipping).

## Review of Literature

The last six decades, the shipping industry has transformed up the world economy. Through the duo revolutions such as mechanized bulk transport system and containerization, has been enormously successful in sinking costs and opening up the global market. Despite these advances, the shipping business holds the cut and thrust of marketplace which are recognized to nineteenth-century with the perfect competition model. This sustained combination of strategic industrial shipping and penetratingly competitive markets makes shipping as one of the world's most exciting businesses. Many shipping fortunes have been made turbulent from political conflict, particularly those brought about by the closure of the Suez Canal in the 1950s and 1960s.Asbusiness has become more international and newly industrializing countries have taken their place alongside the OECD countries, the maritime industry has provided the vehicle for an extraordinary growth of trade (Stopford, 2000).

Because of complexity in functions and dynamics, ports have a complex a structure of activities. So, this complex structure is investigated through simulation techniques instead of analytical methods. Simulation of port system scan be sketched out for various goals such as port design, planning, capacity increase, and productivity. Based on the results generated through simulation experiments, it is possible determined that the most critical bottleneck points are created by loading/unloading vehicles. For the bulk amount of cargo, complexity of loading and unloading takes longer times and so systematic handled the cargo results possible effective operation on port side (Demirci, 2003).

The existing operating methods at the port resulted in a large reduction of rake turnaround time so it reduces rake waiting time and service time; It implises monetary savings to the port authorities through reduction in demurrage costs incurred.

But various container terminals use rail-mounted gantry cranes and trucks to transfer containers, then the bulk material at ports employ conveyors, pipelines, bucket unloaders, dumpers, etc. (Umang, Bierlaire, and Vacca 2013).But actual, complication increases when the container/cargo arrives before ship's actual arrival at the port (Bruzzone and Signorile 1998).So to the deployment of ship unloaders for this significantly affects the operating cost at the port, because it deals with shifting of this cargo from ship to the stockyard (Wadhwa 2007).So this mode of operation of a bulk port is different from a container port and hence it is need for separate approach.

Intermodal transport has gained distinction due to its potential to offer door-to-door service through the integration of various modes of transport in the logistics chain, improved coordination and services, and the development of intermodal interfaces. The development of dry ports, an important component of intermodal transport, could play a major role in promoting intermodal transport in Asia, including its twelve landlocked countries (Hanaoka & Madan B. Regmi, 2011).

## OBJECTIVES OF THE STUDY

- To understand the supply chain management procedure of mechanized berth.
- To minimize the losses of dry bulk cargo.
- To provide the efficient and cost-effective solution.

## RESEARCH METHODOLOGY

This research is descriptive in nature so as to compare productivity of Paradip port with the four mechanized berths.

## DATA COLLECTION AND SAMPLING

In this study, data was collected from the various invoices available in the port office (Traffic Department) and observation which was done during month of April to May, 2017. These sources were used in order to have a complete knowledge of the concerned topic.

In the present study purposive sampling was adopted. So that four berths were chosen out of nineteen berths presently actively running for the operation purpose by consulting with the port authorities. The main work of this study was to collect information regarding productivity of mechanised dry bulk cargo berths and then compared those during the two months.

## DATA ANALYSIS

After data collection, the information was proceeded with the help of MS-Excel spreadsheet. Results were summarized in the forms of the table. The study used simple tabulation and cross tabulation for presenting findings. Also suitable charts were used to present the data graphically.

### Analysis of the Work

Iron Pellets loaded at CQ3 during month of April

A quantity of 3,95,962 tonnes of Iron Pellets was loaded during April month in which stay at berth time was 218.85 hrs and overall productivity was 3,13,328 tonnes.

**Table 1**

| Vessel Name | Date | Total Quantity (Tonnes) | Stay at Berth (Hours) | Productivity (Tonnes) |
|---|---|---|---|---|
| MV. AM OCEAN PRIDE | 03.04.17- 04.04.17 | 52,000 | 28.82 | 43,308 |
| MV. MANDARIN EAGLE | 07.04.17 - 08.04.17 | 53,500 | 43.92 | 29,237 |
| MV.GLOVIS MAPLE | 06.04.17- 06.04.17 | 50,000 | 23.78 | 50,456 |
| MV. ISHWARI | 17.04.17- 18.04.17 | 80,000 | 33.53 | 57,256 |
| MV. SHANDONG HAI SHENG | 20.04.17 - 20.04.17 | 54,567 | 24.3 | 53,893 |
| MV.OCEAN DIAMOND | 27.04.17- 28.04.17 | 51,895 | 34.17 | 36,453 |
| MV.GLOVIS MARIA | 29.04.17- 30.04.17 | 54,000 | 30.33 | 42,725 |
| | **TOTAL** | **3,95,962** | **218.85** | **3,13,328** |

Source: Traffic Department

### Iron Pellets loaded at CQ3 during month of May

A quantity of 3,87,877 tonnes of Iron Pellets was loaded during May month in which stay at berth time was 288.34hrs and overall productivity was 2,85,484 tonnes.

**Table 2**

| Vessel Name | Date | Total Quantity (Tonnes) | Stay at Berth (Hours) | Productivity (Tonnes) |
|---|---|---|---|---|
| MV. MAANIKA | 02.05.17- 03.05.17 | 51,727 | 101.45 | 12,237 |
| MV.MARE FORUM | 06.05.17 - 07.05.17 | 45,830 | 26.33 | 41,769 |
| MV.VISHVA VIJAY | 14.05.17- 16.05.17 | 74,000 | 49.9 | 35,591 |
| MV.EMERALD STAR | 19.05.17- 20.05.17 | 55,000 | 29 | 45,517 |
| MV.GLOVIS MELODY | 23.05.17 - 24.05.17 | 54,320 | 22.58 | 57,728 |
| MV. NEO | 27.05.17- 28.05.17 | 52,000 | 36.5 | 34,192 |
| MV. GLOBAL FRONTIER | 29.04.17- 30.04.17 | 55,000 | 22.58 | 58,450 |
| | **TOTAL** | **3,87,877** | **288.34** | **2,85,484** |

Source: Traffic Department

## DISCUSSION

From the above table 1.1 & 1.2 and figure 1.1 & 1.2, it can be interpreted that more the cargo stay at berth time is less will be the productivity of that cargo. The reason behind that productivity was less at CQ3 berth during the month of May was because of the penalty that was undertaken for the sailing clearance of the vessel. MAANIKA and also due to the hazardous climate conditions on 3rd of May the productivity was less. So, here CQ3 berth during April month had an excess of 27,844 tonnes of productivity.

### Thermal Coal loaded at CB1 & CB2 (MCHP) during month of April

A quantity of tonnes of 15,71,853 Thermal Coal was loaded during April month in which stay at berth time was 662.27hrs and overall productivity was14,39,857tonnes.

**Table 3**

| Vessel Name | Date | Total Quantity (Tonnes) | Stay at Berth (Hours) | Productivity (Tonnes) |
|---|---|---|---|---|
| MV. APJ KAIS | 01.04.17- 01.04.17 | 29,618 | 15.9 | 44,706 |
| MV.DECCAN PRIDE | 08.04.17 - 09.04.17 | 73,985 | 26.55 | 66,879 |
| MV.APJ MAHADEVA | 02.04.17- 03.04.17 | 74,949 | 22.8 | 78,894 |
| MV. SRI PREM POORVA | 04.04.17- 05.04.17 | 70,108 | 29.9 | 56,274 |
| MV.VISHVA UDAY | 06.04.17 - 08.04.17 | 80,035 | 31.08 | 61,796 |
| MV. JS SANAGA | 08.04.17 - 09.04.17 | 53,315 | 24.42 | 52,405 |
| MV. VRINDA | 04.04.17 - 06.04.17 | 67,859 | 46.08 | 35,341 |
| MV. MERAKLIS | 06.04.17 - 07.04.17 | 50,535 | 26.42 | 45,912 |
| MV.CHENNAI SELVAM | 09.04.17 - 10.04.17 | 27,439 | 13.8 | 47,720 |
| MV.DUBAI ENERGY | 09.04.17- 10.04.17 | 55,350 | 27.3 | 48,659 |
| MV.APJ MAHADEVA | 13.04.17 - 14.04.17 | 75,279 | 23.4 | 77,209 |
| MV.APJ MAHAKALI | 11.04.17- 13.04.17 | 71,089 | 30.22 | 56,463 |
| MV. SRI PREM POORVA | 14.04.17- 15.04.17 | 70,273 | 28.8 | 58,561 |

| | | | | |
|---|---|---|---|---|
| MV.DECCAN PRIDE | 18.04.17 - 18.04.17 | 74,480 | 21.5 | 83,140 |
| MV. VRINDA | 19.04.17 - 20.04.17 | 69,880 | 28.08 | 59,719 |
| MV.EMERALD STRAIT | 24.04.17 - 25.04.17 | 55,550 | 26.13 | 51,015 |
| MV.APJ MAHAKALI | 22.04.17 - 23.04.17 | 71,065 | 27.8 | 61,351 |
| MV.VISHVA UDAY | 22.04.17 - 24.04.17 | 80,717 | 31.67 | 61,175 |
| MV.DECCAN PRIDE | 27.04.17- 28.04.17 | 74,185 | 22.5 | 79,131 |
| MV. AP STON | 24.04.17- 25.04.17 | 54,380 | 27.67 | 47,173 |
| MV. TSCHAIKOWSKY | 25.04.17 - 26.04.17 | 57,082 | 24.67 | 55,539 |
| MV.VISHVA MALHAR | 29.04.17 - 30.04.17 | 55,300 | 25.2 | 52,667 |
| MV.MP PANAMAX 5 | 28.04.17 - 29.04.17 | 72,895 | 34.53 | 50,661 |
| MV.VISHVA PRERNA | 30.04.17 - 30.04.17 | 32,514 | 16.95 | 46,038 |
| MV.APJ MAHADEVA | 30.04.17 - 01.05.17 | 73,971 | 28.9 | 61,429 |
| | **TOTAL** | **15,71,853** | **662.27** | **14,39,857** |

Source: Traffic Department

**Thermal Coal loaded at CB1 & CB2(MCHP) during month of May**

A quantity of tonnes of 14,98,577 tonnes Thermal Coal was loaded during May month in which stay at 855.98 hrs berth time was hrs and overall productivity was 11,63,343tonnes.

**Table 4**

| Vessel Name | Date | Total Quantity (Tonnes) | Stay at Berth (Hours) | Productivity (Tonnes) |
|---|---|---|---|---|
| MV.DECCAN PRIDE | 09.05.17- 10.05.17 | 74,120 | 20.43 | 87,058 |
| MV. SRI PREM POORVA | 02.05.17 - 03.05.17 | 68,351 | 29 | 56,566 |
| MV. APJ JAI | 05.05.17- 06.05.17 | 55,479 | 24.2 | 55,020 |
| MV. VRINDA | 04.05.17- 05.05.17 | 66,496 | 33.1 | 48,215 |
| MV.INDIAN LIGHT | 05.05.17 - 06.05.17 | 55,000 | 24.17 | 54,621 |
| MV.VISHVA UDAY | 12.05.17 - 13.05.17 | 80,235 | 44 | 43,765 |
| MV. JS MEKONG | 10.05.17 - 11.05.17 | 55,039 | 24.92 | 53,014 |
| MV.APJ MAHADEVA | 11.05.17 - 13.05.17 | 73,967 | 39 | 45,518 |
| MV.YASA AYSEN | 10.05.17 - 11.05.17 | 54,200 | 28.2 | 46,128 |
| MV.MP PANAMAX 5 | 15.05.17 - 22.05.17 | 53,085 | 172.3 | 7,394 |
| MV.DECCAN PRIDE | 20.05.17 - 20.05.17 | 74,199 | 20.82 | 85,546 |
| MV. SRI PREM POORVA | 16.05.17- 18.05.17 | 68,340 | 40.42 | 40,581 |
| MV. VINAYAK | 21.05.17 - 22.05.17 | 56,835 | 28.48 | 47,889 |
| MV.ROYAL FAIRNESS | 18.05.17- 19.05.17 | 54,420 | 27.47 | 47,551 |
| MV. VRINDA | 21.05.17- 22.05.17 | 68,221 | 33.35 | 49,095 |
| MV.MP PANAMAX 4 | 22.05.17 - 23.05.17 | 68,900 | 29.93 | 55,243 |
| MV. BUTINAH | 24.05.17 - 25.05.17 | 54,771 | 36.75 | 35,769 |
| MV.APJ MAHADEVA | 23.05.17 - 24.05.17 | 73,968 | 28.33 | 62,655 |
| MV.VISHVA UDAY | 24.05.17 - 25.05.17 | 80,259 | 39.8 | 48,397 |
| MV.SAGAR MOTI | 26.05.17 - 27.05.17 | 56,835 | 26.07 | 52,329 |
| MV. SRI PREM POORVA | 27.05.17- 29.05.17 | 68,300 | 36.6 | 44,787 |
| MV.APJ MAHAKALI | 30.05.17- 31.05.17 | 69,334 | 34.37 | 48,419 |
| MV. VRINDA | 30.05.17 - 31.05.17 | 68,223 | 34.27 | 47,783 |
| | TOTAL | 14,98,577 | 855.98 | 11,63,343 |

## DISCUSSION

From the above tables 2.1& 2.2 and 2.1 & 2.2 figures, it can be interpreted that more the cargo stay at berth time is more less will be the productivity of that cargo. The reason behind that productivity was less at CB1 & CB2 berth during the month of May was because of the penalty that was undertaken for the DE ballasting and Loading clearance of the vessel MV.MP PANAMAX 5 and also due to the shortage of labour power for that vessel the productivity was less. So, here CB1 &CB2 berth during April month had an excess of 276,514 tonnes of productivity.

### Cargo loaded at IOB during month of April

A quantity of 4,71,527 tonnes of cargo was loaded during April month in which stay at berth time was 542.54 hrs and overall productivity was1,91,785 tonnes. The quantum of Thermal Coal and Iron Ore was loaded in the Port.

**Table 5**

| Vessel Name | Date | Total Quantity (Tonnes) | Stay at Berth (Hours) | Productivity (Tonnes) | Commodity |
|---|---|---|---|---|---|
| MV. JAHAN MONI | 30.03.17- 01.04.17 | 39,226 | 49.67 | 18,955 | IORE |
| MV.MP PANAMAX 5 | 03.04.17- 05.04.17 | 66,834 | 58.2 | 27,560 | T. COAL |
| MV.MP PANAMAX 4 | 08.04.17- 11.04.17 | 66,704 | 88.82 | 18,025 | T. COAL |
| MV.MANDARIN CHINA | 16.04.17- 18.04.17 | 41,589 | 52.03 | 19,183 | IORE |
| MV. PRABHU MIHIKAA | 13.04.17- 16.04.17 | 53,732 | 72.35 | 17,824 | IORE |
| MV.MP PANAMAX 4 | 20.04.17- 22.04.17 | 66,820 | 67.2 | 23,864 | T. COAL |
| MV. GENCO BRITTANY | 23.04.17- 24.04.17 | 37,747 | 33.17 | 27,314 | IORE |
| MV.AQUAPR-OSPER | 27.0417- 29.04.17 | 55,563 | 65.7 | 20,297 | IORE |
| MV. TAMILNADU | 24.04.17- 26.04.17 | 43,312 | 55.4 | 18,763 | T. COAL |
| | **TOTAL** | **4,71,527** | **542.54** | **1,91,785** | |

Source: Traffic Department

## DISCUSSION

From the above tables 3.1& 3.2 and 3.1 & 3.2 figures, it can be interpreted that more the cargo stay at berth time is more less will be the productivity of that cargo. The reason behind that productivity was less at IOB berth during the month of May was because of the penalty that was undertaken for the sailing clearance of the vessel MV. DIAMOND STAR and Loading clearance of the vessel MV. TAMILNADU and also due to the heavy rain on 8thof May the productivity was less.

## CONCLUSION

Operating and managing a mechanized cargo berth is certainly a capital intensive project with huge investment in infrastructure, equipment and employees. As for dry bulk handling scheme, it is essential to invest time in understanding what the properties of the materials being passed through the process – and to use this information in assessing the adequacy of any designs or plant modifications.

So this study is undertaken based on the total quantity of the cargo which are loaded or exported from the mechanized berth during the period of two months i.e. April and May of 2017 and also studied the respective productivity of the same. From the study we found that April month is having more productivity than May month with an excess of 27,844 tonnes at CQ3, 276,514 tonnes at CB1 & CB2 and 52,329 tonnes at IOB respectively. And also it is found that Coal berths has more productivity.

## LIMITATION OF THE STUDY

Studies is confined to Paradip Port Trust only. Here four berths are undertaken for study out of fifteen berths. Time constrains i.e. only two months' time taken for completion of the project. After frequent request to the authority suitable data are not able to excess.

## SCOPE OF THE STUDY

As the study is confined to Paradip Port Trust, so to generalize the findings the study may extend to other ports of our country. This study is undertaken on four berths only hence the same cane be considered for all the berth. If more time will be allowed or considered the generous of this project may be clarified or manifested. If authority will be convinced and cooperate for the same study so that the authenticated data can be assessed.

## RECOMMENDATION

Giving the berth on a hire basis to the private parties can reduce the major problem. The network of port with the industrial belt should be improved. Upgradation of plant is must require for better productivity. Road and rail connection for cargo traffic should be repaired every year. More number of trucks and cranes should be employed to work so should to improve the berth day output. Plant shut-downs are to be properly planned, after considering the expected life of each part of the equipment. Dispatch of big size/ oversize coal has to be controlled at the loading point should be taken care off.

## REFERENCE

*Bruzzone, A., and R. Signorile(1998). "Simulation and Genetic Algorithms for Ship Planning and Shipyard Layout." Simulation 71 (2).*

*Demirci, E (2003). Simulation Modelling and Analysis of a Port Investment, Simulation, the Society for Modeling and Simulation International, Vol. 79, Issue 2, 94-105*

*Hanaoka, S.and Madan B. Regmi (2011). Promoting intermodal freight transport through the development of dry ports in Asia: An environmental perspective, IATSS Research 35 (2011) 16–23.*

*Stopford, M (2000). Defining the future of shipping markets, a paper was delivered at the International Transport Symposium organised by the US Department of Transport- ITIC Forum*

*Umang, N.,Bierlaire,M. and Vacca, I.(2013). "Exact and Heuristic Methods to Solve the Berth Allocation Problem in Bulk Ports." Transportation Research Part E: Logistics and Transportation.*

*Wadhwa, Lal. C. (2007). "Optimizing Deployment of Ship loaders at Bulk Export Terminal." Journal of Waterway 126 (6): 297–298*

## WEBLIOGRAPHY

*www.paradipport.gov.in;*
*www.geelongport.com.au;*
*www.porttechnology.org*
*www.indiaport.com*

# Bullwhip Effect Reduction Through Multi-Agent System using Jade Tool

**Sandeep Garg*, Dr. S. Srinivasan****
*Research Scholar, NIMS University, Jaipur, India
**Professor Department of Computer Applications, PDMCE Bahadurgarh, Jhajjar, India

## ABSTRACT

*The bullwhip effect is the magnification of demand fluctuations, not the magnification of demand. Whenever demand increases and decreases, the bull whip effect are evident in a supply chain. When the supply chain is large, the issue becomes more complex. Also Bullwhip effect is caused from distortions in information along the supply chain Some of the bull whip effects are excess inventories, problems with quality, increased costs, overtime expenditures, lost customer service, lost sales and more. This leads to poor forecasting of sales, incorrect information along the supply chain. In order to solve bullwhip effect, it is proposed that Multi-agent based Supply chain management which ensures entire supply chain working on real time. Intention of our work is to develop a supply chain management application based on MAS and SOA and build a model how it can help in reducing bullwhip effect in a manufacturing unit. The Supply Chain Management application consists of three different services i.e. MAS, SOA and SCM. These services are designed, integrated and architected separately and brought them together using MAS and SOA technologies.*

## I. INTRODUCTION

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request, or demand. The supply chain not only includes the manufacture and suppliers, but also transporters, warehouses, retailers, and finally the end consumers themselves The objective of every supply chain is to maximize the overall value generated. The value a supply chain generates is the difference between what the final product is worth to the customer and the effort the supply chain expends in filling the customer's request.

Supply chain management involves the management of flows of information, product, or funds between and among stages in a supply chain to maximize total supply chain profitability An important phenomenon in SCM, known as the bullwhip effect, which suggests that the demand variability increases as one moves up a supply chain. It is 1989 that Sterman first introduced regarding this effect. Since then, worldwide researches have been carried out by various authors to study different aspects of SCM, causing the bullwhip effect and suggested a number of methods to reduce its effect.

The impact of the bullwhip effect is to increase Manufacturing cost , Inventory cost, Replenishment lead time, Transportation cost $ Labor cost for shipping and receiving, for building surplus capacity and holding surplus inventories. The impact of the bullwhip effect is also to decrease 'Level of Product Availability', since More run out of stocks in supply chain, and to decrease 'Relationship Across the Supply Chain', since each stage tends to blame other stages of the supply chain.

There are so many minor causes which gives rise to bullwhip effect. But, they can never be quantified through mathematical equations, however, can be controlled through effective managerial levers. Some of these causes can be pointed out as below,

- Lack of supply chain coordination
- Lack of information sharing
- Lack of trust among the members in SC
- Lack of proper incentive scheme
- Lack of proper trained sales forces etc

The major causes which increase in variability are projections of future demand expectations, which result in over-exaggerated responses to changes in demand.

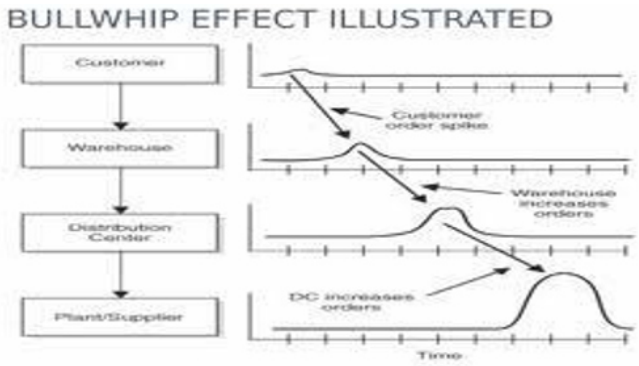



**Figure 1: Bullwhip effect**

In 1997 Lee et al. identified five major causes of the bullwhip effect which was all the consequence of the rational behavior of the supply chain members:

They are the use of

- Demand Forecasting
- Batch purchasing OR Ordering Lots
- Replenishment lead times
- Rationing & Supply Shortages
- Price Fluctuations and Safety Stock

The loss due to this can be quantified through mathematical equations, and can be controlled effectively, if the factors affecting the bullwhip effect are analyzed properly through proper method.

All previous works were only limited on quantifying the bullwhip effect based on common methods of reducing its impact. However, with all these previous works, it is difficult to obtain graphical illustration of the bullwhip effect

## II. RELATED WORK

Lee et.al (1997) stated that the bullwhip effect occurred when the demand order variabilities in the supply chain were amplified as they moved up the supply chain. Distorted information from one end of a supply chain to the other could lead to tremendous inefficiencies. Companies could effectively counteract the bullwhip effect by thoroughly understanding its underlying causes. Industry leaders were implementing innovative strategies that posed new challenges: 1. integrating new information systems, 2. defining new organizational relationships, and 3. implementing new incentive and measurement systems.

Fransoo et.al (2000) stated discussed Increased demand variability in supply chains (the bullwhip effect) in the literature. The practical measurement of this effect, however, entailed some problems that had not received much attention in the literature and that had to do with the aggregation of data, incompleteness of data, the isolation of demand data for defined supply chains that were part of a greater supply web. This paper discussed those conceptual measurement problems and discusses experiences in dealing with some of these problems in an industrial project. Also presented empirical results of measurements of the bullwhip effect in two supply chains.

Merkuryev et.al (2002) described the impact of two different information sharing strategies

- decentralized and centralized information – combined with two inventory control policies
- min-max and stock-to-demand inventory control – on the bullwhip effect. To investigate and measure this impact, simulation models were developed using the Arena 5.0 software package for a four-stage supply chain, consisting of a single retailer, wholesaler, distributor and manufacturer. The experiments with the developed models were described and the results are analyzed

Warburton et.al (2004) described The Bullwhip Effect as problematic: order variability increases as orders propagate along the supply chain. The fundamental differential delayed equations for a retailer's inventory reacting to a surge in demand were solved exactly. Much of the rich and complex inventory behavior was determined by the replenishment delay. The analytical solutions agreed with numerical

integrations and previous control theory results. Managerially useful ordering strategies were proposed. Exact expressions were derived for the retailer's orders to the manufacturer, and the Bullwhip Effect raised naturally. The approach was quite general and applicable to a wide variety of supply chain problems.

Croson et.al (2005) proposed a new behavioral cause of the bullwhip, coordination risk, arising when players deviated from equilibrium to build inventory to protect against the perceived risk that others would not behave optimally. They tested two strategies to mitigate coordination risk: (1) holding additional on-hand inventory, and (2) creating common knowledge by informing participants of the optimal policy. Both strategies

reduced, but did not eliminate, the bullwhip effect. Holding excess inventory reduced order amplification by providing a buffer against the endogenous risk of coordination failure. Such coordination stock differed from traditional safety stock, which buffers against exogenous demand uncertainty. Surprisingly, neither strategy reduced supply-line under weighting. They concluded that the bullwhip could be mitigated but its behavioral caused appeared robust.

Mujaj et.al (2007) addressed the problem of increasing order variances in multi-tier supply chains. The majority of current approaches for reducing this problem, namely the bullwhip effect, relied on information sharing and/or cooperative planning in inter-organizational systems. Due to multiple barriers in implementing these approaches, they maintained the local autonomy of the participants in the supply chain and provided a multiagent-oriented solution to the problem. In particular, they designed an agent-based reverse pricing model for matching supply and demand between independent agents. They adopted reverse pricing for operational procurement decisions and matchmaking that could be automated to a large extent. They evaluated our proposal by conducting a simulation study using a multiagent-based simulation system, and showed that the novel approach results in a significant reduction of the bullwhip effect.

Chaharsooghi et.al (2008) stated that two-echelon supply chain, which included two products based on the following considerations, had been studied and the bullwhip effect was quantified. Providing a measure for bullwhip effect that enabled us to analyze and reduce this phenomenon in supply chains with two products was the basic purpose of this paper. Demand of products was presented by the first order vector autoregressive time series and ordering system was established according to order up to policy. Moreover, lead-time demand forecasting was based on moving average method because this forecasting method is used widely in real world. Based on these assumptions, a general equation for

bullwhip effect measure was derived and there was a discussion about nonexistence of an explicit expression for bullwhip effect measure according to the present approach on the bullwhip effect measure. However, bullwhip effect equation was presented for some limited cases. Finally, bullwhip effect in a two-product supply chain was analyzed by a numerical example.

Duc et.al (2010) studied whether a third-party warehouse can help to reduce the bullwhip effect in a supply chain. We compare the bullwhip effect in a three-stage supply chain with one supplier, one third-party warehouse, and two retailers and that in a two-stage supply chain with one supplier and two retailers. As a result, they exactly quantified an upper bound on variance of order lead time when order lead times of the warehouse and the retailers had the same mean value. In addition, they showed that the bullwhip effect pooling exists (i.e., the existence of third-party warehouse is beneficial for mitigating the bullwhip effect in supply chains) regardless market shares of the retailers if the variance of order lead time of the warehouse is less than the upper bound value.

Barlas et.al (2011) discussed that Supply chain inventories were prone to fluctuations and instability. Known as the bullwhip effect, small variations in the end item demand created oscillations that amplified throughout the chain. By using system dynamics simulation, they investigated some of the structural sources of the bullwhip effect, and explored the effectiveness of information sharing to eliminate the undesirable fluctuations. Extensive simulation analysis was carried out on parameters of some standard ordering policies, as well as external demand and lead-time parameters. Simulation results showed that (i) a major structural cause of the bullwhip effect was isolated demand forecasting performed at each echelon of the supply chain, and (ii) demand and forecast sharing strategies could significantly reduce the bullwhip effect, even though they could not completely eliminate it. They specifically showed how each policy is improved by demand and forecast sharing. Future research involves more advanced ordering and forecasting methods, modelling of other well-known sources of bullwhip, and more complex supply network structures.

## III. MULTI-AGENT SYSTEM

Computers are not very good at knowing what to do: every action a computer performs must be explicitly anticipated, planned for, and coded by a programmer. If a computer program ever encounters a situation that its designer did not anticipate, then the result is not usually pretty—a system crash at best, multiple loss of life at worst. This mundane fact is at the heart of our relationship with computers. It is so self-evident to the computer literate that it is rarely mentioned.

And yet it comes as a complete surprise to those encountering computers for the first time. For the most part, we are happy to accept computers as obedient, literal, unimaginative servants. For many applications (such as payroll processing), it is entirely acceptable. However, for an increasingly large number of applications, we require systems that can decide for themselves that they need to do in order to satisfy their design objectives. Such computer systems are known as agents.

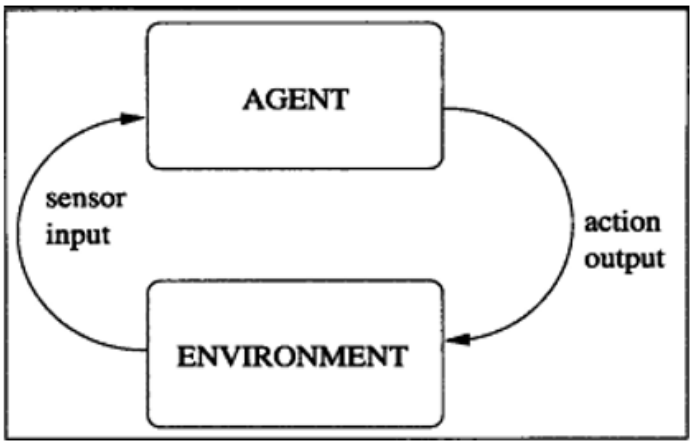



**Figure 2: Intelligent Agent**

Agents that must operate robustly in rapidly changing, unpredictable, or open environments, where there is a significant possibility that actions can fail are known as intelligent agents, or sometimes autonomous agents. Here are examples of recent application areas for intelligent agents:

- When a space probe makes its long flight from Earth to the outer planets, a ground crew is usually required to continually track its progress, and decide how to deal with unexpected eventualities. This is costly and, if decisions are required quickly, it is simply not practicable. For these reasons, organisations like NASA are seriously investigating the possibility of making probes more autonomous— giving them richer decision making capabilities and responsibilities.
- Searching the Internet for the answer to a specific query can be a long and tedious process. So, why not allow a computer program—an agent—do searches for us? The agent would typically be given a query that would require synthesising pieces of information from various different Internet information sources. Failure would occur when a particular resource was unavailable, (perhaps due to network failure), or where results could not be obtained.

The multi-agent system (M.A.S.) is a computerized system composed of multiple interacting intelligent agents within an environment. Multi-agent systems can be used to solve problems that are difficult or impossible for an individual agent or a monolithic system to solve. Intelligence may include as given below:

- some methodic,

- functional,
- procedural or algorithmic search,
- find and
- processing approach.

Although there is considerable overlap, a multi-agent system is not always the same as an agent-based model (ABM). The goal of an ABM is to search for explanatory insight into the collective behavior of agents (which don't necessarily need to be "intelligent") obeying simple rules, typically in natural systems, rather than in solving specific practical or engineering problems. The terminology of ABM tends to be used more often in the sciences, and MAS in engineering and technology.

Agents communicate in order to achieve better the goals of themselves or of the society/system in which they exist. Note that the goals might or might not be known to the agents explicitly, depending on whether or not the agents are goal based. Communication can enable the agents to coordinate their actions and behavior, resulting in systems that are more coherent.

Coordination is a property of a system of agents performing some activity in a shared environment. The degree of coordination is the extent to which they avoid extraneous activity by reducing resource contention, avoiding live lock and deadlock, and maintaining applicable safety conditions. Cooperation is coordination among nonantagonistic agents, while negotiation is coordination among competitive or simply self-interested agents. Typically, to cooperate successfully, each agent must maintain a model of the other agents, and also develop a model of future interactions. This presupposes sociability.

## IV. MULTI-AGENT SYSTEM BASED SUPPLY CHAIN SYSTEM

A multi-agent approach is applied for designing the system in order to deal with the complexity of the domain and to provide flexibility regarding the system architecture. Indeed, agent technology has become the most popular tool for designing distributed SCM systems as it provides an adaptable and dynamic way for managing separate links within the chain.

Unlike centralised approaches, agent-based SCM systems can respond quickly to changes and disturbances (either internal or external) through local decision making. Another advantage of designing the SCM solution as a multi-agent system (MAS) is that it allows different tasks within the SCM to be separated and explored both independently and in relation to each other. This feature is particularly important for the project presented in the thesis, as the research is mainly focused on one side of the supply chain, namely, its demand part, which deals with selling products to customers. The

main problem which sellers are facing when managing their supply chains is of deciding on the details of offers to be made to customers: which prices to set, how many items, when and to whom to sell in order to increase profit, and when to sell available stocks without being penalized for late deliveries at the same time. The ability to predict market prices is crucial for developing better selling strategies. The task is not easy to solve in the context of e-Commerce, where prices are established dynamically. Using the principles of the MAS, this problem is studied in the thesis: a number of predictive models are deployed in the Demand agents of the MAS, and their effect on the behaviour of other internal agents as well as the whole system is investigated. The principles of the multi-agent approach help to meet the requirements of SCM in the following way:

- **Distributed:** The functions of SCM are divided among a set of separate, asynchronous software agents.
- **Dynamic:** Each agent performs its functions asynchronously as required, as opposed to in a batch or periodic mode.
- **Intelligent:** Each agent is an "expert" in its function; it uses artificial intelligence and operations research problem-solving methods.
- **Integrated:** Each agent is aware of and can access the functional capabilities of other agents.
- **Responsive:** Each agent is able to ask for information and/or a decision from another agent - each agent is both a client and a server.
- **Reactive:** Each agent is able to respond to events as they occur, modifying its behaviour as required, as opposed to responding in a pre-planned, rigid, batch manner.
- **Cooperative:** Each agent can cooperate with other agents in finding a solution to a problem - that is, they do not act independently.
- **Interactive:** Each agent may work with people to solve a problem.
- **Anytime:** No matter how much time is available, an agent is able to respond to a request, but the quality of the response is proportional to the time given to respond.
- **Complete:** The total functionality of the agents must span the range of functions required to manage the supply chain.
- **Reconfigurable:** The SCM system itself must be adaptable and must support the "relevant subset" of software agents.
- **General:** Each agent must be adaptable to as broad a set of domains as possible.
- **Adaptable:** Agents need to quickly adapt to the changing needs of the human organization. For example, adding a resource or changing inventory policy should be quick and easy for the user to do.
- **Backwards Compatible:** Agents need to have a seamless upgrade path so that the release of new or changed features does not compromise existing integration or functionality.

Various type of hybrid agent is used here which describe as below:

- **Demand Agent** used for handling the point-of-sale data and provide the information to central agent.


**Figure 3: Demand Agent**

- **Forecasting Agent** used for analysising the market and upcoming trends and up and down and gives a optimistic forecasting values.


**Figure 4: Forecasting Agent**

- **Supply Agent** used for sequencing and handling the order data with high managing skills and control supply for the manufacturing process.


**Figure 5: Supply Agent**

- **Delivery Agent** used for studying everyday price of market and mention the peak high and deliver the product below the price in day and their reasons and provide this information to central agent

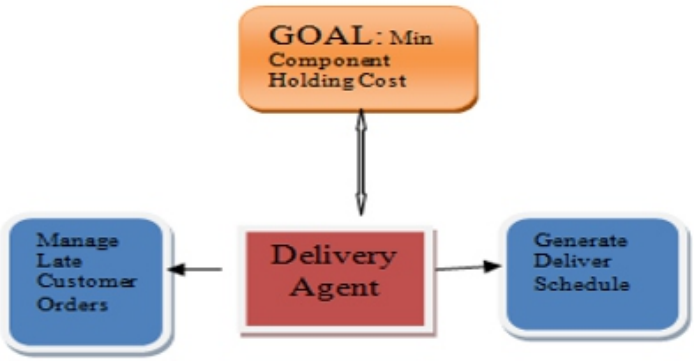



**Figure 6: Delivery Agent**

- **Stock Control Agent (SCA)** used for handling the stock and control each steps of stocking related to market demand and up- down, and all these work done by sharing the information to central agent.

- **Inventory Agent (IA)** used for handling the inventory control system.


**Figure 7: Inventory Agent**

- **Central Information Managing Agent (CIMA)** used for sharing the information from all the agent and provide the information which is required for particular agent.

- **Production Agent (PA)** used for handling the production of the product which is related to supply chain agent, because production low and high demand also cause the bullwhip.


**Figure 8: Scheduling Agent**

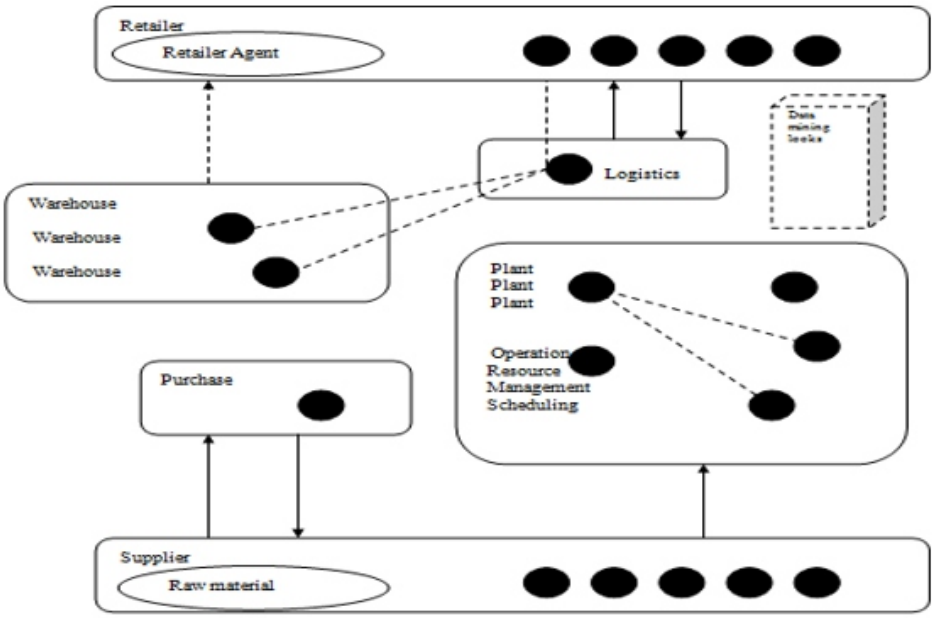



**Figure 9: MAS based SCM system**

## V. BULLWHIP EFFECT REDUCTION

Supply Chain encompasses all those activities needed to design, manufacture and deliver a product or service needs a mechanism or frame work for information sharing. Agent-based manufacturing is a new way of thinking about and applying information. With this idea an effort is made to provide a multi agent system model for the supply chain management in order to reduce the bull whip effect. Basic interface is given below:

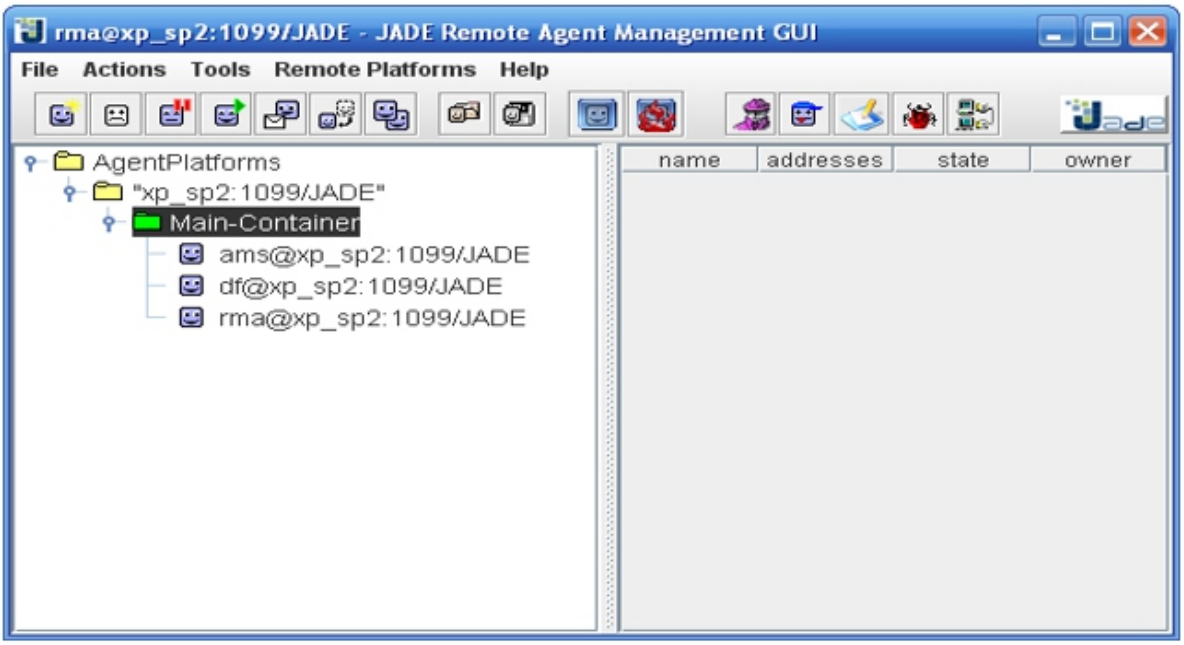



**Figure 10 GUI of the JADE RMA**

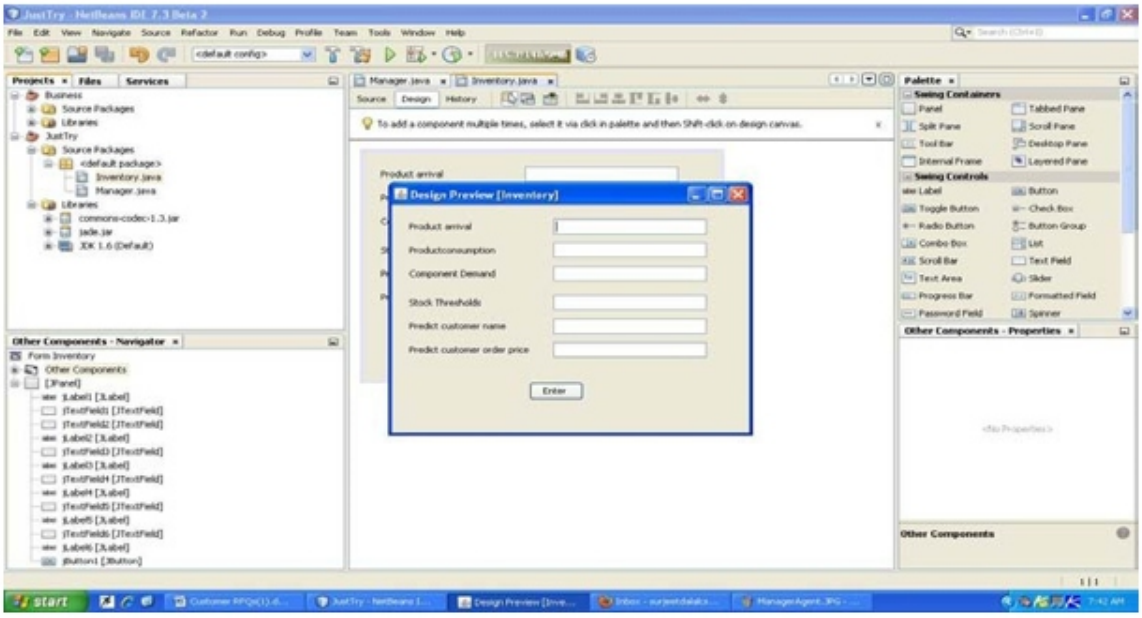


**Fig 11:- Manger Agent**

In the proposed model (bull whip effect model) each agent performs a specific function of the organization and share the information with information agent. There by the most important requirement of successful supply chain i.e information sharing is achieved besides controlling the demand-supply trouble in the proposed model. In the current work a part of the model related to control agent is designed and it may be the first ever such system to reduce the bull whip effect.

## VI. CONCLUSION

Supply Chain networks are multi stage complex dynamical systems consist of various involved organizations performing different processes and activities in each and consequent stages which are connected through upstream and downstream linkages to produce value in the form of products and services Demand forecasting and decision making processes are among the key activities which directly affect the performance of this complex systems. The variability of the demand information between the stages of Supply Chain networks and the increase in this variability as the demand data moves upstream from the customer to the consequent stages which cause the bull whip, and there are lot of buff whip calling factor is available in supply chain, so control these factor proposed multi-agents are being designed, and it control very effectively and reduce the bull whip in the supply chain networks

## VII. REFERENCES


*[1] Angappa Gunasekaran and Bulent Kobu, (2006), Performance measures and metrics in logistics and supply chain management: a review of recent literature (1995– 2004) for research and applications, International Journal of Production Research, Vol. pp 1–22. DOI: 10.1080/00207540600806513.*

*[2] Agostino Villa, (2002), Emerging trends in large-scale supply chain management, International. Journal of. Production Research, vol. 40, no. 15, 3487-3498. DOI:10.1080/00207540210131833.*

*[3] Sunil Chopra, Peter Meindl, (2008), Supply Chain management,3rd edition, Pearson Education Asia, New Delhi, ISBN : 81-7808-272-1*

*[4] C. Martinez-Olvera and D. Shunk (2006), Comprehensive framework for the development of a supply chain strategy, International Journal of Production Research, Vol. 44, No. 21, 1, pp 4511–4528.*

*[5] Mario Verdicchio and Marco Colombetti (2002), Commitments for Agent-Based Supply Chain Management, ACM SIGecom Exchanges, Vol. 3, No. 1, pp 13-23*

*[6] MACE-SCM: A multi-agent and case-based reasoning collaboration mechanism for supply chain management under supply and demand uncertainties, Ohbyung Kwona.*

*[7] Roger D H Warburton, An analytical investigation of Bull Whip Effect , NTC SO3- MDI3s , , University of Massachusetts, Dartmouth , Nov , 2004.*

*[8] R Michael Donavan, Supply Chain Management cracking Bull whip effect .*

*[9] Dragana Makajic, Biljana ,Bull whip effect and supply chain modeling and analyzing using CPN Tools ,Operation Research Laboratory , University of Belgrade.*

*[10] Aryya Gangopadhyay, Zhensen Huang ,Studying the value of information sharing in E-Business Supply Chain Management , University of Maryland , Baltimore .*

# Influence of Educational Status of Customers on Service Quality

**Dr.S.Valli Devasena,**
Assistant Professor, Department of Commerce, Mother Teresa Women's University,
Kodaikanal-624 102, Dindigul District, Tamil Nadu, India

## A B S T R A C T

*The customer choice and awareness have been increasing tremendously during this decade due to more open economy, the advent of information technology and media revolution, besides hectic competition for resources by banks. As markets have become increasingly competitive, customers can now immediately go elsewhere if they do not get what they want. Continuous improvement, gaining the competitive edge, increased market share, higher profits-none of these things is possible unless businesses can find new ways of maintaining the loyalty of existing customers.*

*It takes only a few incidents and direct experiences for the knowledgeable customers to form an opinion about the quality of the services and the quality of the product offered. Hence, "customer service is not being viewed as just a business strategy but should become a corporate mission."*

## INTRODUCTION

"By entering into your premises, the customer is giving you opportunity to serve him, but you are not doing a favour by serving him"

**- Mahatma Gandhi.**

The liberalisation and globalisation of Indian economy took place almost a decade ago. Ever since, the focus point in any service organisation has been "customer service", more so in the banking industry. The phrases such as "customer is the king in our business", "service to customer is service to God" are no more a myth but have turned out to be a reality. Customer service is the base for business expansion because of the stiff competition prevalent in the banking industry. With the advent of new private banks, the concept of "customer service" has become an important and pivotal issue in banks, whether it is in the public sector, private sector, co-operative sector and so on. The survival of banking business is dependent on customer services.

## CUSTOMER SERVICE-SIGNIFICANCE

"The Banking sector industry is considered a service oriented industry. It has to render manifold services to the people who visit the banks. Customer service refers essentially to counter level inter face or through other modes with the customers." [1]

The issue of proper customer service is central to all business operations. That is why management experts have for long, considered customer service as an integral part of the growth strategy of their businesses.

'The leader of an organisation should live and breathe customers' needs and should communicate this across the organisation."[2]

Hence, the major component of customer service is related to the involvement and commitment of the staff rendering such service. Since the marketing of financial service offered by bank very much depends on the quality of customer service and the satisfaction that customers derive from the services they receive the important criterion to judge the benchmark of a bank is customer satisfaction in terms of good service.

## BANKER AND CUSTOMER RELATIONSHIP

Today the relationship between the banker and customer has come under sharp focus both at the banker's as well as at the customer's ends. Many customers are expecting better service. The dominant questions which are bothering the minds of bank management today are how to improve customer service and competitive advantage. The products are almost the same; however, the battleground is service.

**Paradigm Shift – Scenario in India**

| *Before 1991* | *After1991* |
|---|---|
| Seller's market | Buyer's market |
| Protected market | Open market |
| Not many global brands | Increase in number of global brands |
| Friendly competition | Cut-throat competition |
| Patient customers | Demanding customers |
| Limited choice for customers | Increasing choice for customers |
| Limited role of service | Increased role of service |
| Speed @ will | Turbo speed |
| Fundamental standalone system | Enterprise system |
| IT-competitive advantage | IT-Enabler |
| Gaining new customers | Retaining existing customers |
| Monologue | Dialogue |
| Transaction | Relationship |

Source: IBA Bulletin, August 2004, p-6.

## STATEMENT OF PROBLEM

Customers' preferences keep on changing at a rapid speed and their demands are turned insatiable. In order to cater to the changing preferences, bankers are bound to provide the services suitable to their needs to survive in the competition. Hence an attempt is made to analyse the influence of educational status of customers on service quality of banks by Chi Square test.

## REVIEW OF LITERATURE

Kamath3 in his thesis entitled "Marketing of Bank Service with Special Reference to the Branches in Bombay City of Syndicate Bank" has concluded that quick and better services mattered in attracting and retaining a bank customer.

R.P Goyal4 in his article "Customer Service in Banks" has underlined the importance of improving customer service in banks and suggested that it could be achieved by motivating and orienting the staff, simple systems and procedures and specific schemes to suit customer needs.

H.K. Bedbak5 in his study entitled "Institutional Financing for Priority Sectors – An Analysis of Delay and Attitude," has analysed the delays in sanctioning of loans and attitude of institutional agencies towards the customers as borrowers.

Manjit Singh6 in his project "A Study of the Impact of Bank Lendings on Weaker Sections – A Case Study of Agricultural Development Branch of State Bank of India, Moga" has reviewed the standard of living of beneficiaries and non beneficiaries in Moga of Madhya Pradesh.

R. Neelamegam7 in his research study "Institutional Financing to Small Scale Industries" has reviewed the various types of institutional financing facilities available to small scale industrial units in Tamil Nadu.

Ranade8 in his study entitled "Marketing of Deposit and Allied Service to Non-resident" customers concluded that guide service is the major factor influencing an NRI in the selection of a bank.

Eugene W. Anderson, Daes and Furness and Donald R. Lehmann9 discussed the links between quality, expectations, customer satisfaction and profitability. The findings state that when quality and expectations increase, there is a positive impact on customer satisfaction and in turn, profitability.

## OBJECTIVES OF THE STUDY

1. to analyse the influence of educational status of customers on service quality in banks.
2. to offer suggestions for the improvement of customer services in State Bank of India

## SCOPE OF THE STUDY

This study covers the customer services rendered by State Bank of India in Madurai city. As the study is an empirical study to identify the attitude of the customers towards the services rendered by the banker, the study has been focused towards customers who are the recipient of services and bank employees who are the agencies of delivery of services. As such, it has been projected from the point of view of bank employees and from the point of view of bank customers. It is analysed with reference to customers and employees attitude. The State Bank of India in Madurai city consists of 13 branches. The study was undertaken on the customers and Bank employees of 13 branches only.

## METHODOLOGY

The present study is an empirical one based on survey method. Data were collected from both primary and secondary sources. The primary data were collected from banks' customers and bank employees by means of interview schedule and questionnaire.

## SAMPLING DESIGN

The study aims at analysing the attitude of customers of State Bank of India in Madurai city branches with regard its services.

242 bank employees were supplied with the questionnaire in 13 branches of State Bank of India in Madurai city. But only 240 respondents filled in the questionnaire. Out of these 240 respondents, 60 respondents were bank officials (Bank Managers and Officers). All of them have responded. The remaining was clerical which amounting to 60 per cent of the clerical staff selected on proportionate random sampling method. Indeed, the questionnaires were given through branch managers of the said 13 branches to the clerical staff and they got back researcher the questionnaire filled in by the clerical staff of the respective branches.

## GEOGRAPHICAL AREA OF THE STUDY

The study covers the whole area of Madurai city only where the branches of the State Bank of India are situated. They are Amman Sannadhi Branch, Arasaradi Branch, Commercial Tax Complex, Madurai Agricultural Development Bank Branch, Madurai city Branch, Pasumalai Branch, Personal Banking Branch, Tallakulam Branch, Vinayaganagar Branch, West Tower Branch, Railway Station Branch and Madurai Main Branch.

## ANALYSIS OF THE STUDY

An attempt has been made to analyse the influence of educational status on service quality of banks by Chi Square test.

### I. Educational Status of the Respondents and their Opinion Level

The sample customers have different educational qualifications. Hence, an attempt has been made to analyse whether there is any significant relationship between educational qualification and their opinion level.

**Educational Qualification and Opinion Level of Sample Customers**

| *Sl. No.* | *Educational Level* | *Opinion Level* | | | *Total* |
|---|---|---|---|---|---|
| | | *Low* | *Medium* | *High* | |
| 1 | School level | 37 | 175 | 22 | 234 |
| 2 | Under graduates | 16 | 170 | 50 | 236 |
| 3 | Post graduates and others | 39 | 79 | 62 | 180 |
| | Total | 92 | 424 | 134 | 650 |

Source : Computed from Primary Data.

It is inferred from Table 1 that among 134 sample customers who have high level opinion of banking services, 22 are school level, 50 are undergraduates and 62 are postgraduates and rest the others.

Of the 424 sample customers who have medium level opinion, 175 are of school level, 170 are undergraduates 79 are postgraduates and the rest others.

Among the customers who have low level 37 are of school level, 16 are undergraduates and 39 are postgraduate and the rest others.

## NULL HYPOTHESIS

There is no significant relationship between the educational qualification of the customers and their level of opinion.

Table 2 shows the working of the chi-square test.

**TABLE 2 : Chi-square Test for Educational Qualification and Opinion Level of Sample Customers**

| *Cell* | *O* | *E* | *O-E* | $(O-E)^2$ | $(O-E)^2/E$ |
|---|---|---|---|---|---|
| $R_1 C_1$ | 37 | 33.12 | 3.88 | 15.0544 | 0.454541 |
| $R_1C_2$ | 175 | 152.64 | 22.36 | 499.9696 | 3.275482 |
| $R_1C_3$ | 22 | 48.24 | -26.24 | 688.5376 | 14.27317 |
| $R_2C_1$ | 16 | 33.40308 | -17.4031 | 302.8671 | 9.067042 |
| $R_2C_2$ | 170 | 153.9446 | 16.05538 | 257.7754 | 1.674468 |
| $R_2C_3$ | 50 | 48.65231 | 1.347692 | 1.816275 | 0.037332 |
| $R_3C_1$ | 39 | 25.47692 | 13.52308 | 182.8736 | 7.17801 |
| $R_3C_2$ | 79 | 117.4154 | -38.4154 | 1475.742 | 12.56856 |
| $R_3C_3$ | 62 | 37.10769 | 24.89231 | 619.627 | 16.69807 |
| Total | | | | | 65.22667 |

Degrees of freedom $= df = (c\text{-}1)\,r - 1)$

$= (3-1)(3-1)$

$= 2 \times 2 = 4$

Calculated value of $\chi^2 = 65.22667$

Table value of $\chi^2\, 0.05 = 9.49$

Since the calculated value 65.22667 is more than the table value at five per cent level of significance, the null hypotheses is rejected. To conclude, there is a significant relationship between the educational qualification of the sample customers and their opinion level.

## SUGGESTIONS

Recognition of service quality as a competitive weapon is relatively a recent phenomenon in the Indian Banking sector. Prior to the liberalisation era the banking sector in India was operating in a protected environment and was dominated by nationalised Banks. Banks at that time did not feel the need to pay attention to service quality issues and they assigned very low priority to identification and satisfaction of customer needs. Hence banks should concentrate more on tech savy products and services to have more customers and to retain their loyalty.

## CONCLUSION

Customers vary in their expectations and attitudes and belong to wide socio-economic and cultural backgrounds. The gap between the expectations of customers and their fulfillment is the root cause of grievances which affects the image of the bank. To overcome this situation, there should be an effective monitoring mechanism and constant vigil over the services provided to customers. Since they have a

wide choice of services and multiplicity of products they are more conscious of convenience and cost, safety and speed, respect and quality, courtesy and elegance. State Bank of India has to be very careful in responding to the needs of their customers in an intensely competitive and rapidly changing environment.

## REFERENCES


1. *K.V. Bhaskara Rao, "Customer Service in Banks" Banking and Finance, January 2006, p.8.*
2. *Debashis Sarkar, TIPs for Customer Satisfaction, Beacon Books, New Delhi, 1997, p.10.*
3. *Kamath, "Marketing of Bank Service with Special Reference to the Branches in Bombay City of Syndicate Bank" BMP Ph.D., Thesis, Submitted to NIBM Pune, 1979.*
4. *R.P Goyal, "Improving Quality of Banking Service Commerce" Banking Supplement, Bombay, July 30, 1983 p.3.*
5. *H.K. Bedbak, "Institutional Financing for Priority Sectors – An Analysis of Delay and Attitude," Commerce and Management Vol.3, No.1, pp.20-30, 1983.*
6. *Manjit Singh, "A Study of the Impact of Bank Lending on Weaker Sections – A Case Study of Agricultural Development Branch of State Bank of India, Moga" Research Project Sponsored by Indian Council of Social Research, New Delhi, 1983.*
7. *R. Neelamegam, "Institutional Financing to Small Scale Industries", Ph.D., Thesis Submitted to Madurai Kamaraj University, Madurai, 1983*
8. *M.P.Ranade, "Marketing of Deposit and Allied Service to Non-Resident", BMP, Ph.D., Thesis Submitted to NIBM, Pune, 1985.*
9. *Eugene W. Anderson, Daes, Furness and Donald R. Lehmann, "Customer Satisfaction, Market Share and Profitability: Findings from Sweden", Journal of Marketing, Vol.58, July 1994, pp.53-66.*
10. *R.M. Chidambaram, "Promotional Mix for Bank Marketing", IBA Bulletin, Vol.16, No.3, March 1991, pp.24-26.*
11. *Biswa N. Bhattacharyya, "Marketing Management and Innovators in the Light of Liberalisation", Prajnan, Vol.20, No.5, 1991, p.419-425.*
12. *Valariee A. Zeithaml and Mary Jo Bitner, Building Customer Relationship through Segmentation and Retention Strategies, Service Marketing, McGraw Hill, 1996, pp.169-199.*
13. *A.M. Sadare, "Competency Building for Improving Customer Service in Banks", Banking and Finance, Vol.17, No.8, August 2004, pp.19-21*
14. *Financial Express 8th March 2004.*
15. *Financial Express 29th May 2004.*
16. *Krachenberg, Anthony Richard, "The Marketing of Services with Particular Reference to Commercial Bank Services," Ph.D., Thesis Submitted to University of Michigan, 1963.*
17. *Person Marjorie, "Marketing and Banking – An Evaluation of Marketing Program Development in Selected Commercial Banks", Ph.D., Thesis Submitted to Indiana University, 1965.*
18. *Reed Jim Dale, "Commercial Bank Selection: A Factor Analysis of the Determinants of Consumer Choice", Ph.D., Thesis University of Arkansas, 1972.*
19. *Robert Lee Fitts, "Predictors of Usage Rates for Selected Commercial Bank Service - A Cross Sectional Approach Utilizing Socio-economic, Demographic and Attitudinal Variables" Ph.D., Thesis Submitted to University of Alabama, 1975.*
20. *R.P Goyal, "Improving Quality of Banking Service Commerce" Banking*

# A Study of Financial Performance: A Comparative Analysis of SBI and ICICI Bank

**KolluSrinivas[1], Dr. Pawan Kumar Varma[2]**
Department of Management
[1,2]OPJS University, Churu (Rajasthan)

## ABSTRACT

*Banking Sector assumes an essential part in economic development of a nation. The banking arrangement of India is highlighted by an extensive system of bank offices, serving numerous sorts of financial administrations of the general population. The State Bank of India, prevalently known as SBI is one of the main bank of open area in India. SBI has 14 Local Head Offices and 57 Zonal Offices situated at essential urban areas all through the nation. ICICI Bank is second biggest and driving bank of private area in India. The Bank has 2,533 branches and 6,800 ATMs in India. The motivation behind the review is to inspect the financial execution of SBI and ICICI Bank, open division and private area individually. The examination is enlightening and logical in nature. The information utilized for the review was completely auxiliary in nature. The present review is directed to look at the financial execution of SBI and ICICI Bank on the premise of proportions, for example, credit store, net revenue and so on. The time of study taken is from the year 2007-08 to 2011-12. The review found that SBI is performing admirably and financially stable than ICICI Bank yet in setting of stores and use ICICI bank has preferable overseeing effectiveness over SBI.*

***KEYWORDS: Credit Deposit Ratio, ICICI, Net Profit Margin, Net worth Ratio, Advances, SBI.***

## 1. INTRODUCTION

A productive banking framework is perceived as fundamental necessity for the economic development of any economy. Banks activate the funds of group into gainful channels. The banking arrangement of India is included by an expansive system of bank offices, serving numerous sorts of financial needs of the general population.

The State Bank of India, famously known as SBI is one of the main banks in India. The State Bank Group, with more than 16,000 branches gives an extensive variety of banking items through its unlimited system of branches in India and abroad, including items went for Non- Resident Indians (NRIs). The headquarter of SBIis at Mumbai. SBI has 14 Local Head Offices and 57 Zonal Offices that are situated at imperative urban areas all through the nation. It additionally has around 130 branches out of the nation. It has a piece of the pie among Indian commercial banks of around 20% in deposits and credits.

The underlying foundations of the State Bank of India rest in the principal decade of nineteenth century, when the Bank of Calcutta later on renamed the Bank of Bengal, was set up on 2 June 1806. The Bank of Bengal was one of three Presidency banks, the other two being the Bank of Bombay (fused on 15 April 1840) and the Bank of Madras (joined on 1 July 1843). With the aftereffect of the illustrious sanctions each of the three Presidency banks were consolidated as business entities and got the elite ideal to issue paper cash in 1861 with the Paper Currency Act. They held this privilege till the development of the Reserve Bank of India. The Presidency banks amalgamated on 27 January 1921, and renamed Imperial Bank of India. The Imperial Bank of India remained a business entity.

The State Bank of India was constituted on first July 1955, in accordance with the State Bank of India Act, 1955 (the "SBI Act") with the end goal of making a state-collaborated and state- supported bank incorporating the previous Imperial Bank of India. In 1959, the State Bank of India (Subsidiary Banks) Act was passed, empowering the Bank to assume control eight previous state related banks as its auxiliaries.

The State Bank of India's is biggest bank, with around 9,000 branches in India and 54 global workplaces. Its Associate Banks have a local system of around 4,600 branches, with solid provincial ties. The Bank additionally has backups and joint ventures outside India, including Europe, the United States, Canada, Mauritius, Nigeria, Nepal, and Bhutan. The Bank has the biggest retail banking client base in India.

## 2. ICICI BANK-PROFILE

ICICI Bank is second biggest and driving bank of private sector in India. Its headquarter Mumbai, India. As per Forbes State Bank of India is the 29th most rumoured organization on the planet. The Bank has 2,533 branches and 6,800 ATMs in India. In 1998 ICICI Bank propelled web banking operations. The Bank offers an extensive variety of banking items and financial administrations to the corporate and retail clients. It likewise gives benefits in the regions of funding investment banking, resource management and life and non-life coverage. ICICI Bank's value shares are recorded in India on Bombay Stock Exchange (BSE) and the National Stock Trade (NSE) and its American Depositary Receipts (ADRs) are additionally recorded on the New York Stock Exchange (NYSE).

ICICI Bank constrained is real banking and financial administrations association in India. The bank is the second biggest bank in India and the biggest private sector bank in India by market capitalization. They are openly held banking organization occupied with giving an extensive variety of banking and financial administrations including commercial banking and treasury operations. The bank and their auxiliaries offers an extensive variety of banking and financial administrations including commercial

banking, retail banking, extend and corporate back, working capital fund, protection, investment and private value, investment banking, broking and treasury items and administrations. They offer through an assortment of conveyance channels and through their particular auxiliaries in the region of investment banking, life and non-extra security, funding and resources management. The bank has a system of 2035 branches and around 5518 ATMs in India and nearness in 18 nations. They have backups in the United Kingdom, Russia and Canada, branches in United States, Singapore, Bahrain, Hong-Kong, SRI LANKA, Qatar and Dubai International fund focus and delegate workplaces in United Arab Emirates, China, South Africa, Bangladesh, Thailand, Malaysia and Indonesia. Our UK auxiliary has built up branches in Belgium and Germany.

The bank value shares are recorded in India on Bombay Stock Exchange and National stock trade of India Limited and their American Depository Receipts (ADRs) are recorded on NYSE. The bank is first Indian banks recorded NYSE.

## 3. OBJECTIVE OF THE STUDY

- To concentrate the financial execution of SBI and ICICI Bank.
- To think about the financial execution of SBI and ICICI Bank.

## 4. RESEARCH METHODOLOGY

In the present review, an endeavour has been made to quantify, assess and analyse the financial execution of SBI and ICICI Bank which one identified with general society sector and private sector separately. The review depends on auxiliary information that has been gathered from yearly reports of the particular banks, magazines, diaries, records and other distributed data. The review covers the time of 5 years i.e. from year 2007-08 to year 2011-12. Proportion Analysis was connected to analyse and think about the patterns in banking business and financial execution. Mean and Compound Growth Rate (CGR) have additionally been conveyed to analyse the patterns in banking business profitability.

## 5.LIMITATION OF THE STUDY

Because of imperatives of time and assets, the review is probably going to experience the ill effects of specific impediments. Some of these are specified here under so that the discoveries of the review might be comprehended in a legitimate viewpoint.

The confinements of the review are:

- The study depends on the auxiliary information and the restriction of utilizing optional information may influence the outcomes.

- The auxiliary information was taken from the yearly reports of the SBI and ICICI Bank. It might be conceivable that the information appeared in the yearly reports might be window dressed which does not demonstrate the genuine position of the banks.

Financial investigation is predominantly done to look at the development, profitability and financial soundness of the individual banks by diagnosing the data contained in the financial explanations. Financial investigation is done to distinguish the financial qualities and shortcomings of the two banks by appropriately setting up connection between the things of Balance Sheet and Profit and Loss Account. It helps in better comprehension of banks financial position, development and execution by breaking down the financial proclamations with different instruments and assessing the connection between different components of financial explanations.

## 6. ANALYSIS

### Credit Deposit Ratio:-

Credit-Deposit Ratio is the extent of advance resources made by a bank from the deposits got. Credits are the advances and advances allowed by the bank. As it were it is the sum loaned by the bank to a man or an association which is recuperated later on. Intrigue is charged from the borrower. Store is the sum acknowledged by bank from the savers and premium is paid to them.

**Table 1: Credit Deposit Ratio**

(in per cent)

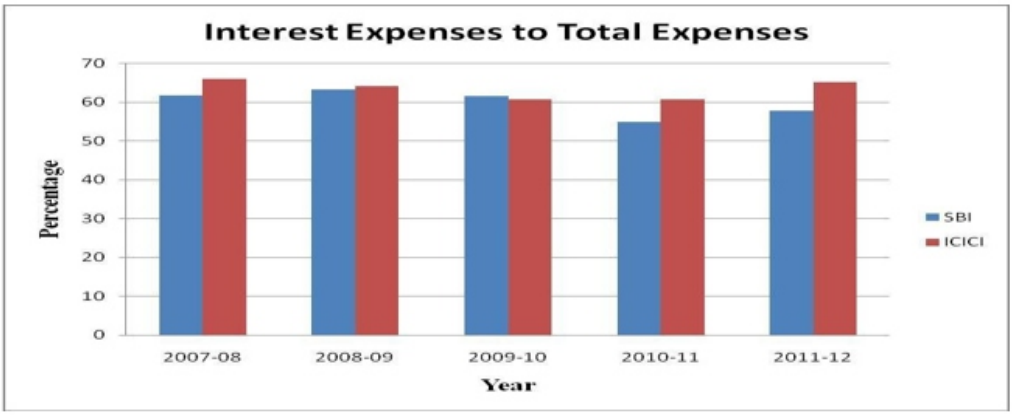
| YEAR | SBI | ICICI |
|---|---|---|
| **2007-08** | 77.57 | 84.99 |
| **2008-09** | 74.97 | 91.44 |
| **2009-10** | 73.56 | 90.04 |
| **2010-11** | 76.32 | 87.81 |
| **2011-12** | 78.5 | 92.23 |
| **MEAN** | 76.184 | 89.302 |
| **CGR** | 1.19 | 8.51 |

Source: Annual Reports of SBI and ICICI from 2007-08 to 2011-12

### Interest Expenses to Total Expenses:-

Interest Expenses to Total Expenses uncovers the costs brought about on interest in extent to aggregate costs. Banks acknowledges deposits from savers and pay interest on these records. This instalment of interest is known as interest costs. Add up to costs incorporate the sum spent as staff costs, interest costs, overhead costs and other working costs and so on.

**Figure 1:- Interest Expenses to Total Expenses**




**Interest Income to Total Income:-**

Interest Income to Total Income demonstrates the proportionate commitment of interest salary in complete wage. Banks loan cash as credits and advances to the borrowers and get interest on it. This receipt of interest is called interest wage. Add up to pay incorporates interest pay, non-interest pay and working salary.

**Table 2:-Interest Income to Total Income in SBI and ICICI**

(in Per cent)

| YEAR | SBI | ICICI |
|---|---|---|
| **2007-08** | 83.89 | 77.61 |
| **2008-09** | 83.4 | 79.29 |
| **2009-10** | 82.58 | 77.9 |
| **2010-11** | 84.49 | 78.51 |
| **2011-12** | 88.12 | 80.92 |
| **MEAN** | 84.49 | 78.84 |
| **CGR** | 5.04 | 4.26 |

Source: Annual Reports of SBI and ICICI from 2007-08 to 2011-12

**Other Income to Total Income:-**

Other salary to aggregate wage uncovers the proportionate share of other pay in complete wage. Other wage incorporates non-interest pay and working wage. Add up to wage incorporates interest pay, non-interest pay and working pay.

**Table 3:-Other Income to Total Income in SBI and ICICI**

(in Per cent)

| YEAR | SBI | ICICI |
|---|---|---|
| **2007-08** | 16.1 | 22.38 |
| **2008-09** | 16 | 20.7 |
| **2009-10** | 17 | 22.09 |
| **2010-11** | 16 | 21.48 |
| **2011-12** | 11 | 19.07 |
| **MEAN** | 15.22 | 21.44 |
| **CGR** | -31.6 | -14.7 |

## 7. FINDINGS AND CONCLUSIONS:-

The review found that the mean of Credit Deposit Ratio in ICICI was higher (89.302 %) than in SBI (76.184%). This demonstrates ICICI Bank has made more credit resources from its deposits when contrasted with SBI. The share of interest costs in complete costs higher in ICICI (63.36 %) as contrast with SBI (59.99 %) and the extent of interest pay to aggregate pay was higher in the event of SBI (84.49 % ) when contrasted with ICICI (78.84%), which demonstrates that individuals incline toward ICICI to contribute their investment funds and SBI to take credits and advances. The proportion of other wage to aggregate salary was moderately higher in ICICI (21.44 %) when contrasted with SBI (15.22 %). The Net Profit Margin of ICICI is higher (14.37 %) while in SBI it was (10.99 %), which demonstrates that ICICI has indicated similarly preferable operational productivity over SBI. The development rate of net benefit is 73.97% in SBI which is higher than ICICI which is 55.49%.

This demonstrates SBI performed well when contrasted with ICICI. The mean estimation of aggregate pay was higher in SBI (87,598.58) when contrasted with that in ICICI (37,282.114). Total assets proportion was likewise higher in SBI (14.11 %) than ICICI (8.87 %), which uncovered that SBI has used its assets all the more proficiently when contrasted with ICICI.

The mean estimation of aggregate consumption was higher in SBI (Rs. 78,784.06 crores) when contrasted with that in ICICI (Rs.32,570.61) and the joined development rate of use was negative (-1.47%) on account of ICICI though in SBI it is 111.52%. Deposits in SBI were persistently expanded. However deposits in ICICI were diminished (with a declining pattern) till 2009-10 yet these were expanded in the ensuing years. In the event of SBI Advances were persistently expanded (with a diminishing pattern) with the consolidated development rate of (108.16 %), However Advances in ICICI were diminished

(with a declining pattern) till 2009-10 yet these were expanded from there on with joined development rate of (12.45 %). It demonstrates that ICICI has endured with assets or abstain from giving advances through 2007-08 to 2009-10. Consequently, on the premise of the above review or investigation banking client has more trust on people in general sector banks when contrasted with private sector banks.

## REFERENCES:-


- *Maheshwari&Maheshwari, Banking Law and Practices, Himalaya Publishing Pvt Ltd, Allahabad, pp.152.*
- *Pandey, I.M. Financial Management, Vikas Publishing. House Pvt. Ltd. 2002, pp. 633.*
- *Study material, Financial Management Unit 17, IGNOU, New Delhi. pp.6*
- *Trend and progress of banking, RBI, pp.22-23*
- *Gaylord A Freeman, "The Problem of AdequCrosse in his book on Management Policies for Commercial Banks, pp. 158.*
- *Development Research Group Study, No. 22, Department of Economic Analysis and Policy, Reserve Bank of India, Mumbai September 20, 2000.*
- *Financial year report of SBI 2007-08 to 2011-12.*
- *SBI bulletin publication 2012.*
- *Financial year report of ICICI Bank 2007-08 to 2011-12.*
- *ICICI Bank bulletin publication 2012*
- *RBI statistical table relating to banks 2011-12.*


## INFORMATION MEMORANDUM


- *SBI and ICICI Bank annual report 2007-12.*

# Overloading of Heavy Vehicles Around the World

**Osama Mahmoud Yassenn[*], Intan Rohani Endut, Ph.D.[**], Mohamed Ahmed Hafez, Ph.D.[***], Siti Zaharah Ishak, Ph.D.[****], Hazem Mahmood Yaseen[*****]**

[*]Ph.D. Candidate, Universiti Teknologi MARA, Malaysia Institute of Transport, 40450 Shah Alam, Selangor, MALAYSIA

[**] Senior Lecturer, Universiti Teknologi MARA, Faculty of civil engineering, 40450 Shah Alam, Selangor, MALAYSIA

[***] Associate Professor, Universiti Tenaga Nasional, Department of civil engineering, 43000 Kajang, Selangor, MALAYSIA

[****] Senior Lecturer, Universiti Teknologi MARA, Malaysia Institute of Transport, 40450 Shah Alam, Selangor, MALAYSIA

[*****] Student, University Putra Malaysia, Faculty of engineering, 43400 UPM Serdang, Selangor, MALAYSIA.

## ABSTRACT

*It is impossible for any country to have a rapid economic growth without a good and efficient transportation system. However, there are several problems affecting the transportation systems. One of the most important and common problem nowadays is the overloading of heavy vehicles and trucks. Road pavements performance, infrastructure performance, and safety are severely reduced by heavy vehicles overloading. This paper presents a review on studies that has investigated overloading in different countries of the world including Malaysia, China, South Africa, Thailand, Pakistan, and Taiwan. It was found that several studies confirmed that overloading is a common and series problem around the world.*

***Keywords: Overloading, Pavement Performance, Road Infrastructure Performance, Road Safety, Transportation.***

## INTRODUCTION

Transportation is very important. It is impossible for any country to have a rapid economic growth without a good and efficient transportation system. Development of good transportation systems facilitates the movement of resources form the location where they are found to the place where they are utilized. Without efficient transportation systems it would be difficult to send raw materials, fuel and machineries to the different industries to operate.

Good transportation systems also help in increasing the production of raw materials and industrial products by providing a wider market. Since products can move to distant places in a shorter time, which allows the product to reach to more customers. This causes a large scale production, as a results industries get the benefit and the country economy as well.

Another point of how good transportation system helps the economy is by solving the problem of unemployment in the rural areas, since it helps the unemployed to move to the industrial areas. In the same time, this helps the industries by providing labor force.

However, there are several problems affecting the transportation systems. One of the most important and common problem nowadays is the overloading of heavy vehicles and trucks. Overloading is to load the heavy vehicles beyond legal limits. The road pavement performance and road safety are severely reduced by overloading; this will cost the country not only in terms of money but also in terms of human lives. It is worth mentioning that in terms of road maintenance cost, the government of Malaysia spent 5 billion ringgit between 2001 and 2010 for federal road maintenance [1]; this value would be smaller if overloading stopped.

Overloaded trucks are a threat to the pavement structure. Overloading is one of the most important factors causing rapid increment in pavement deteriorations or distresses. A study that took place in Ghana demonstrated that overloading should be considered as a serious economic crime because of its negative impact on the pavement, especially when the pavement structure is thin as it is more sensitive to overloading, or when the maintenance and rehabilitation budget is relatively small. According to Molenar, the only effective solution was to unload the overloaded vehicle on site. In addition, Molenar believed that solving the overloading problem by increasing the pavement thickness to reduce stresses and strains at the lower layers was not an effective solution because of its expensive costs [2]. It was also reported by other scholars that allowing extra weight for a given type of trucks would increase the pavement damage because of the increase of axle loading [3].

Another study inspects the damage caused to the pavement by tridem and trunnion axle groups. The study included both flexible and rigid pavements by analyzing the mechanistic responses of both types of pavements to the different axle groups. The study concluded that pavement wear will increase due to the increase of axle loading. The study also concluded that axle spacing and tyre pressure will also have an impact on pavement structure wearing. It also showed that pavement deterioration is more affected by pavement type and axle load than by the other vehicle characteristics [4].

In the United States of America and South Africa, a lot of research have shown that the damage caused by overloaded vehicles exceeds all proportions. For instance, an overloaded axle carrying merely twice the loading of the permissible limits will cause more damage to the pavement than a legally loaded axle by four to sixty times, based on the pavement condition and its type [5].

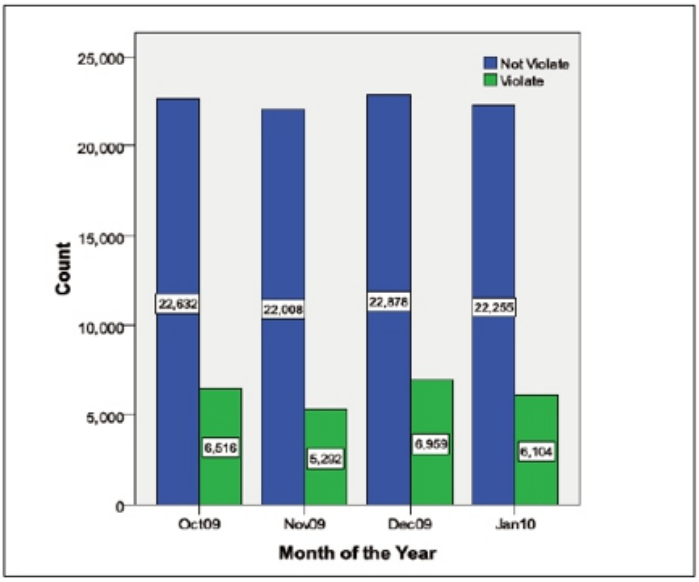
Consequently, Load limits were implemented by many countries with the main aim of reducing the effect of overloading on road infrastructures and to reduce the safety hazards caused by the overloaded vehicles. However, there are several studies proved that overloading is one of the widespread problems around the world.

This paper examines several published studies that have investigated vehicles weight from several countries around the world.

## 1. OVERLOADING IN MALAYSIA

A study has been done in Malaysia in 2009 and published in 2011 has checked the weight of approximately hundred thousand commercial vehicles in a period of four months. The study found that 24% to 29% of the total number of the investigated vehicles violated the total allowable gross weight limits. It was also reported in this study that some of the overloaded vehicles GVW is twice the permissible weight. Figure 1 [6].

**Figure 1. No. of Gross Vehicle Weight Violation Cases at the Survey Station between (Oct 2009 – Jan 2010)[6]**

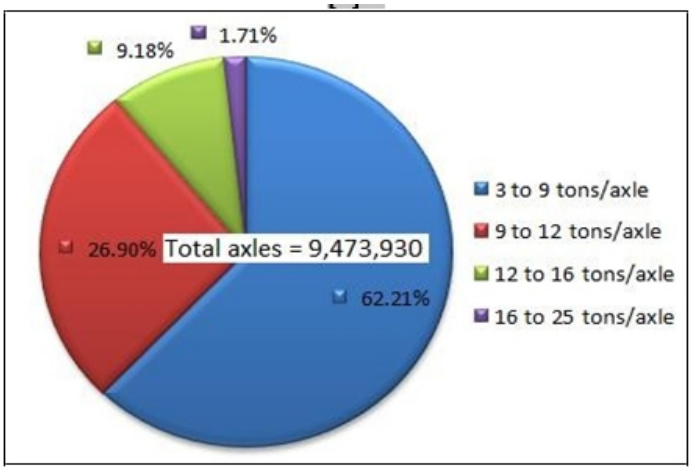



Another study was performed to evaluate the level of enforcement of the single axle load limitation in the northern part of Peninsular Malaysia's North-South Expressway. The axle weights were collected form selected sites along the North-South Expressway, over a period of one year, using Weight-In-Motion devices. The survey stations were located at Alor Setar, Bertam, Taiping, Gurun and Bukit Merah Figure 2 [7].

Based on the Study, The majority of axles weighted between 3 and 9 tons formed 62.21% of the total volume. The second major group was the axles that weighted between 9 and 12 metric tons; this group formed 26.90% of the total weighted axles. However, the overloaded axles formed 10.89% of the total volume. The majority of the overloaded axles weighted between 12 and 16 tons; they formed 9.18% of the total volume. The remaining 1.71% were the axles that weighted between 16 and 25 tons per axle. It is worth mentioning that axles that weighted above 25 tons were very rare, and they formed a negligible percentage of the total volume Figure 3 [7]. Another two studies by have been done by the same author confirmed similar results in other locations in Malaysia [8, 9].

**Figure 2. WIM Approximate Locations. S1At Alor Setar, S2 At Gurun, S3 At Bertam, S4 At Bukit Merah, And S5 At Taiping [7].**


**Figure 3. Axle Loading Distribution For The Five Stations [7].**



## 2. Overloading in China

A site survey was published in 2004 based on the analysis of truck weights in Anhui province, China [10]. The study was an extensive overloading survey performed to assess the overloading status and enforcement effectiveness in Anhui with. The survey was done with the support of the World Bank. The number of survey sites were six at Fuyang, Huainan, Luan, Hefei, Huangshan, and Wuhu Areas with mainly four contents:

1- Traffic volume

2- Freight information

3- Registration information

4- Axle load [10].

Based on the analysis of the collected data from the six sites, it was concluded that vehicles illegal overloading is very severe and common at the major highways in the study areas, the actual load of nearly all of the trucks running in the study areas are higher than their registered weights, except a small number of small freight trucks [10]. The actual loading caused by traffic is far higher than the designed bearing capacity of the highways. Thus, it causes premature damages to road pavements, particularly rigid pavements [10]. Table 1 shows the overloading proportion in the study areas. Overloading proportion is the percentage of overloaded trucks to the total of operating vehicles.

**Table 1. Trucks Overloading Proportion in Anhui [10]**

**Table 1. Trucks Overloading Proportion in Anhui [10]**

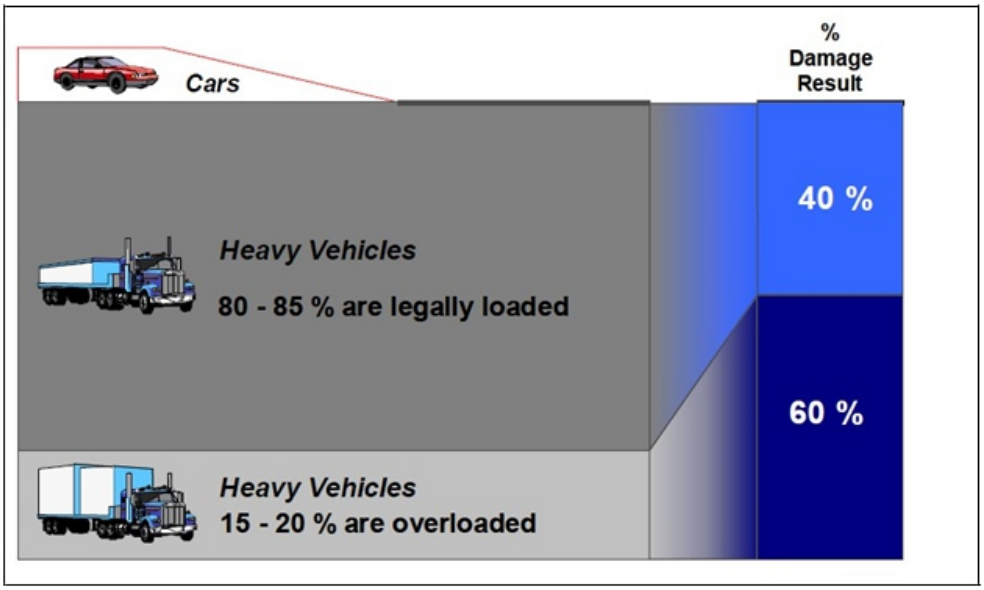
| Index | Highway Types | SU2 | SU3 | 2-S2 | 2-F2 |
|---|---|---|---|---|---|
| OLP (%) | type one | 60.3 | 75.6 | 76.5 | 91.3 |
| | type two | 50.6 | 70.9 | 51.9 | 67.2 |
| | type three | 18.6 | - | - | - |

## 3. OVERLOADING IN SOUTH AFRICA

Based on the information published by South African department of transport in 1997 [5]. A study was done in 1996 on 58,904 vehicles. The studied vehicles were weighed at weighbridges. It was found that 33% of the investigated vehicles were loaded beyond legal limits. Moreover, only 24% of the weighted overloaded heavy vehicles were fined. Till February 1996, the drivers of illegally overloaded heavy vehicles were fined only if the overload on non-steering single axles and axle units exceeded the maximum allowable load limit by a percentage of more than 15% or if the maximum allowable gross vehicle weight of the vehicle or the allowable load based on the bridge formula, exceeded by percentage of more than 5%. These tolerances were change on beginning of March 1996 after the rise of maximum allowable weights. The tolerance changed to only 5% to all load limits [5].

In the same published document, it was stated that legally loaded heavy vehicles causes a small amount of pavement damage when compared to overloaded heavy vehicles. Overloaded heavy vehicles causes approximately 60% of the damage compared to only 40% caused by legally loaded heavy vehicles. This represents approximately 400 million Rands per year [5]. Figure 4 shows a comparison between the damage caused by overloaded vehicles and legally loaded vehicles.

**Figure 4. Damage Caused by Overloaded Vehicles [5]**




## 4. OVERLOADING IN THAILAND

It was stated by Ying [11] that truck is a remarkable social issue in Thailand. According to the surveys performed in 1996, overloading is usually caused by class 5 heavy vehicles (3 axles and ten wheels). Although they forms only 25% of the total operating trucks, the carry approximately 78% of the total weight carried by operating trucks [12]. Based on the data collected by weight- in-motion devices it was found that 33% of class 5 trucks are overloaded. Furthermore, 94% of these vehicles weighted between 21 to 30 tones, while the legal limits for this type of vehicles is only 21 tons [12]. [12] point out that almost 80% of the highway pavements damages are caused by merely 33% of the overloaded vehicles.

## 5. OVERLOADING IN PAKISTAN

A study was published by Rabia et al. [13] investigated the variation in truck factor on pavement performance in Pakistan. Data was collected using weight-in-motion devices located at two survey stations at Sanghjani and Mullah Mansoor. The survey stations are located on Grand Trunk Road (N-5), which connects two major cities in Pakistan (Peshawar and Rawalpindi). The data was collected for a period of three months from October to December 2006 at Sanghjani weight -in-motion station. On the other hand, data was collected in a period of six months at Mullah Mansoor weight-in-motion station

The collected data contains varies details such as:

1- Time

2- Date

3- Gross Vehicle Weight (GVW) 4- Overloading Status

5- Axle load

6- Percentage of Overloading, etc.

Based on the analysis of the collected data, it was concluded that 62% of the operating trucks at Sanghjani weight-in-motion station were loaded, out of these loaded trucks 33% were overloaded. Similarly, 76% of the operating trucks at Mullah Mansoor weight-in-motion station were loaded, out of these loaded trucks 48% were overload Figure 5 and 6 [13].

**Figure 5. Total Truck Traffic Summary of Sanghjani (3 Months Data) [13]**

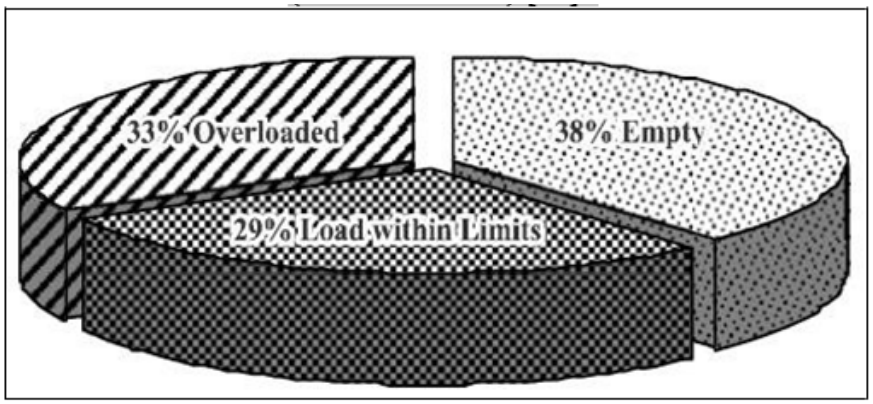
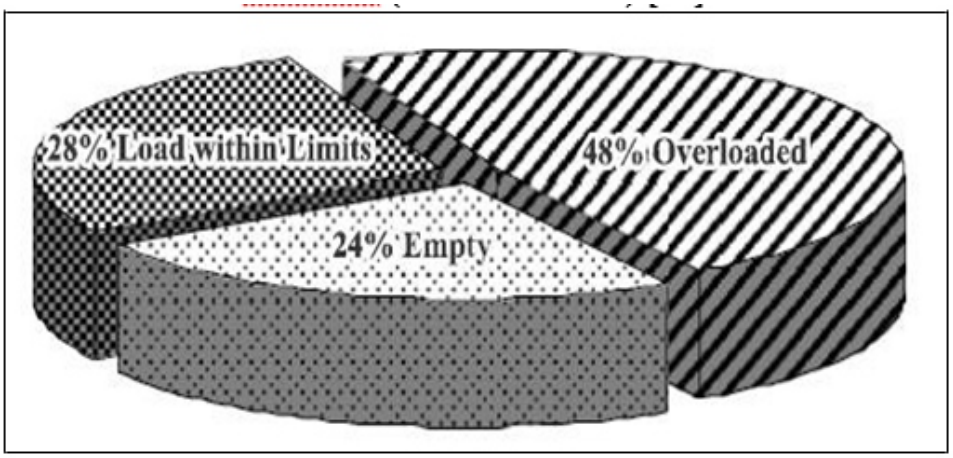



**Figure 6. Total Truck Traffic Summary Of Mullah Mansoor (6 Months Data) [13]**




## 6. OVERLOADING IN TAIWAN

In Taiwan, one of the studies reported that overloading formed 14.2% of the total volume of the traffic along the National freeway [14]. Moreover, It was found that for certain vehicle type the overloading percentage reaches 24%.

Based on the analysis of Weight in Motion results it was also found that the tandem axle group overloading is a lot higher than that of the single axle. The tandem axle group has an overloading percentage of 53% while the single axle group only reaches 12%. Figure 7 shows the legal limits based on vehicle gross weight of the vehicles in Taiwan. It was found that vehicle S112 type has the highest overloading rate for tandem axle (71.1%) (Figure 8).

**Figure 7. Legal Gross Weights of Heavy Vehicles in Taiwan [14]**

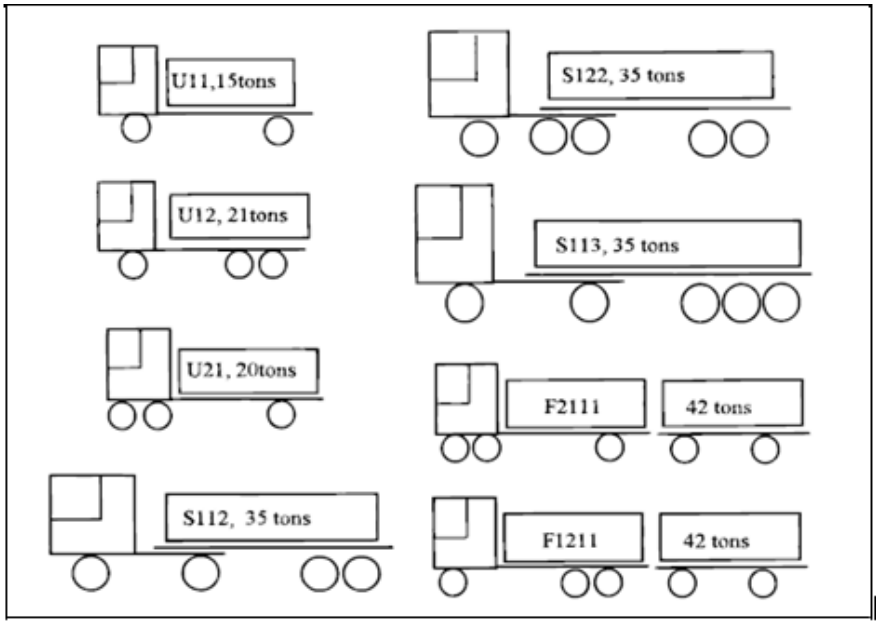
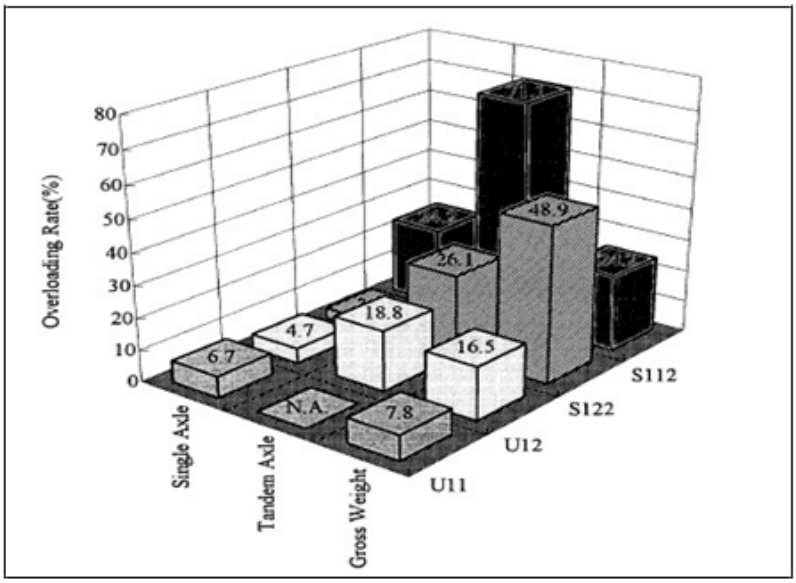



**Figure 8. Overloading Rates for S112, S122, U12, and U11 on Taiwan National Freeways [14]**




Only few studies are shown in this paper. However, there are plenty of studies investigating several locations in the world and confirming similar results that overloading is a common problem around the world. The following studies investigating overloading and its damaging effects on road pavements, infrastructure and environment, some also investigate the safety hazard caused by overloading [14-51].

## CONCLUSION

Several studies investigated overloading in Malaysia, Thailand, China, South Africa, Pakistan, Taiwan and several other countries showed that overloading is a common and series problem around the world. The studies also showed that overloading causes a rapid deterioration for road pavements and infrastructures. Furthermore, Studies showed that overloading causes safety hazards and affects the environment as well.

## REFERENCES


1. *Fewer Potholes with New Type of Asphalt, in New Strait Times. 22nd of June 2010. p. 14.*
2. *Molenar, A.A., Axle and Wheel Loads in Developing Countries and Consequences for Material Specifications, in 84th Transportation Research Board Annual Meeting. 2005.*
3. *Luskin, D.M. and C.M. Walton, Effects of Truck Size and Weights on Highway Infrastructure and Operations. University of Texas at Austin. Center for Transportation Research. Report, 2001: p. 2122-1.*
4. *Zhang, Z. and S. Tighe, Impact of tridem and trunnion axle groups on premature damage of pavement infrastructure. Canadian Journal of Civil Engineering, 2007. 34(2): p. 156-161.*
5. *CSIR and R.a.T. Technology, The Damaging Effects of Overloaded Heavy Vehicles on Roads (Pad27 - revised). 1997: Republic of South Africa.*
6. *Abdullah, A.S., Development of Integrated Weigh-in-motion System and Analysis of Traffic Flow Characteristics considering Vehicle Weight. 2011, The University of Tokushima Japan.*
7. *Yassenn, O.M., et al., Overloading At The Northern Part Of The Malaysian Expressway, in 2011 IEEE Colloquium on Humanities, Science and Engineering Research. 2011: Penang, Malaysia.*
8. *Yassenn, O.M., Hafez, M. A., Endut , I. R., Baharom, B., & Wahab, M. Y., Axle Load Distribution and Overloading at the Central Part of the North-South Expressway in Malaysia. EUROPEAN JOURNAL OF SCIENTIFIC RESEARCH, 2012. Volume 79(Issue No.2).*
9. *Yassenn, O.M., Hafez, M. A., Endut , I. R., Baharom, B., & Wahab, M. Y., Axle Overloading At The Southern Part Of The North-South Expressway In Malaysia, in 2012 IEEE business engineering and industrial applications colloquium. 2012: Malaysia.*
10. *Wen, H., et al. Site survey and analysis of highway trucks overloading status quo in Anhui. 2005; Available from: http://eprints.qut.edu.au/27727/.*
11. *Chan, Y.C.M., Truck overloading study in developing countries and strategies to minimize its impact. 2008.*
12. *Kanok-Nukulchai, W. Heavy weight champion of the road. 1997; Available from: http://www.thaieninee ering.com/viewnew.php?id=231.*
13. *CHAUDRY, R. and A.B. MEMON, Effects of Variation in Truck Factor on Pavement Performance in Pakistan. 2000.*
14. *Chou, C.-p., Effect of Overloaded Heavy Vehicles on Pavement and Bridge Design. Transportation Research Record: Journal of the Transportation Research Board, 1996. 1539(-1): p. 58-65.*
15. *Bagui, S., A. Das, and C. Bapanapalli, Controlling Vehicle Overloading in BOT Projects. Procedia-Social and Behavioral Sciences, 2013. 104: p. 962-971.*
16. *Karim, M.R., et al., Effectiveness of vehicle weight enforcement in a developing country using weigh-in-motion sorting system considering vehicle by-pass and enforcement capability. IATSS Research, 2013.*
17. *Taylor, B., et al., The importance of commercial vehicle weight enformcement in safety and road asset management. Annual Review pp, 2000. 234: p. 237.*
18. *Cottrell Jr, B., The Avoidance ofWeigh Stations in Virginia by Overweight Trucks. 1992.*
19. *WAHYUDI, W., et al. Impact of Axle Load Overloading on Freight Vehicles Towards the Increasing of Greenhouse Gas Emissions by Oxides of Carbon (Case Study: East Java, Indonesia). in Proceedings of the Eastern Asia Society for Transportation Studies. 2013.*
20. *Jacob, B. and V. Feypell-de La Beaumelle, Improving truck safety: Potential of weigh-in-motion technology. IATSS research, 2010. 34(1): p. 9-15.*
21. *Dodoo, N.A. and N. Thorpe, A new approach for allocating pavement damage between heavy goods vehicles for road-user charging. Transport Policy, 2005. 12(5): p. 419-430.*
22. *Troutbeck, R., Effect of heavy vehicles at Australian traffic circles and unsignalized intersections. Transportation Research Record, 1993(1398).*

23. *Chou, C.-p.J., Effect of overloaded heavy vehicles on pavement and bridge design. Transportation Research Record: Journal of the Transportation Research Board, 1996. 1539(1): p. 58-65.*
24. *van Loo, F. Remove: Requirements for Enforcement of Overloaded Vehicles in Europe. in European Congress on Intelligent Transportation Systems and Services, 4th, 2004, Budapest, Hungary. 2004.*
25. *Zaghloul, S. and T.D. White, Guidelines for permitting overloads-part I: effect of overloaded vehicles on the Indiana highway network. 1994.*
26. *Nishikawa, K., J. Murakoshi, and T. Matsuki, Study on the fatigue of steel highway bridges in Japan. Construction and building materials, 1998. 12(2): p. 133-141.*
27. *Terrell, R.L. and C.A. Bell, Effects of permit and illegal overloads on pavements. 1987.*
28. *Newton, W., B. Frith, and I. Barbour. Use of weigh-in-motion systems to aid the selection of goods vehicles for enforcement weighing. in Road Traffic Monitoring, 1992 (IEE Conf. Pub. 355). 1992. IET.*
29. *Craus, J., et al., Development of Failure Curves and Investigation of Asphalt Concrete Pavement Cracking From Super-Overloaded Vehicles. Report to Division of New Technology, Materials, and Research, California Department of Transportation, 1994.*
30. *Stanczyk, D. and Y. Machadour. Overloaded Vehicles Pre-selection. in Post-proceedings of the 4th International Conference on Weigh-In-Motion, February20-22, Taipei, Taiwan. 2005.*
31. *Sadeghi, J. and M. Fathali, Deterioration analysis of flexible pavements under overweight vehicles. Journal of Transportation Engineering, 2007. 133(11): p. 625-633.*
32. *TIAN, B., et al., Stress analysis of cement concrete pavement with heavy loading. China Journal of Highway and Transport, 2000. 13(2).*
33. *Fu, G. and O. Hag-Elsafi, Vehicular overloads: Load model, bridge safety, and permit checking. Journal of Bridge Engineering, 2000. 5(1): p. 49-57.*
34. *Kostem, C., OVERLOADING OF PRESTRESSED CONCRETE I-BEAM HIGHWAY BRIDGES. FINAL REPORT. 1985.*
35. *Dehua, C., Stress analysis of asphalt pavement under overload. China Water Transport, 2007. 11: p. 070.*
36. *PaulLeidy, J., C.E. Lee, and R. Harrison, MEASUREMENT AND ANALYSIS OF TRAFFIC LOADS ACROSS THE TEXAS-MEXICO BORDER. 1995.*
37. *Wang, G., et al., Long-Life Pavement Design and Construction–A Case Study. Bridges, 2014. 10: p. 9780784412299.0069.*
38. *Chen, B., et al., Measurement-Based Vehicle Load Model for Urban Expressway Bridges. Mathematical Problems in Engineering, 2014. 2014.*
39. *Moussa, G.K.M. and S. El-Hamrawy, Load equivalence factors as function of axial loads and tire pressure for design of flexible pavemet. AEJ - Alexandria Engineering Journal, 2003. 42(4): p. 443-451.*
40. *Mulyono, A.T., et al., Analysis of Loss Cost of Road Pavement Distress due to Overloading Freight Transportation. Journal of the Eastern Asia Society for Transportation Studies, 2010. 8: p. 706-721.*
41. *Morales-Nápoles, O. and R.D. Steenbergen, Analysis of axle and vehicle load properties through Bayesian Networks based on Weigh-in-Motion data. Reliability Engineering & System Safety, 2014. 125: p. 153-164.*
42. *Bai, S., Z. Zhou, and J. Ou, Advances of Vehicle Detection Techniques for Traffic Monitoring.*
43. *Falcón, M.d.C.P.T., et al., Application of chebyshev's theorem for estimating CO2 emissions due to over loading of heavy duty diesel trucks. Interciencia, 2014. 39(4): p. 228-233.*
44. *Nkem Ede, A., Cumulative Damage Effects of Truck Overloads on Nigerian Road Pavement. International Journal of Civil & Environmental Engineering, 2014. 14(1).*
45. *Kolo, S.S., et al., Analysis of Axle Loadings on a Rural Road in Nigeria.*
46. *Dhivya, M. and R. Yugapriya. Effectual Consignment Supervision and Anti-Cheating Monitoring System for Heavy Loaded Vehicles. in International Journal of Engineering Research and Technology. 2014. ESRSA Publications.*
47. *Dong, Q., et al. Estimation of Pavement Damage Costs Caused by Heavy Weight Vehicles Using Finite Element Analysis and Fatigue Failure Model. in Transportation Research Board 93rd Annual Meeting. 2014.*
48. *Zhou, D.W. and R.J. Wang, Analysis of Perpetual Asphalt Pavement Response under Heavy Loads in Northeast Area of China. Advanced Materials Research, 2014. 838: p. 1203-1215.*
49. *Fiorillo, G. and M. Ghosn, Procedure for Statistical Categorization of Overweight Vehicles in a WIM Database. Journal of Transportation Engineering, 2014. 140(5).*
50. *Wang, Z.Y. and L.J. Liu, Study on the Durability of Highway Bridge under Heavy Traffic. Applied Mechanics and Materials, 2013. 340: p. 100-103.*
51. *Pais, J.C., S.I. Amorim, and M.J. Minhoto, Impact of traffic overload on road pavement performance. Journal of Transportation Engineering, 2013. 139(9): p. 873-879.*

# Supply Chain Management : An Overview

**Mukesh Kumar*, Vineet Kumar****
*Research Scholar, Department of Mechanical Engineering, U.I.E.T (M.D.U.), Rohtak
**Professor, Department of Mechanical Engineering, U.I.E.T (M.D.U.), Rohtak

## A B S T R A C T

*Supply chain management (SCM) has become an important focal point of competitive advantage organization for business. It deals with material and information that flow between facilities. It should be formulated and may be considered more comprehensive of management activities than the field of operation management. Many organisation develops their plans over time and then study the effect in terms of precision where as strategic SCM is concerned with structural modification to enhance productivity. However the success or failure of the SCM policy will depend upon how the plan is operationally implemented. By selecting the chain of activities in time an operation SCM plan is formed in order to realize the firms objective or more generally a sequence of alternative activities are considered from which the actual path is selected step by step on the basis of suitable criteria.*

***Key words : decision support system, Modelling system, Language system dynamics, Supply chain management, Set valued mappings.***

### 1.1. INTRODUCTION

Supply chain management is becoming increasingly important in competitive business. To compete at the supply chain level, firms must adopt an appropriate supply chain management strategy. The strategy needs to be integrated and coordinated throughout the supply chain, to generate the performance of supply chain members. Supply chain has become an important focus of competitive advantage for organization business. Supply chain management(SCM) deals with material and informations that flow between facilities. It should be formulated and may be considered more comprehensive of management activities than the field of operation management [1].many organisation develops their plans over time and then study the effect in terms of precision where as strategic SCM is concerned with structural modification to enhance productivity. However the success or failure of the SCM policy will depends upon how the plans is operationally implemented [2]. By selecting the chain of activities in time an operation SCM plan is formed in order to realize the firms objective or more generally a sequence of alternative activities are considered from which the actual path is selected step by step on the basis of suitable criteria.

The study of management of supply chain emphasizes how to maximize the overall value of the firm by better using and deployment of resources across the whole of the firm. The principle of supply chain activity is receiving input from firm's suppliers – add value – deliver to customers. A supply chain encompasses all the parties that are involved, directly or indirectly, in fulfilling a customer request. It includes manufacturer, suppliers, transporters, warehouses, retailers and even customers themselves. These functions includes new product development, marketing, operation, distribution, finance, customer service and other function that related to serving customer request (Chopra and Meindl, 2007). Effective supply chain management is important to build and sustain competitive advantage in product and services of the firms ( Gunasekaran and Ngai, 2004). The performance of supply chain is influenced by managing and integrating key element of information into their supply chain Qrunfleh (2010). To achieve effective supply chain integration, the firms need to implement information technology (Handfield and Nichols, 1999; Qrunfleh , 2010). B y using technology of information, the firms could manage the flow and impact of numerous supply chains dimension, such as quality, cost, flexibility, delivery, and profit (Brandyberry et al. ,1999). The development and long-term utilization of information technology improves firm performance in terms of return on investment (ROI), return on equity (ROI) and market share (Byrd and Davidson, 2003). Supply chain coordination and integration is facilitated by using integrated information technology, which directly impacts a financial performance of the firms (Vickery et al., 2003). To achieve a competitive advantage and better performance, supply chain management strategy needs to support the business strategy.

This study a i ms to find out the effect of supply chain management strategy such as lean supply chain, agile supply chain, and hybrid supply chain on supply chain performance. It will also investigates the effect of supply chain management practices in terms of strategic supplier partnership, customer relationship and information sharing on supply chain performance. The paper is organized as follows: Relevant literature is reviewed and synthesized first to develop a conceptual model, followed by research methodology. The results are then presented along with discussion. Finally Conclusions are drawn and implications are discussed.

### 1.2. WHAT IS SUPPLY CHAIN MANAGEMENT (SCM)

Supply chain management (SCM) is the streamlining of a business' supply-side activities to maximize customer value and to gain a competitive advantage in the marketplace. Supply chain management represents an effort by suppliers to develop and implement supply chains that are as efficient and economical as possible. Supply chains cover everything from production, to product development, to the information systems needed to direct these undertakings. SCM is the oversight of materials, information, and finances as they move in a process from supplier to manufacturer to wholesaler to

retailer to consumer. SCM also involves coordinating and integrating these flows both within and among companies. It is said that the ultimate goal of any effective supply chain management system is to reduce inventory (with the assumption that products are available when needed). As a solution for successful supply chain management, web-based application service providers (ASP) for companies are completing for sophisticated software systems with web interfaces. The following are five basic components of SCM.

1. **Plan:** This is the strategic portion of SCM. Companies need a strategy for managing all the resources that go toward meeting customer demand for their product or service. A big piece of SCM planning is developing a set of metrics to monitor the supply chain so that it is efficient, cheap and delivers high quality and value to customers.
2. **Source:** The companies must choose suppliers to deliver the goods and services they need to create their product. Therefore, supply chain managers must develop a set of pricing, delivery and payment processes with suppliers and create metrics for monitoring and improving the relationships. And then, SCM managers can put together processes for managing their goods and services inventory, including receiving and verifying shipments, transferring them to the manufacturing facilities and authorizing supplier payments.
3. **Make:** This is the manufacturing step. Supply chain managers schedule the activities necessary for production, testing, packaging and preparation for delivery. This is the most metric-intensive portion of the supply chain—one where companies are able to measure quality levels, production output and worker productivity.
4. **Deliver:** This is the part that many SCM insiders refer to as logistics, where companies coordinate the receipt of orders from customers, develop a network of warehouses, pick carriers to get products to customers and set up an invoicing system to receive payments.
5. **Return:** This can be a problematic part of the supply chain for many companies. Supply chain planners have to create a responsive and flexible network for receiving defective and excess products back from their customers and supporting customers who have problems with delivered products.


**Layout of Supply Chain Management**

## 1.3. WHAT IS THE RELATIONSHIP BETWEEN ERP, CRM AND SCM?

Many SCM applications rely upon the kind of information that is stored inside enterprise resource planning (ERP) software and, in some cases, to some customer relationship management (CRM)

packages. Theoretically a company could assemble the information it needs to feed the SCM applications from legacy systems but it can be a nightmare to try to get that information flowing on a fast, reliable basis from all the areas of the company. ERP is the battering ram that integrates all that information in a single application, and SCM applications benefit from having a single major source to go to for up-to-date information. Most CIOs who have tried to install SCM applications say they are glad they did ERP first. They call the ERP projects "putting your information house in order." Of course, ERP is expensive and difficult, so you may want to explore ways to feed your SCM applications, the information they need without doing ERP first. These days, most ERP vendors have SCM modules, so doing an ERP project may be a way to kill two birds with one stone. In addition, the rise and importance of CRM systems inside companies today puts even more pressure on a company to integrate all of its enterprise wide software packages. Companies will need to decide if these products meet their needs or if they need a more specialized system.

Applications that simply automate the logistics aspects of SCM are less dependent upon gathering information from around the company, so they tend to be independent of the ERP decision. But chances are, companies will need to have these applications communicate with ERP in some fashion. It's important to pay attention to the software's ability to integrate with the Internet and with ERP applications because the Internet will drive demand for integrated information.

### 1.4. OBJECTIVES OF INSTALLING SUPPLY CHAIN MANAGEMENT SOFTWARE?

Before the internet came along, the aspirations of supply chain software devotees were limited to improving their ability to predict demand from customers and make their own supply chains run more smoothly. But the cheap, ubiquitous nature of the internet, along with its simple, universally accepted communication standards, have thrown things wide open. Now, companies can connect their supply chain with the supply chains of their suppliers and customers together in a single vast network that optimizes costs and opportunities for everyone involved. This was the reason for the B2B explosion; the idea that everyone in a company does business which could be connected together into one big happy, cooperative family. Of course, reality isn't quite that happy and cooperative. But today most companies share at least some data with their supply chain partners. The goal of these projects is to create greater supply chain visibility. The supply chain in most industries is like a big card game: the players don't want to show their cards because they don't trust anyone else with the information, but if they showed their hands they could all benefit. Suppliers wouldn't have to guess how many raw materials to order, and manufacturers wouldn't have to order more than they need from suppliers to make sure they have enough on hand if demand for their products unexpectedly increases. Additionally retailers would have fewer empty shelves if they shared the information they had about sales of a manufacturer's product in all their

stores with the manufacturer. The internet makes showing your hand to others possible, but centuries of distrust and lack of coordination within industries make it difficult. During the last few years most companies have gotten over the trust issue. In many cases "gotten over" is a euphemism for "have been bullied into sharing supply chain information from a dominant industry player." Want to sell your goods in Wal-Mart? Better be prepared to share data and adhere to Wal-Mart's data- exchange standards.

The payoff of timely and accurate supply chain information is the ability to make or ship only as much of a product as there is a market for. This is the practice known as just-in-time manufacturing, and it allows companies to reduce the amount of inventory that they keep. This can cut costs substantially, since you no longer need to pay to produce and store excess goods. But many companies and their supply chain partners have a long way to go before that level of supply chain flexibility can be achieved.

## 1.5. EFFECT OF RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY ON SUPPLY CHAIN

The recent publicity of radio frequency identification (RFID) and its use in supply chain management has created awareness among businesses. RFID for the supply chain (RFID/SC) is an emerging technological trend that has attracted a lot of attention in the U.S., Europe, and Asia. Information sharing is important to achieve supply chain visibility. RFID is a type of automatic identification and data capture technology that uses radio waves as a means of communication between a tag and a reader. RFID tags are essentially barcodes on steroids. Whereas barcodes only identify the product, RFID tags can tell what the product is, where it has been, when it expires - essentially whatever information a company wishes to program. RFID technology generates mountains of new data about the location of pallets, cases, cartons, totes and individual products in the supply chain. It produces oceans of information about when and where merchandise is manufactured, picked, packed and shipped. It creates rivers of numbers telling retailers about the expiration dates of their perishable items - numbers that will have to be stored, transmitted in real-time and shared with warehouse management, inventory management, financial and other enterprise systems. In other words, as RFID technologies in the supply chain spread into the operations of more manufacturers, parts suppliers and retailers, they will transform the supply chain as we know it today.

Another benefit of RFIDs is that, unlike barcodes, RFID tags can be read automatically by electronic readers. Imagine a truck carrying a container full of widgets entering a shipping terminal in China. If the container is equipped with an RFID tag, and the terminal has an RFID sensor network, that container's whereabouts can be automatically sent to Widget Co. without the truck ever slowing down. It has the potential to add a substantial amount of visibility into the extended supply chain. Right now, the two

biggest hurdles to widespread RFID adoption are the high cost of building the infrastructure to manage RFID data and a lack of return on investment (ROI) for many midsize and small manufacturers working in today's supply chains.

### 1.6. WHAT IS THE IMPACT OF RESPONSIBLE SOURCING, ENVIRONMENTAL SUSTAINABILITY AND THE "GREEN" MOVEMENT ON THE SUPPLY CHAIN?

If the technological side of supply chain management wasn't hard enough, the new "corporate social responsibility" (CSR) movement inside 21st century organisation and IT departments adds another layer of complexity. Broadly defined, CSR initiatives for companies include such strategies as being able to show environmental sustainability (i.e. reducing the carbon footprint), responsible sourcing from a wide range of global suppliers, and how "green" an organization is.

In order to prove that a company has lowered its carbon emissions, isn't dumping hazardous materials into rivers and doesn't buy its materials from suppliers that employ underage workers, company leaders need to be able to gain insight into and track the actions of their suppliers, and their suppliers and their suppliers - all the way down the chain into some good and not-so-good parts of the global economy. This ability also becomes critical when tainted goods need to be identified and found quickly in a supply chain, before the goods spread throughout a country's population.

Wal-Mart announced in fall 2008 that all of its suppliers—including the thousand located in China—would have to be in compliance with laws and regulations relating to rigorous social, environmental and energy efficiency mandates. Wal-Mart's suppliers would even have to attest that their suppliers received high ratings on environmental and social practices.

## REFERENCES


1. *Blackstone Jr., J.H. (2008). Operations management, twelth ed., The Association for Operations Management APICS Dictionary, APICS, Chicago Ill, 2008.*
2. *Brandyberry, A., Rai, A., & White, G. P. (1999). Intermediate performance impacts of advanced manufacturing technology systems: An empirical investigation. Decision Sciences, 30 (4), pp.993-1020.*
3. *Boyer, K.K. Swink, M.L. (2008). Empirical elephants - why multiple methods are essential to quality research in operations and supply chain management, Journal of Operations Management 26: 337–348.*
4. *Byrd, T. A., & Davidson, N. W. (2003). Examining possible antecedents of IT impact on the supply chain & its effect on firm performance. Information and Management, 41 (2), pp. 243-255.*
5. *Chopra, S., & Meindl, P. (2007). Supply Chain Management: Strategy, Planning, & Operation. (3th ed) NJ: Prentice-Hall. Inc.*
6. *Cohen, S., & Roussel J. (2005). Strategic Supply Chain Management: The Five Disciplines for Top Performance. New York: McGraw-Hil*
7. *Dong, J. Zhang, D. Nagurney, A. (2004). A supply chain network equilibrium model with random demands, European Journal of Operational Research 156:194–212.*
8. *Fisher, M. L. (1997). What is the Right Supply Chain for Your Product? Harvard Business Review, 75 (2), pp.105-116.*

9. *Green Jr., K. W., Whitten, D., & Inman, R. A. (2008). The impact of logistics performance on organizational performance in a supply chain context. Supply Chain Management, 13 (4), pp.317-327.*
10. *Gunasekaran, A., & Ngai, E. W. T. (2004). Information systems in supply chain integration & management. European Journal of Operational Research, 159 (2), pp.269- 295.*
11. *Handfield, R.B., & Nichols Jr., E.L. (1999). Introduction to Supply Chain Management. Upper Saddle River, NJ: Prentice-Hall.*
12. *Koh, S.C., Demirbag, M., Bayraktar, E., Tatoglu, E., & Zaim, S. (2007). The impact of supply chain management practices on performance of SMEs. Industrial Management and Data Systems, 107 (1), pp.103-124.*
13. *Lewicka, D. (2011). Creating Innovative Attitudes in an Organisation – Comparative Analysis of Tools Applied in IBM Poland and ZPAS Group. Journal of Asia Pacific Business Innovation and Technology Management. Vol. 1, No. 1, p1-12*
14. *Li, S. & Lin, B. (2006). Accessing information sharing and information quality in supply chain management. Decision Support Systems, 42 (3), pp.641-1656.*
15. *Mason-Jones, R., Naylor, B., & Towill, D. R. (2000). Lean, agile or leagile? Matching your supply chain to the marketplace. International Journal of Production Research, (38), pp. 4061-4070.*
16. *Qrunfleh Sufian M. (2010) Alignment of Information Systems with Supply Chains: Impacts on Supply Chain. Performance and Organizational Performance: published PhD thesis. University of Toledo. Stadtler, H. Kilger, C. (2002). Supply Chain Management and Advanced Planning,Springer Verlag, New York, 2002*
17. *Vickery, S. K., Jayaram, J., Droge, C., & Calantone, R. (2003). The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships. Journal of Operations Management, 21 (5), pp.523-539.*
18. *Wisner, J.D. (2003). A structural equation model of supply chain management strategies and firm performance. Journal of Business Logistics, 24 (1), pp.1-26.*

# Instructions for Authors

**Essentials for Publishing in this Journal**

1 Submitted articles should not have been previously published or be currently under consideration for publication elsewhere.

2 Conference papers may only be submitted if the paper has been completely re-written (taken to mean more than 50%) and the author has cleared any necessary permission with the copyright owner if it has been previously copyrighted.

3 All our articles are refereed through a double-blind process.

4 All authors must declare they have read and agreed to the content of the submitted article and must sign a declaration correspond to the originality of the article.

**Submission Process**

All articles for this journal must be submitted using our online submissions system. http://enrichedpub.com/ . Please use the Submit Your Article link in the Author Service area.

---

**Manuscript Guidelines**

The instructions to authors about the article preparation for publication in the Manuscripts are submitted online, through the e-Ur (Electronic editing) system, developed by **Enriched Publications Pvt. Ltd**. The article should contain the abstract with keywords, introduction, body, conclusion, references and the summary in English language (without heading and subheading enumeration). The article length should not exceed 16 pages of A4 paper format.

**Title**

The title should be informative. It is in both Journal's and author's best interest to use terms suitable. For indexing and word search. If there are no such terms in the title, the author is strongly advised to add a subtitle. The title should be given in English as well. The titles precede the abstract and the summary in an appropriate language.

**Letterhead Title**

The letterhead title is given at a top of each page for easier identification of article copies in an Electronic form in particular. It contains the author's surname and first name initial .article title, journal title and collation (year, volume, and issue, first and last page). The journal and article titles can be given in a shortened form.

**Author's Name**

Full name(s) of author(s) should be used. It is advisable to give the middle initial. Names are given in their original form.

**Contact Details**

The postal address or the e-mail address of the author (usually of the first one if there are more Authors) is given in the footnote at the bottom of the first page.

**Type of Articles**

Classification of articles is a duty of the editorial staff and is of special importance. Referees and the members of the editorial staff, or section editors, can propose a category, but the editor-in-chief has the sole responsibility for their classification. Journal articles are classified as follows:

**Scientific articles:**

1. Original scientific paper (giving the previously unpublished results of the author's own research based on management methods).

2. Survey paper (giving an original, detailed and critical view of a research problem or an area to which the author has made a contribution visible through his self-citation);

3. Short or preliminary communication (original management paper of full format but of a smaller extent or of a preliminary character);

4. Scientific critique or forum (discussion on a particular scientific topic, based exclusively on management argumentation) and commentaries. Exceptionally, in particular areas, a scientific paper in the Journal can be in a form of a monograph or a critical edition of scientific data (historical, archival, lexicographic, bibliographic, data survey, etc.) which were unknown or hardly accessible for scientific research.

**Professional articles:**

1. Professional paper (contribution offering experience useful for improvement of professional practice but not necessarily based on scientific methods);
2. Informative contribution (editorial, commentary, etc.);
3. Review (of a book, software, case study, scientific event, etc.)

**Language**

The article should be in English. The grammar and style of the article should be of good quality. The systematized text should be without abbreviations (except standard ones). All measurements must be in SI units. The sequence of formulae is denoted in Arabic numerals in parentheses on the right-hand side.

**Abstract and Summary**

An abstract is a concise informative presentation of the article content for fast and accurate Evaluation of its relevance. It is both in the Editorial Office's and the author's best interest for an abstract to contain terms often used for indexing and article search. The abstract describes the purpose of the study and the methods, outlines the findings and state the conclusions. A 100- to 250-Word abstract should be placed between the title and the keywords with the body text to follow. Besides an abstract are advised to have a summary in English, at the end of the article, after the Reference list. The summary should be structured and long up to 1/10 of the article length (it is more extensive than the abstract).

**Keywords**

Keywords are terms or phrases showing adequately the article content for indexing and search purposes. They should be allocated heaving in mind widely accepted international sources (index, dictionary or thesaurus), such as the Web of Science keyword list for science in general. The higher their usage frequency is the better. Up to 10 keywords immediately follow the abstract and the summary, in respective languages.

**Acknowledgements**

The name and the number of the project or programmed within which the article was realized is given in a separate note at the bottom of the first page together with the name of the institution which financially supported the project or programmed.

**Tables and Illustrations**

All the captions should be in the original language as well as in English, together with the texts in illustrations if possible. Tables are typed in the same style as the text and are denoted by numerals at the top. Photographs and drawings, placed appropriately in the text, should be clear, precise and suitable for reproduction. Drawings should be created in Word or Corel.

**Citation in the Text**

Citation in the text must be uniform. When citing references in the text, use the reference number set in square brackets from the Reference list at the end of the article.

**Footnotes**

Footnotes are given at the bottom of the page with the text they refer to. They can contain less relevant details, additional explanations or used sources (e.g. scientific material, manuals). They cannot replace the cited literature.
The article should be accompanied with a cover letter with the information about the author(s): surname, middle initial, first name, and citizen personal number, rank, title, e-mail address, and affiliation address, home address including municipality, phone number in the office and at home (or a mobile phone number). The cover letter should state the type of the article and tell which illustrations are original and which are not.