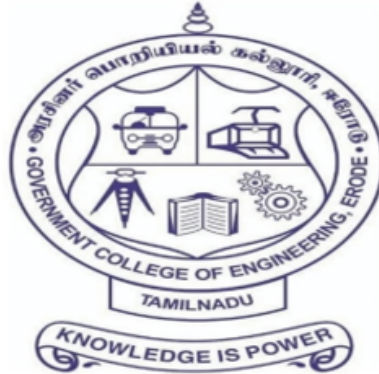


**GOVERNMENT COLLEGE OF ENGINEERING  
(Formerly IRTT)  
ERODE-638 316**



**BONAFIDE CERTIFICATE**

Certified that this project titled “**TRAFFIC AND CAPACITY ANALYTICS FOR MAJOR PORTS USING DATA ANALYTICS**” is the Bonafide work of of “**SENTHILNATHAN .M(731119106031), ADITHIYA .R(731119106001), GOKUL .K(731119106006), MUTHUKUMAR .R(731119106019)**” Who carried out the project work under my supervision

**SIGNATURE OF HOD**

Dr.R.VALARMATHI, M.E., Ph.D.,  
HEAD OF THE DEPARTMENT  
DEPARTMENT OF ECE,  
GOVERNMENT COLLEGE OF  
ENGINEERING, ERODE – 638316

**SIGNATURE OF SPOC**

Dr.G.GOWRISON, M.E., Ph.D.,  
ASSISTANT PROFESSOR(SR)  
DEPARTMENT OF ECE,  
GOVERNMENT COLLEGE OF  
ENGINEERING, ERODE - 638316

**SIGNATURE OF FACULTY MENTOR**

Dr.R.SENTHILKUMAR, Ph.D.,  
ASSISTANT PROFESSOR(SR)  
DEPARTMENT OF ECE,  
GOVERNMENT COLLEGE OF  
ENGINEERING, ERODE – 638316

**SIGNATURE OF FACULTY EVALUATOR**

Mrs.S.k.FAIROZE BANU, ME.,  
ASSISTANT PROFESSOR(SR)  
DEPARTMENT OF ECE,  
GOVERNMENT COLLEGE OF  
ENGINEERING, ERODE - 638316

Team id: PNT2022TMID44353

Project Domain: Data Analytics

project Name: Traffic And Capacity Analytics For Major Ports

Date: 19/11/22

Team Leader : Senthilnathan .M

Team Members: Adithiya .R

Gokul .K

Muthukumar .R

# **PROJECT REPORT SUBMISSION**

## **TABLE OF CONTENT**

### **1.INTRODUCTION**

1.1 Project Overview

1.2 Purpose

### **2.LITERATURE SURVEY**

2.1 Existing problem

2.2 Reference

2.3 Problem Statement Definition

### **3. IDEATION & PROPOSED SOLUTION**

3.1 Empathy Map Canvas

3.2 Ideation & Brainstorming

3.3 Proposed Solution

3.4 Problem Solution fit

### **4.REQUIREMENT ANALYSIS**

4.1 Functional requirement

4.2 Non-Functional requirements

### **5. PROJECT DESIGN**

5.1 Data Flow Diagrams

5.2 Solution & Technical Architecture

5.3 User Stories

### **6. PROJECT PLANNING & SCHEDULING**

6.1 Sprint Planning and Scheduling

6.2 Reports from JIRA

## 7. RESULTS

### 7.1 Performance Metrics

## 8. ADVANTAGES & DISADVANTAGES

## 9. CONCLUSION

## 10. FUTURE SCOPE

## 11. APPENDIX

### 11.1 Github Link

### 11.2 Project Demo Video Link

## **ABSTRACT**

The purpose of this project is to improve the railway market share in some commodities and overcome the challenges and maintain sustainable growth in all its commodities. We also try to reduce the congestion on rail corridors and improving port connectivity. And lastly help in the development of dedicated freight corridor across Key ports. All of this is done by analysing already existing data or new data on Railway traffic and data on amount of capacity of passenger and goods a train carries from each port.

# CHAPTER 1

## 1.INTRODUCTION

India has been the world's fastest-growing major economy for four of the past five years, due to rising demand for goods and services. The movement of good across the country and beyond its borders has created economic opportunities for millions of India's citizens. Today, the logistics sector represents five percent of India's Gross Domestic Product (GDP)<sup>1</sup>and employs 2.2 crore people. India handles 4.6 billion tonnes of goods each year, amounting to a total annual cost of INR 9.5 lakh crore. These goods represent a variety of domestic industries and products: 22 percent are agricultural goods, 39 percent are mining products, and 39 percent are manufacturing-related commodities. Trucks and other vehicles handle most of the movement of these goods. Railways, coastal and inland waterways, pipelines, and airways account for the rest. Recognising the critical role of the sector in the country's future, the Government of India (GOI) is pursuing a range of actions to improve its logistics performance. These include the development of dedicated rail-based freight corridors, improvements to the capacity and connectivity of coastal and inland water-based shipping. It is also looking at the buildout of road infrastructure projects such as Bharatmala and the Golden Quadrilateral, and the creation of supportive policies. As national freight activity grows about five-fold by 2050, India's freight transport ecosystem has a critical role to play in supporting India's ambitious priorities. Some of these include international competitiveness, job growth, urban and rural livelihoods, and clean air and environment.

As products are made, they move along a supply chain until they reach the consumer. To move those goods, the logistics sector combines vehicles and warehouses, all of which are selected to efficiently move and process them. The types of vehicles and storage facilities selected are typically based on the type of goods being moved and the distance over which they are being moved. This process of supply chain managers efficiently deploying and using a set of vehicles and warehouses to move goods through the production process to their final use by consumers is critical to the wellbeing of communities and economies.

To sustain the growing demand for freight transport without driving existing externalities to extreme levels, Indian stakeholders need to take steps to shift to a new freight paradigm that is more cost-effective, clean, and efficient. This new freight transportation paradigm will also help India achieve its development goals, including improved air quality, improved GDP, better public health, enhanced logistics productivity, more employment opportunities, and is in-line with India's clean mobility ambitions. With a strong foundation of supportive policies and market trends, India can leverage the opportunities by implementing a set of solutions.

## 1.1 PROJECT OVERVIEW

Transport Research Wing (TRW), Ministry of Ports, Shipping and Waterways collects, compiles and disseminates time series data on Ports, Shipping, Ship Building and Ship Repairing and Inland Water Transport. Besides, it is also responsible for rendering necessary research and data support to the various wings of the Ministry of Ports, Shipping and Waterways for policy planning in the above mentioned sectors. Transport Research Wing collects data on Ports, Shipping, Ship Building and Ship Repairing and Inland Water Transport sectors from the concerned source agencies viz. Major ports; State Maritime Boards/State Directorates; Directorate General of Shipping, Shipping Corporation of India, shipping companies in private sector, Ship building companies; Inland Waterways Authority of India and State Governments. The data received from various primary/secondary sources is scrutinised and validated for consistency and comparability and compiled as per the requirement. The compiled data is disseminated to the users through the following publications:

- Basic Port Statistics (Annual)– It gives information on major ports and non-major ports in respect of cargo traffic – commodity wise, type of cargo, performance indicators, port capacity and its utilization, employment and financial performance.
- Update on Indian Port Sector (biannual) – This publication throws light on latest developments at Indian Ports inter-alia macro-economic indicators of India as compared with world indicators. The publication covers state-wise analysis of the developments in the area of sea-borne traffic for maritime States/UTs particularly in respect of cargo traffic, efficiency Indicators and projects under implementation.
- Indian Shipping Statistics(Annual)–The publication contains data on Indian fleet-overseas and coastal fleet by type, size and age of vessels; Net additions to Indian fleet; fuel prices for vessels plying on international run, fleet owned by Shipping Corporation of India, performance of Shipping.
- Statistics of India's Ship Building and Ship –Repairing Industry (Annual)–The publication contains information on Indian Ship Building and Ship Repairing Industry –capacity, facilities, orders in hand and delivered, employment and financial performance etc.
- Statistics on Inland Water Transport (Annual)–The publication contains data on navigable waterways, no. of inland water transport vehicles and their ownership infrastructure facilities available on national/state waterways, cargo movement, Plan outlay and expenditure etc

## 1.2 PURPOSE

In FY22, major ports in India handled 720.29 million tonnes of cargo traffic, implying a CAGR of 2.89% in FY16-22. From April-August 2022, all key ports in India handled 322.64 million tonnes (MT) of cargo traffic. India's key ports had a capacity of 1,561 million tonnes per annum (MTPA) in FY21. In FY22, all key ports in India handled 720.29 million tonnes (MT) of cargo traffic. India's merchandise exports in FY22 were at US\$ 417.8 billion, up 40% from the previous year.

Non-major ports accounted for 45% of the total cargo traffic at Indian ports in FY22, due to

a significant shift of traffic from the major ports to the non-major ports.

The Government of India has allowed Foreign Direct Investment (FDI) of up to 100% under the automatic route for projects related to the construction and maintenance of ports and harbours. Indian ports received cumulative FDI inflow worth US\$ 1.63 billion between April 2000-March 2022. A 10-year tax holiday is extended to enterprises engaged in the business of developing, maintaining, and operating ports, inland waterways, and inland ports. The Government has also initiated National Maritime Development Programme (NMDP), an initiative to develop the maritime sector with a planned outlay of US\$ 11.8 billion. In Union Budget 2020-21, the total allocation for the Ministry of Shipping was Rs. 1,702.35 crore (US\$ 233.48 million).

## CHAPTER 2

### 2. LITERATURE SURVEY

#### 2.1 EXISTING PROBLEM

Ports in India suffer from high turnaround times for ships. For example, in Singapore, average ship turnaround time is less than a day. However, in India it is over two days. Port congestion due to container volume, shortage of handling equipment and inefficient operations is a major concern. Lack of requisite infrastructure for evacuation from major and non-major ports leads to sub-optimal transport modal mix. Analysts have cited the concerns over development of multiple ports in close vicinity handling similar cargo as it might lead to ports competing for the same cargo arrivals. Lack of adequate training, falling manpower quality, opposition to reform are major issues.

#### 2.2 REFERENCES

- Traffic performance and efficiency of major ports ([www.researchgate.net](http://www.researchgate.net))
- Cargo traffic handled at major ports (<https://shipmin.gov.in>)
- Cargo traffic at major Indian ports in rough water ([www.timesnow.com](http://www.timesnow.com))
- Cargo traffic growth momentum continues at major ports ([indiashippingnews.com](http://indiashippingnews.com))
- Port Development in India (Port\_Dev\_In\_India .pdf)

#### 2.3 PROBLEM SOLUTION DEFINITION

INDIAN PORT RAIL & ROPEWAY CORPORATION LIMITED (IPRCL) is a first of its kind Joint Venture Company (JVC) between 11 Major Ports under the Ministry of Ports, Shipping and Waterways (Formerly Ministry of Shipping) holding 90% of equity capital and Rail Vikas Nigam Limited (RVNL) under Ministry of Railways holding 10% of equity capital, incorporated with the objective to provide efficient rail evacuation systems to Major Ports and for enhancing their capacity and throughput. The company was registered on 10th July 2015 as a Public Limited Company under the Companies Act, 2013. The Company is under the Ministry of Ports, Shipping and Waterways (Formerly Ministry of Shipping), Government of India.

- IPRCL will play a strategic role and position itself to act as mentor & coordinator for Major Ports Railway systems.
- Interface with Government departments/ agencies and autonomous bodies on strategic issues and also work with consultants for removing bottlenecks.
- Act as a consultant for bringing in best practices in areas of IT, processes, systems, and other areas related to evacuation of Cargo.
- Develop technical and financial competence for undertaking DPR/PMC work.



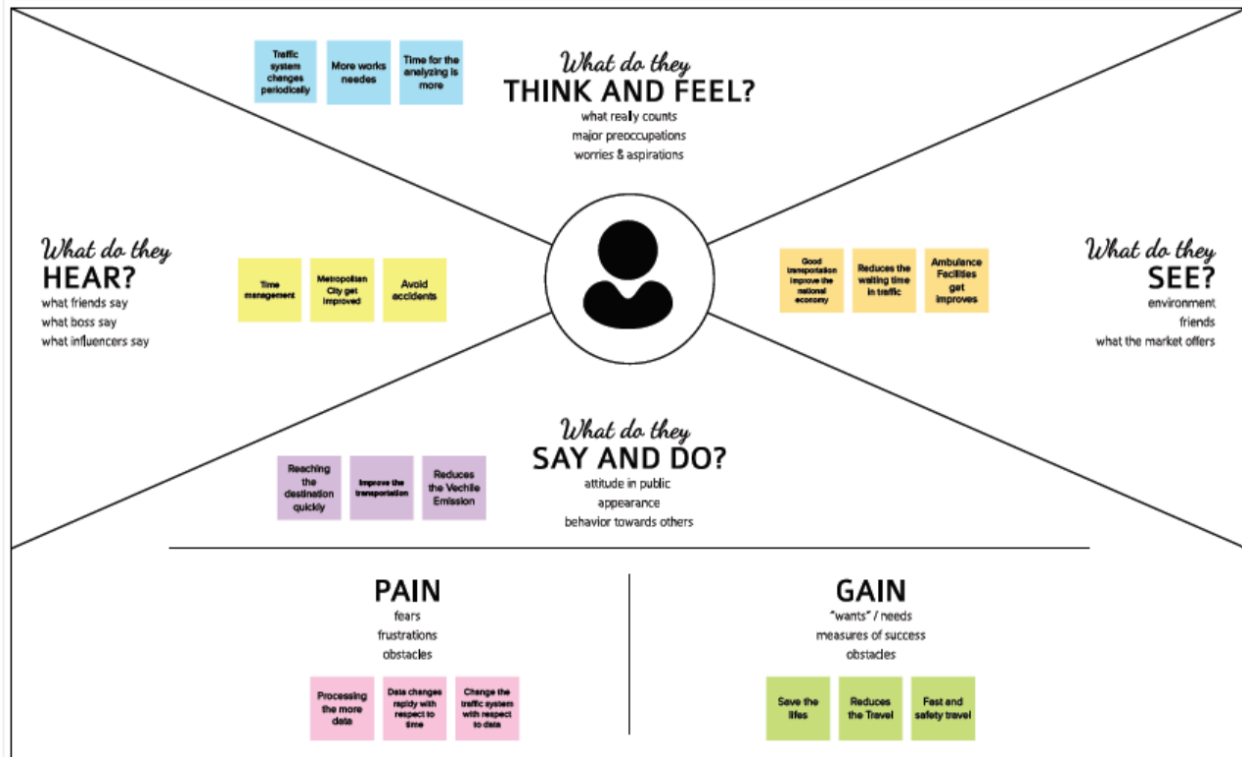
- IPRCL can leverage the experience, expertise, and linkages to various organizations (Ministry of Ports, Shipping and Waterways (Formerly Ministry of Shipping), Major Ports, RVNL) to build a strong base in the initial years of its existence.
- Contribute to the role of a Think-tank to develop scalable, workable models in port infrastructure for evacuation of cargo.
- Effectively interface with the Indian Railways for addressing issues such as the supply of rakes, pre-project approvals, and post-project certifications.
- Attract investors and financial resources for port evacuation infrastructure projects.

# CHAPTER 3

## 3. IDEATION & PROPOSED SOLUTION


### 3.1 EMPHATY MAP CANVAS

#### Traffic and Capacity analytics for major ports






## 3.2 IDEATION AND BRAINSTORMING


Template



# Brainstorm & idea prioritization


Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.


-  **10 minutes** to prepare
-  **1 hour** to collaborate
-  **2-8 people** recommended




**Before you collaborate**

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.


 **10 minutes**

 **Team gathering**


Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

 **Set the goal**

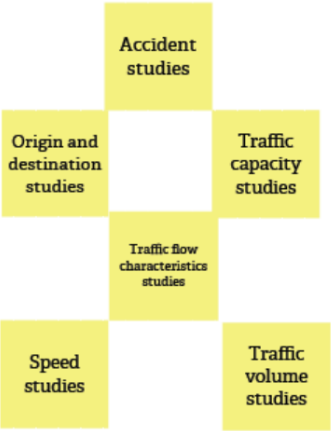
Think about the problem you'll be focusing on solving in the brainstorming session.

 **Learn how to use the facilitation tools**

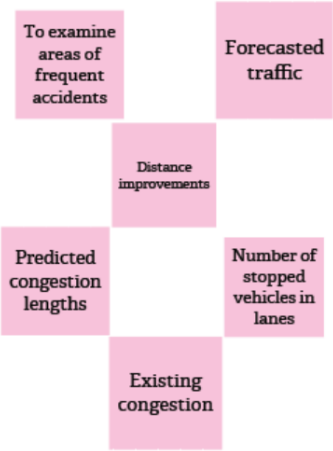
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) 

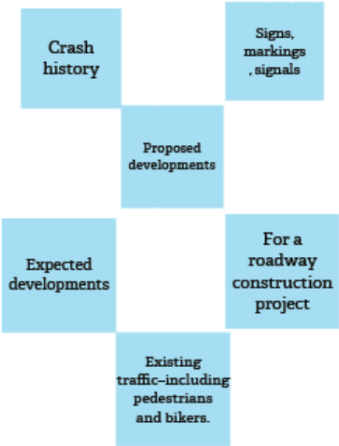
Senthil Nathan M



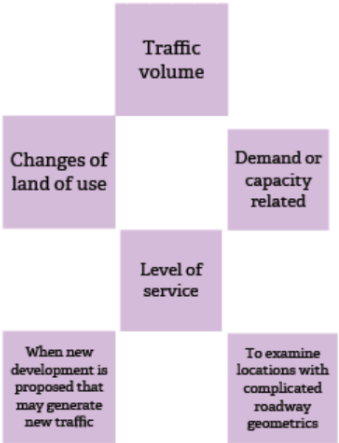
Adithiya R



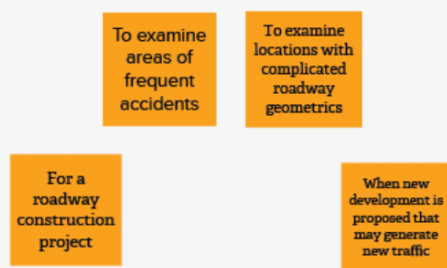
Gokul K



Muthukumar R



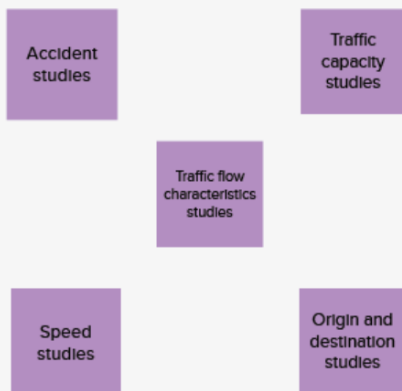
## Importance of Traffic studies



## Objectives of Traffic Engineering

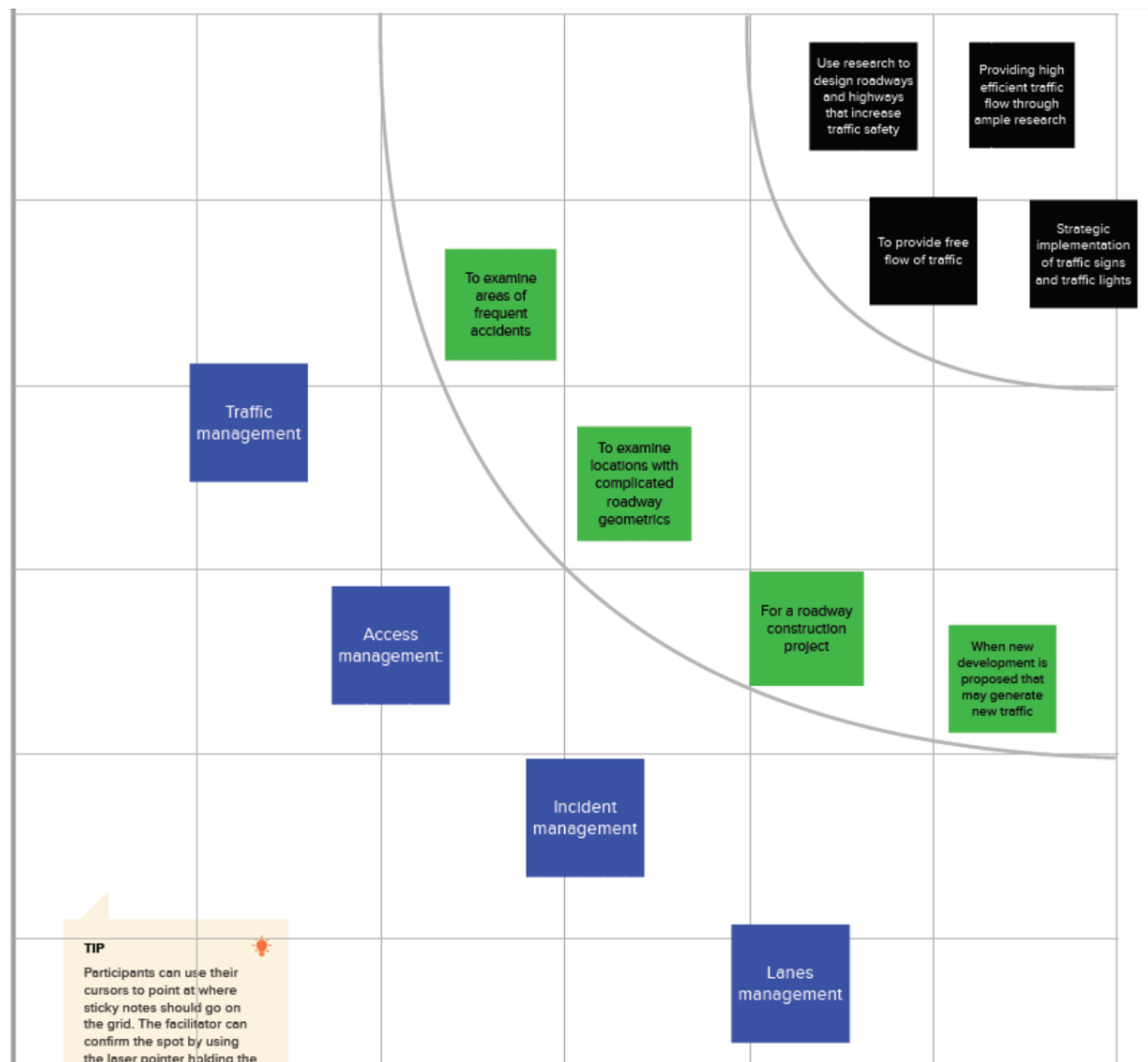


## What are the studies involved



## System to support traffic management





### 3.3 PROPOSED SOLUTION

S.No	Parameter	Description
1.	Flyover	<ul style="list-style-type: none"><li>❖ Flyover are the ultimate solution in order to minimize the congestion because we don't have enough space at intersection for any other solution</li><li>❖ Two flyovers were designed on eastern and western side along with specification</li><li>❖ Eastern flyover will accommodate the traffic moving towards Peshawar and bus stops on NB and SB .</li></ul>
2.	Bus Stand and Bus Stops	<ul style="list-style-type: none"><li>❖ A new Bus stand has been proposed in which all above mentioned bus stops will be there</li><li>❖ New bus stand will provide easiness for passengers by providing all bus stands at one place.</li></ul>

		<ul style="list-style-type: none"> <li>❖ The new bus stand proposed in the available space in front of Roylson Hotel at reduced distance 0+740 (From the beginning of project on NB)</li> </ul>
3.	Rickshaw stands	<ul style="list-style-type: none"> <li>❖ Rickshaw stands have been proposed separately for all direction .</li> <li>❖ On which every Rickshaw will be registered and will follow schedule of movement towards its destination.</li> <li>❖ Rickshaw stand for HMC proposed on service road on left of N-5 south bound (1+150)</li> </ul>
4.	Pedestrian crossing	<ul style="list-style-type: none"> <li>❖ Pedestrians are one of the reasons that make the traffic stream slow .</li> <li>❖ Most crashes occur when pedestrians try to cross the road without traffic rules.</li> </ul>



## CHAPTER 4

### REQUIREMENT ANALYSIS

#### 4.1 FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through mail
FR-2	User Confirmation	Confirmation via Email
FR-3	User Input Acceptance	The dashboard accepts user input by means of selecting the location of the ports.
FR-4	Options for User to filter location of ports	The user can use filter options to view ports by countries.
FR-5	Visualization of ports.	The dashboard provides various visualization techniques to understand the flow.
FR-6	Providing Delay Information of trains.	The dashboard is able to provide the user the information like delay of a particular train to the ports

## 4.2 NON FUNCTIONAL REQUIREMENT

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The dashboard is able to provide the users the consistency and the aesthetic they expect. The user can constantly use the dashboard without any flaw in the visual quality.
NFR-2	Security	The dashboard is much secured that the data of the users are kept confidential and also it is not prone to any kind of attacks.
NFR-3	Reliability	The failure rate is minimal and the failure can easily be rectified using the measures. <u>Thus</u> this makes the dashboard much reliable.
NFR-4	Performance	The dashboard gives better performance. It provides the user a convenient and flexible User Interface.
NFR-5	Availability	The dashboard is always available to serve the users. The availability is ensured in such a way that the user can access the dashboard any time anywhere.
NFR-6	Scalability	The dashboard is highly scalable. It can withstand any increase or decrease of loads.

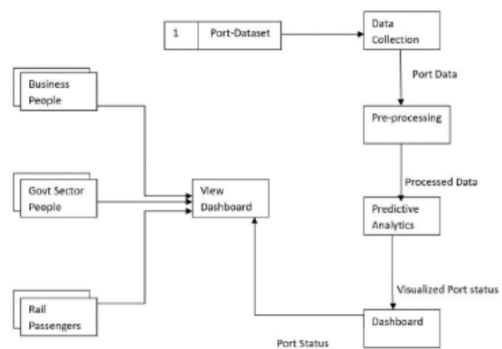
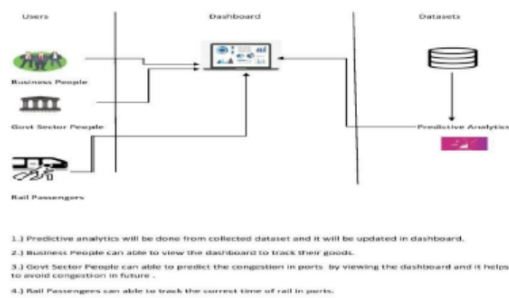
# CHAPTER 5

## PROJECT DESIGN

### 5.1 DATA FLOW DIAGRAMS

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

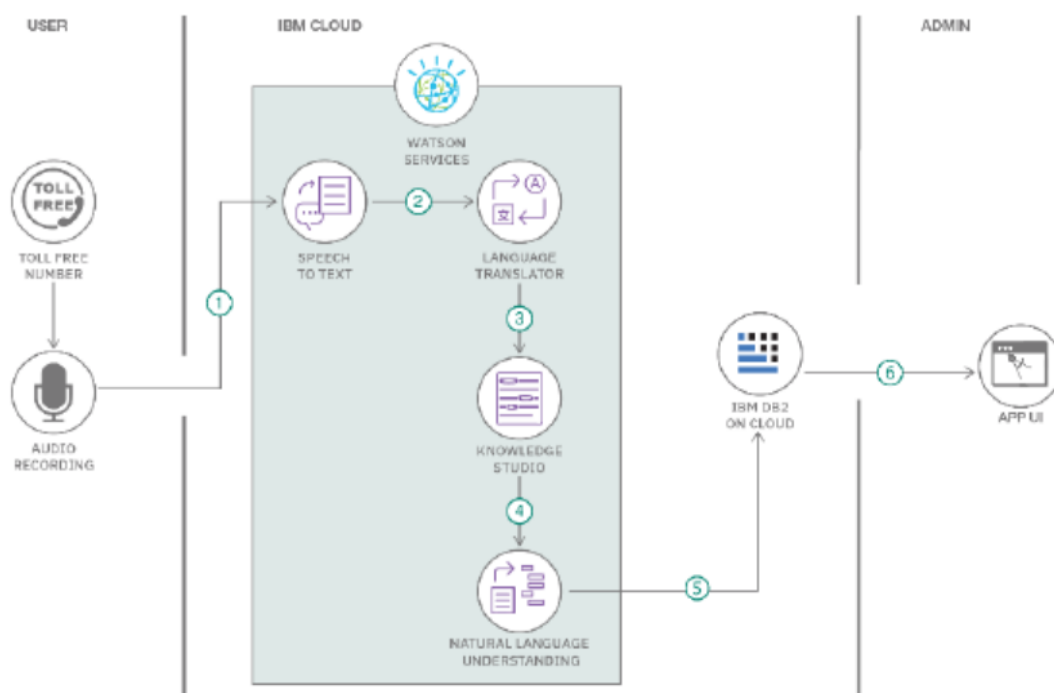
DATA FLOW DIAGRAM



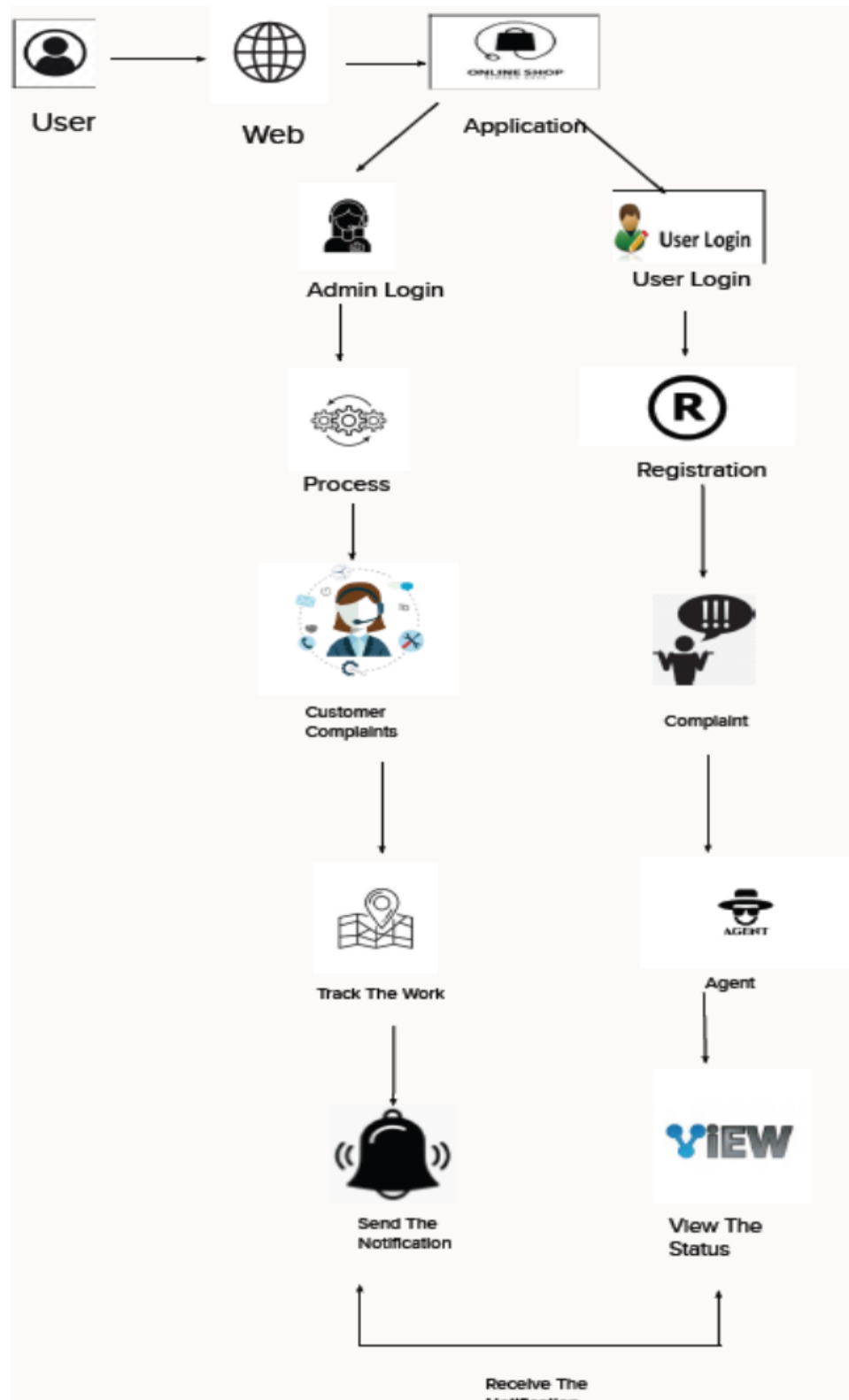
## 5.2.1 TECHNOLOGY ARCHITECTURE

The Deliverable shall include the architectural diagram as below and the information as per the table 1 & table 2

Example: Order processing during pandemics for offline mode



## 5.2.2 SOLUTION ARCHITECTURE



### 5.3 USER STORIES

USER TYPE	FUNCTIONAL REQUIREMENT	USER STORY NUMBER	USER STORY/TASK	ACCEPTANCE CRITERIA	PRIORITY	RELEASE
Business People	Monitoring	USN-1	As a user, I can view the dashboard to see the port status	I can visualize the port status in dashboard	High	Sprint-1
	Tracking	USN-2	As a user,I can track the goods.	I can track the goods by it's arrival/departure time	High	Sprint-2
Government Sector People	Viewing	USN-1	As a user,I can view the port status regularly	I can able to know the port status	Low Sprint-1	Sprint-1
	Predicting	USN-2	As a user,I will reduce the congestion in ports by predicting the port congestion through dashboard	I can able to predict the congestion in future	High	Sprint-2
Passengers	Tracing	USN-1	As a user, I can trace the arrival/departure time of rail in ports.	I can able to track the correct time of rail.	High	Sprint-2

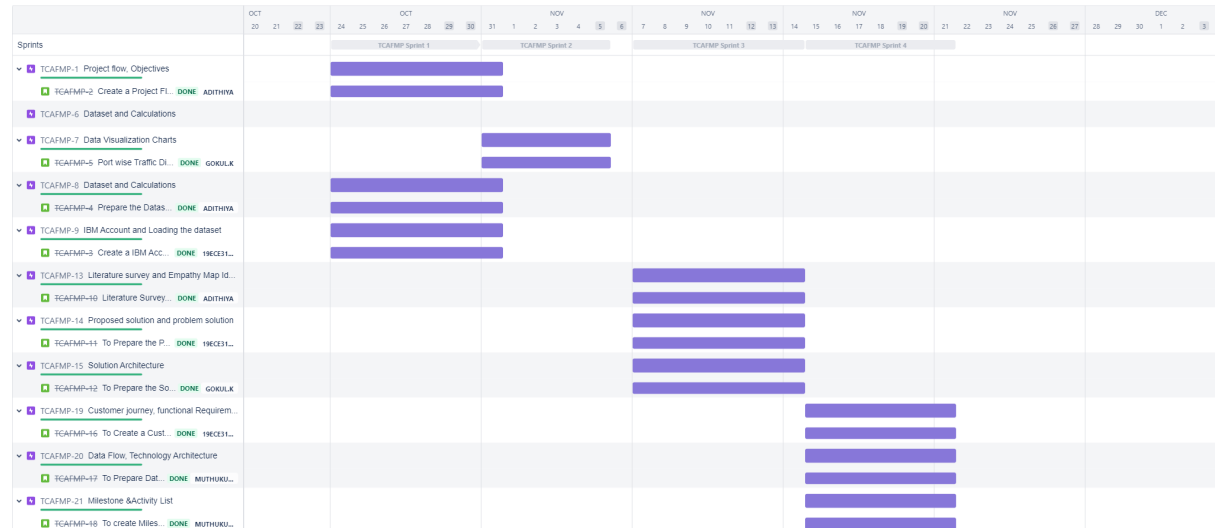
# CHAPTER 6

## PROJECT PLANNING & SCHEDULING

### 6.1 SPRINT PLANNING AND SCHEDULING

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Project flow, Objectives	USN-1	Create a Project Flow	5	Medium	Whole Team
	IBM Account and Loading the dataset	USN-2	Create a IBM Account and dataset	5	Medium	R. Adithya
	Dataset and Calculations	USN-3	Prepare the Dataset and Prepare the Calculation	10	High	R. Adithya
Sprint-2	Data Visualization Charts	USN-4	Port wise Traffic <a href="#">Distribution</a> , <a href="#">Traffic</a> Vs Capacity and Prepare Line & Bar Chart ,Area Chart	20	High	Whole Team
Sprint-3	Literature Survey and Empathy <a href="#">Map</a> , ideation	USN-5	Literature Survey <a href="#">On</a> The Selected Project & Information Gathering and Prepare Empathy map, ideation	10	High	Whole Team
Sprint-3	Proposed Solution And Problem Solution fit	USN-6	To Prepare the Proposed Solution And Problem Solution fit	5	Medium	M Senthil Nathan R. Adithya
Sprint-3	Solution Architecture	USN-7	To Prepare the Solution Architecture	5	Medium	R. Muthukumar K. Gokul
Sprint-4	Customer journey, functional Requirement	USN-8	To Create a <a href="#">Customer</a> journey and functional Requirement	10	high	Whole Team
Sprint-4	Data Flow, Technology Architecture	USN-9	To Prepare Data Flow, Technology Architecture	5	medium	R. Muthukumar K. Gokul
Sprint-4	Milestone &Activity List	USN-10	To create Milestone and Activity List	5	medium	R. Muthukumar M. Senthil Nathan

## 6.2 REPORT FROM JIRA



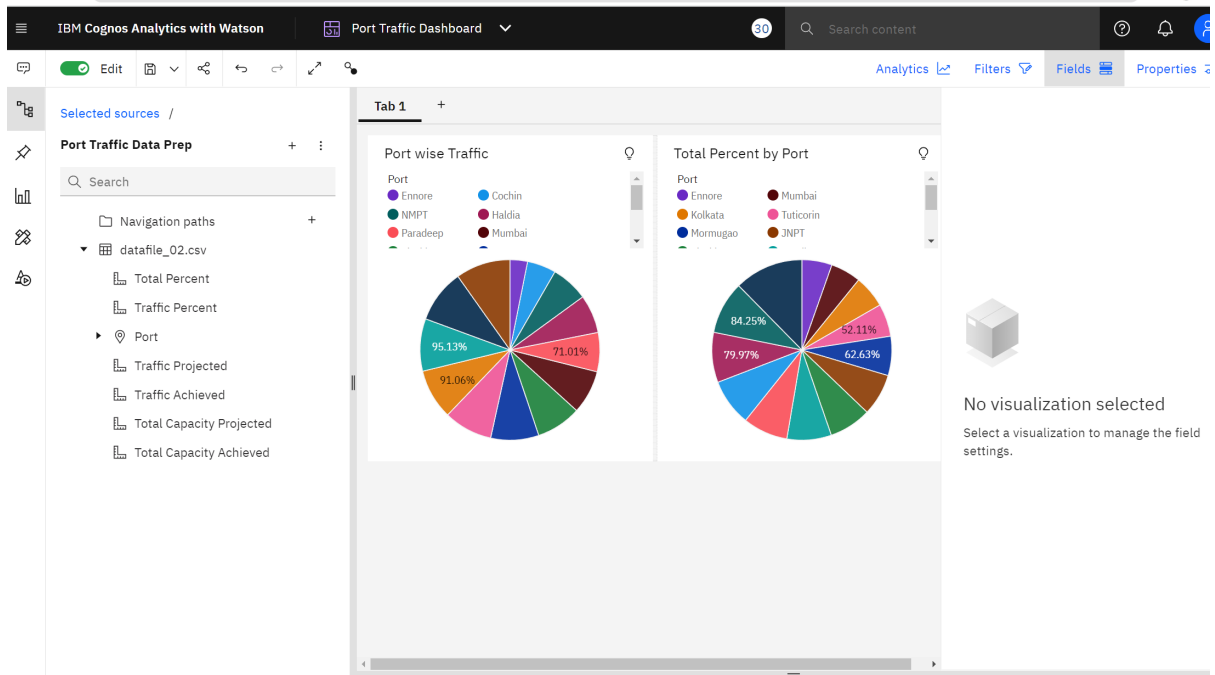


# CHAPTER 7

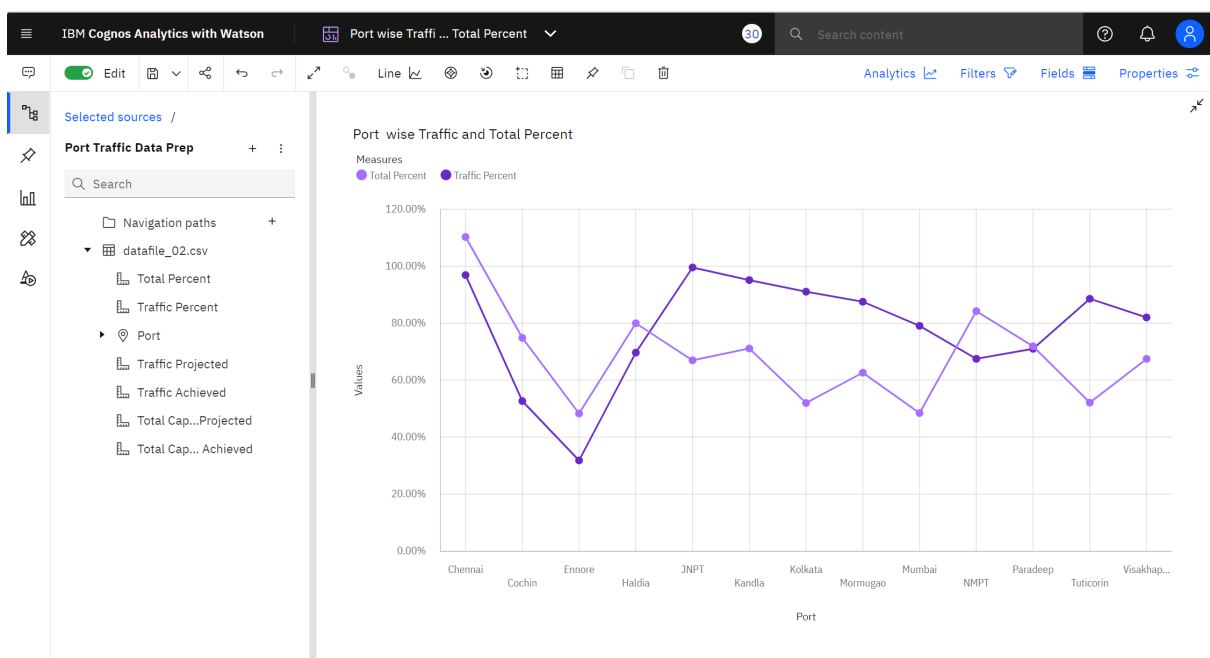
## RESULTS

### 7.1 PERFORMANCE METRICES

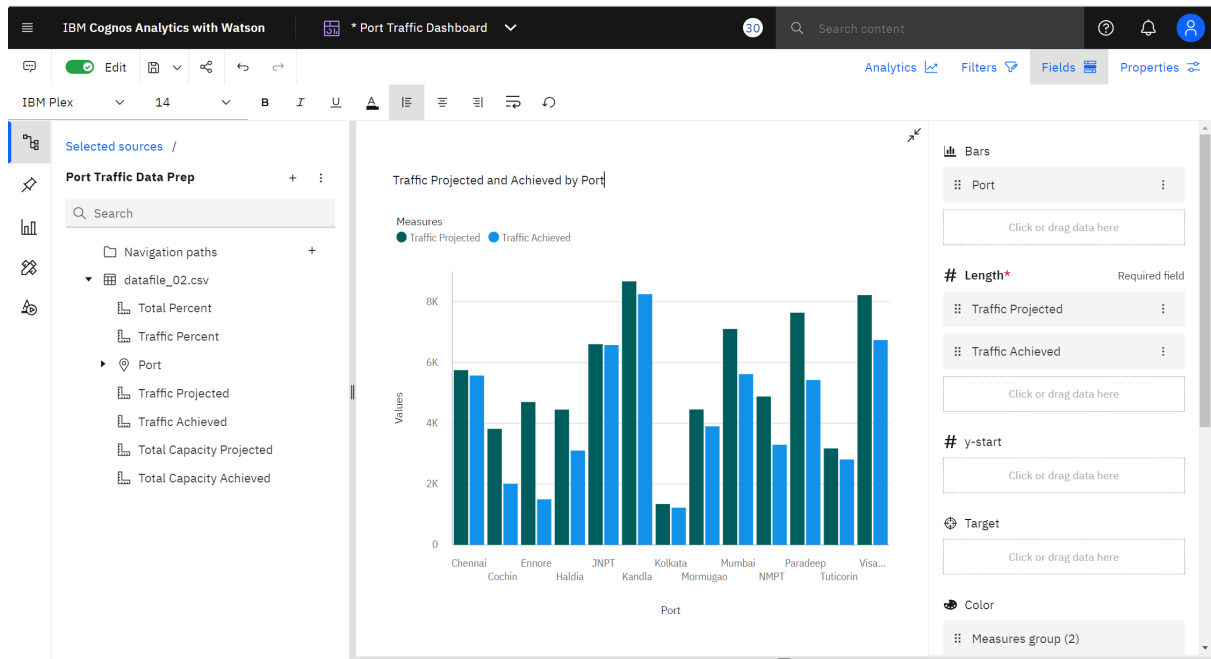
#### ► Port-Wise Traffic Distrubution, Port Wise Capacity Distrubution



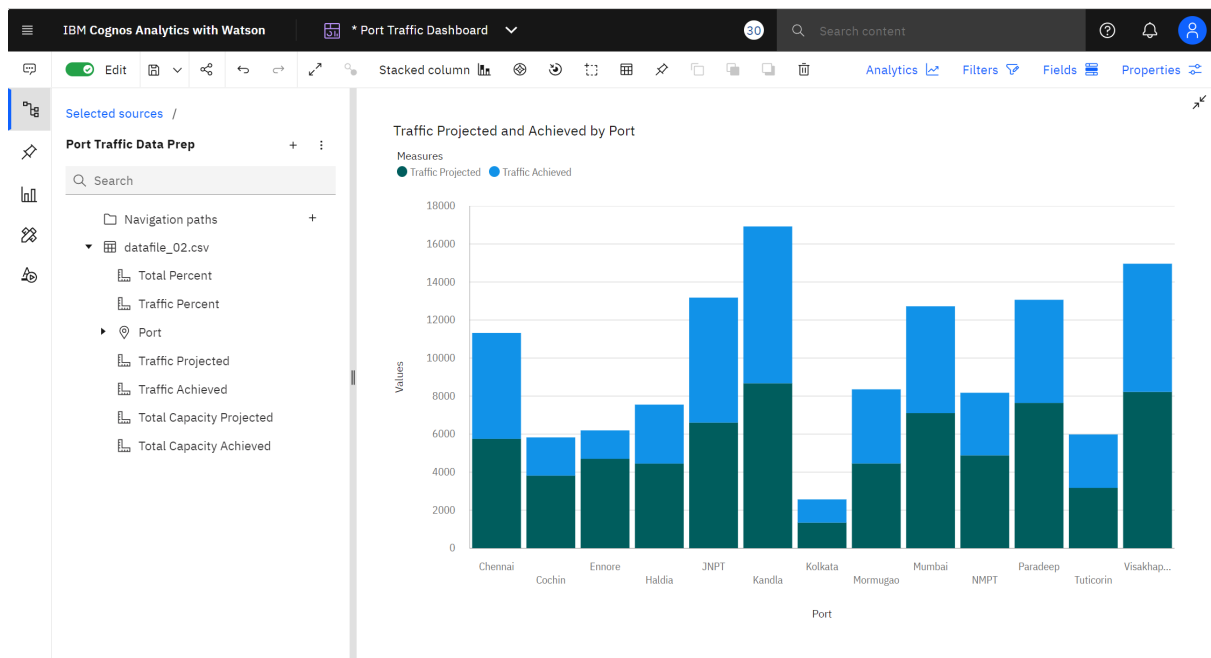
#### ► Port-Wise Traffic Vs Capacity By Line Chart



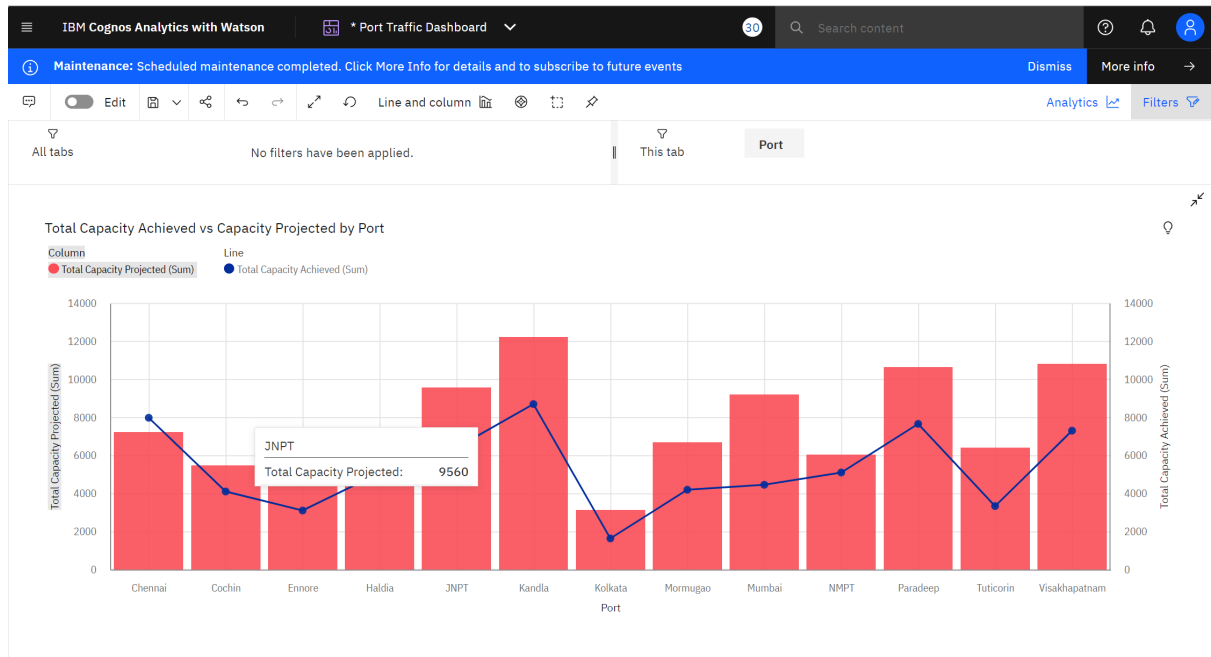
## ► Port-Wise Traffic Projected Vs Achieved by Coloumn Chart



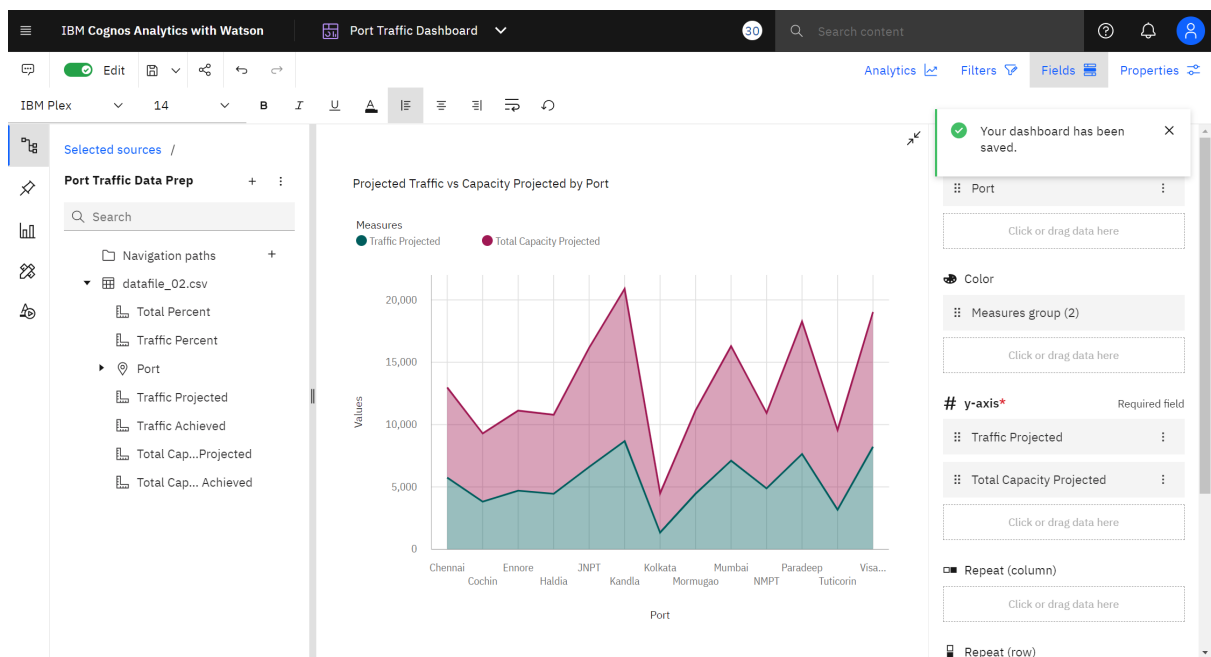
## ► Port-Wise Traffic Projected Vs Achieve By Stacked Coloumn Chart



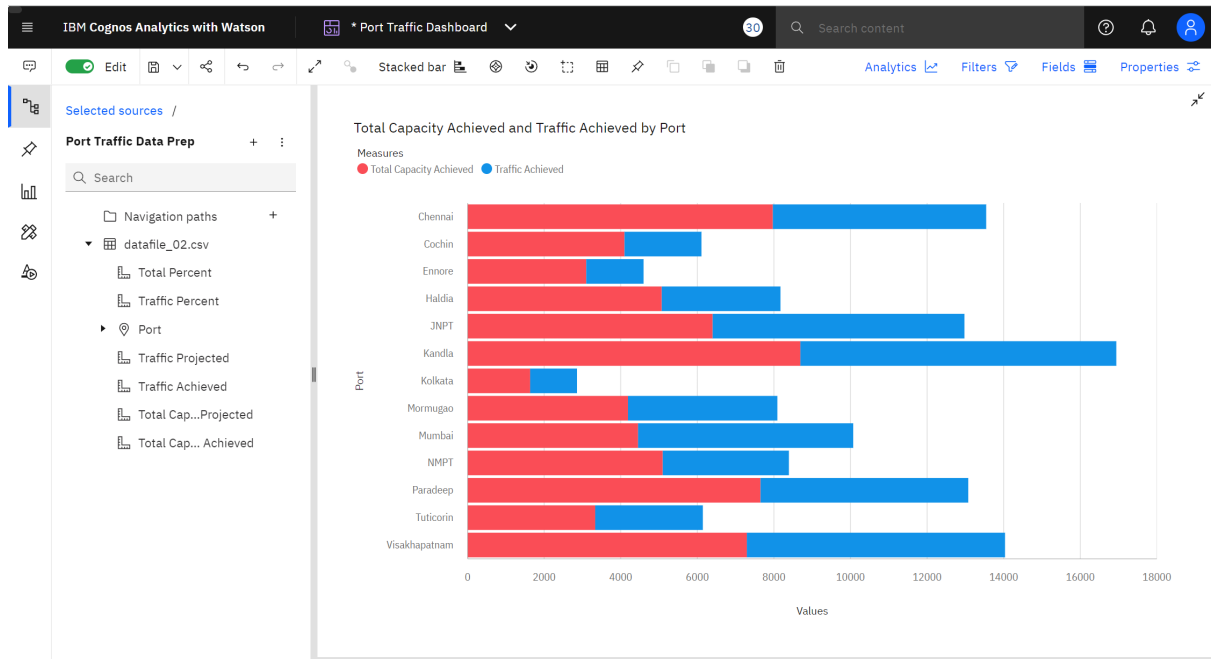
## ► Port-Wise Total Capacity Projects Vs Total Capacity Achieve By Line and Bar Chart



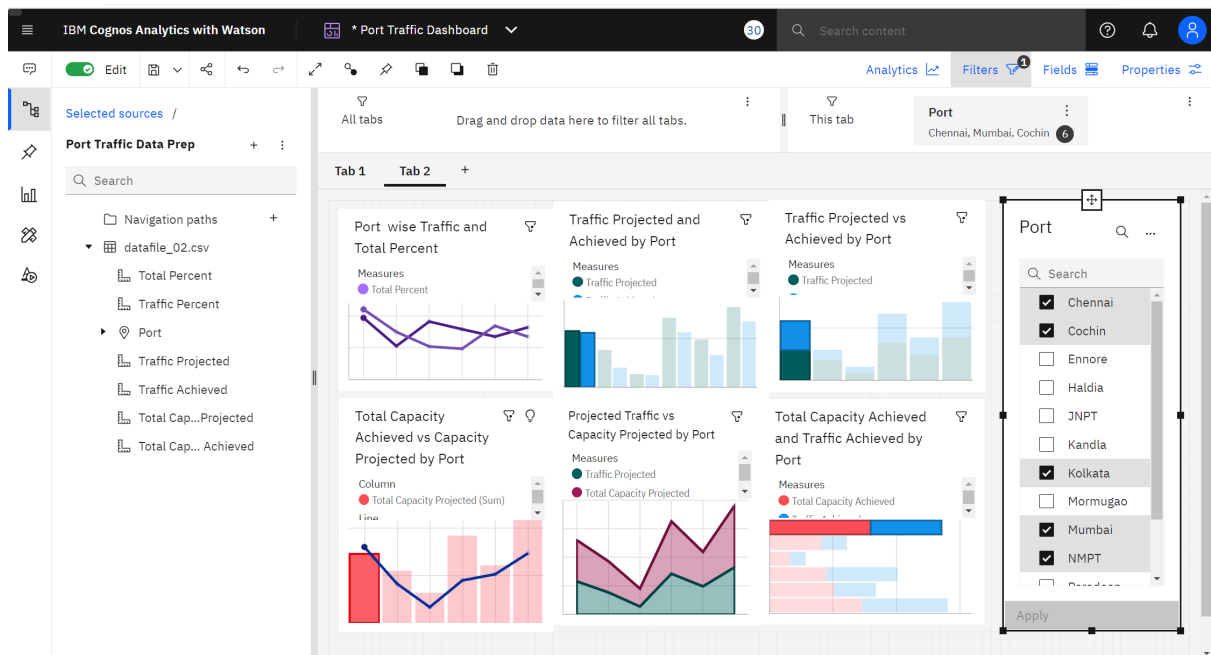
## ► Port-wise Total Projects Vs Total Projected By Area Chart



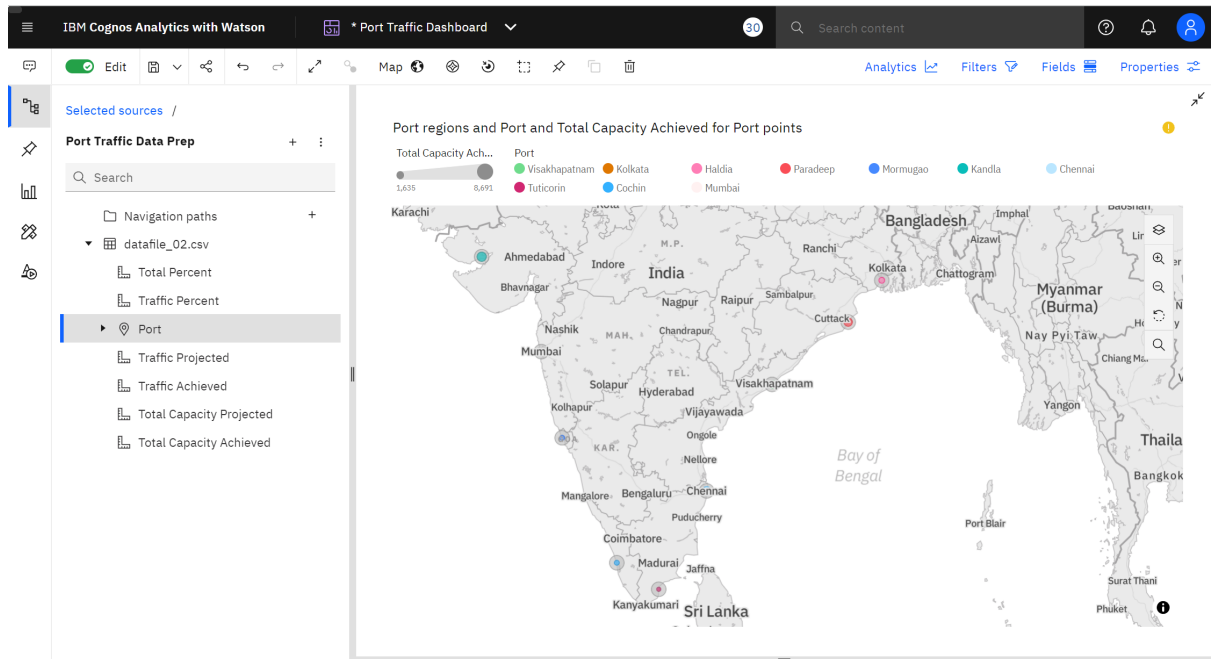
## ► Port-Wise Total Capacity Achieve, Traffic Achieved Using Stacked Bar



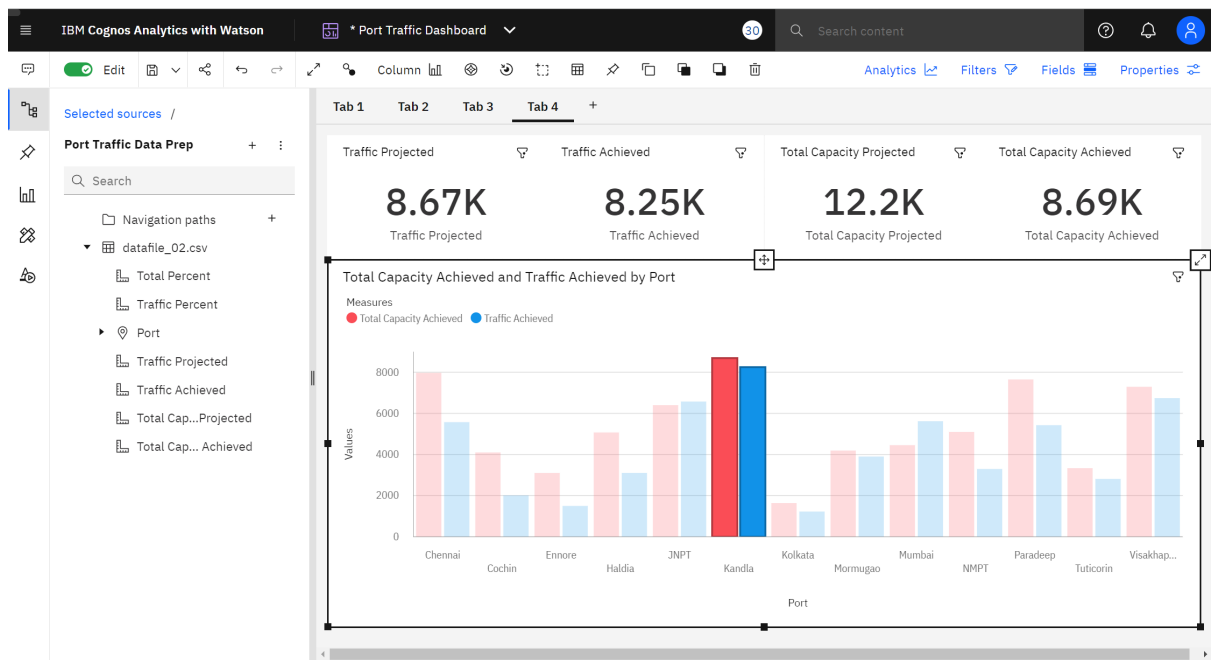
## ► Filters



## ► Port-Wise Total Capacity Achieved Using Map



## ► Summary Cards And Visual Using Total Capacity Vs Actual Capacity Column Chart



## CHAPTER 8

### ADVANTAGES AND DISADVANTAGES

#### ADVANTAGES

- ✓ Ports sector in India is being driven by high growth in external trade.
- ✓ In FY22, all key ports in India handled 650.52 million tonnes (MT) of cargo traffic.
- ✓ The Finance Minister proposed to double the ship recycling capacity of ~4.5 million light displacement tonnes (LDT) by 2024; this is expected to generate an additional ~1.5 lakh employment opportunities in India.
- ✓ India has a coastline which is more than 7,517 kms long, interspersed with more than 200 ports.
- ✓ Most cargo ships that sail between East Asia and America, Europe and Africa pass through Indian territorial waters.

#### DISADVANTAGES

- ✓ High turnaround times
- ✓ Port congestion
- ✓ Sub-optimal transport modal mix
- ✓ Limited hinterland linkages

## **CHAPTER-9**

### **CONCLUSION**

Sagarmala project has to be devised to reduce logistics cost and strengthen india's EXIM industry. thus, in order to achieve higher economic growth and higher efficiency levels, the trade-GDP ratio needs to increase substantially. Improvement in the efficiency of ports and expansion of their capacity is essential for promoting the growth of trade and export competitiveness

## **CHAPTER 10**

### **FUTURE SCOPE**

The operational efficiency of Indian major ports is determined primarily by the following efficiency parameters, average output per ship berth-day, turn-round time. Pre-berthing detention time and idle time. Every year each major port enters into a memorandum of understanding with the Ministry of Shipping, Government of India in which targeted efficiency parameters are agreed upon. Performances of a port with respect to the above parameters enhance its competitiveness. But targets fixed by the Ministry are not based on the standard outputs of equipments and berths and remain a mere upgrade of the previous performances. Very low targets are set in some ports based on past achievements which do not motivate them to achieve higher mechanization levels and adopt better practices.



# CHAPTER-11

## APPENDIX

### 11.1 GITHUB LINK

<https://github.com/IBM-EPBL/IBM-Project-1359-1658385902>

### 11.2 PROJECT VIDEO DEMO LINK

