Traffic and Capacity Analytics for Major Ports

Team id: PNT2022TMID00308

Project Domain: Data Analytics

project Name: Traffic And Capacity Analytics For Major Ports

Date: 19/11/22

Team Leader : Logesh J

Team Members: Lijo Ferdinand J

Mathesh raju mainar

Jeyaprakash

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ABSTRACT

This project aims to increase the railway's market share in a few commodities, overcome obstacles, and sustain sustainable growth across all of its commodities. Additionally, we work to improve port connectivity and lessen traffic on rail corridors. Last but not least, assist in creating a dedicated freight corridor between important ports. A train's capacity for carrying passengers and goods from each port is determined by analysing both previously collected and newly collected data on railroad traffic.

CHAPTER 1

1.INTRODUCTION

Due to a rise in the demand for products and services, India has had the fastest major economic growth rate for four out of the last five years. For millions of Indians, economic possibilities have been made possible by the flow of goods within and outside of the nation. 2.2 crore people are employed in the logistics industry today, which contributes 5% to India's GDP1. India transports 4.6 billion tonnes of cargo annually at a total expense of INR 9.5 lakh crore. These items are made up of a range of domestic industries and products: 22% of them are tied to agriculture, 39% to mining, and 39% to manufacturing. Most of the transportation of these items is done by trucks and other vehicles.The other transportation modes include railroads, inland and coastal rivers, pipelines, and airways.

The Government of India (GOI) is pursuing a variety of activities to enhance the performance of its logistics system in recognition of the sector's crucial role in the future of the nation. Among these are the creation of specialised rail-based freight routes as well as enhancements to the connectivity and capacity of coastal and inland water-based shipping. Additionally, it examines the development of road infrastructure initiatives like Bharatmala and the Golden Quadrilateral as well as the formulation of beneficial policies. The ecosystem of India's freight transportation has a crucial role to play in supporting India's ambitious aspirations as the country's freight activity is expected to increase by roughly five times by 2050. International competitiveness, job creation, rural and urban lives, and clean air and environment are a few of them.

Products go through a supply chain after being manufactured until they are purchased by a customer. The logistics industry combines trucks and warehouses, all of which are chosen to carry and handle those items in an effective manner. The kind of commodities being moved and the distance they are being transported determine the sorts of trucks and storage facilities that are commonly chosen. For the welfare of communities and economies, supply chain managers must effectively deploy and employ a collection of trucks and warehouses to transfer commodities from the point of production to their final usage by consumers.

Indian stakeholders need to take action to transition to a new freight paradigm that is more affordable, clean, and efficient in order to sustain the growing demand for freight transport without pushing existing externalities to extreme levels. The improvement of air quality, GDP, public health, logistics productivity, and employment opportunities are just a few of the development goals that this new freight transportation paradigm will help India achieve. It also aligns with India's goals for clean mobility. India can take advantage of the opportunities by putting a number of solutions into place on the solid foundation of encouraging policies and market trends.

1.1PROJECT 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 TranMinistry of Ports, Shipping and Waterways sport 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

1.2PURPOSE

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

India's ports struggle with lengthy ship turnaround times. For instance, the typical ship turnaround time in Singapore is less than a day. However, it has been almost two days in India. Port overflow brought on by container volume. inadequate and ineffective handling equipment

Operations are a top priority. An inadequate mix of transport modalities results from a lack of required infrastructure for evacuation from major and non-major ports. Analysts have raised worries about the growth of many ports handling the same cargo in close proximity, as this could result in ports vying for the same cargo arrivals. Major problems include inadequate training, declining workforce standards, and resistance to reform.

2.2 REFERENCES

- Revisiting traffic forecasting by port authorities in the context of port planning and development (https://shipmin.gov.in)
- Enhancing port activities using information and communication technology ((www.timesnow.com)
- From historical positioning data to unsupervised maritime traffic monitoring (www.indiashippingnews.com)
- Big data analytics and their use for decision making in port terminal and maritime companies (Port_Dev_In_India .pdf)

2.3 PROBLEM SOLUTION DEFINITION

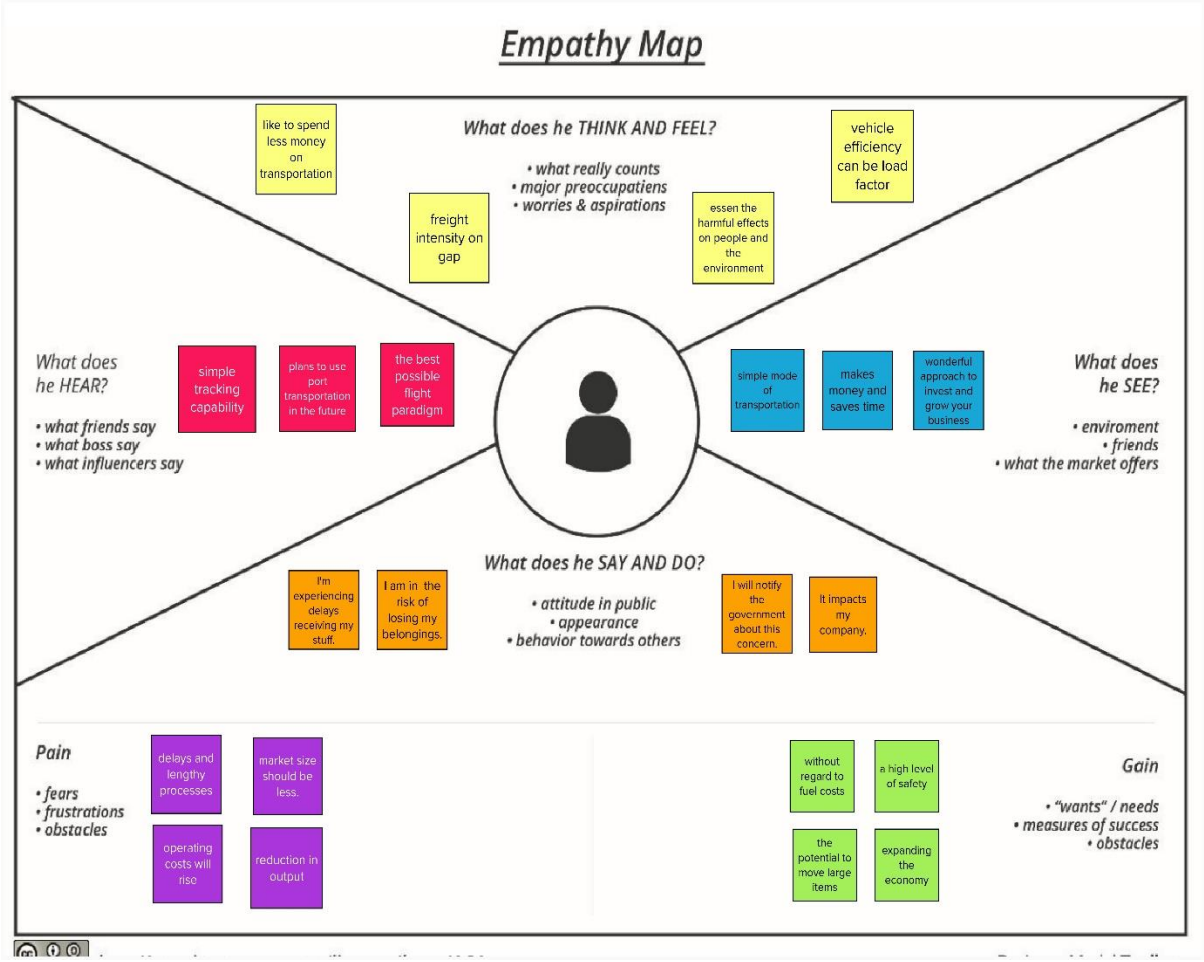
INDIAN PORT RAIL & ROPEWAY CORPORATION LIMITED (IPRCL) is a first-of-its-kind Joint Venture Company (JVC) between 11 Major Ports under the Ministry of Ports, Shipping and Waterways (Formerly Ministry of Shipping), holding 90% of equity capital, and Rail Vikas Nigam Limited (RVNL), under the Ministry of Railways, holding 10% of equity capital. IPRCL was established with the goal of providing effective rail evacuation systems to Major Ports In accordance with the Companies Act of 2013,

the business was registered as a public limited company on July 10, 2015. The Ministry of Ports, Shipping and Waterways (formerly the Ministry of Shipping), Government of India, is responsible for the Company.

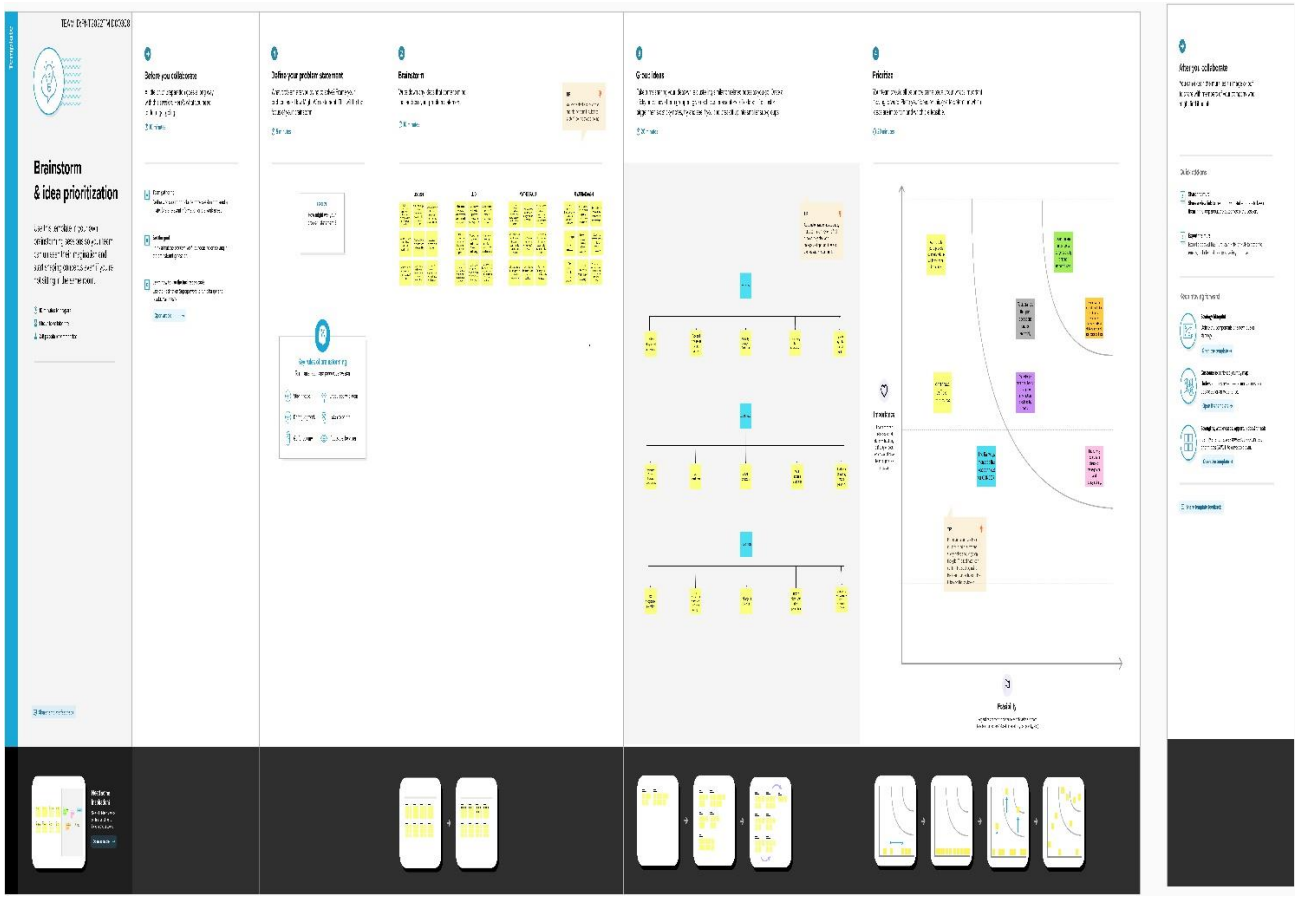
- IPRCL will take a proactive attitude and play a strategic role in serving as a mentor and coordinator for the Major Ports Railway systems.
- Interact with autonomous bodies, government departments, and agencies on strategic concerns. Collaborate with consultants to find and fix bottlenecks.
- Develop technical and financial proficiency for carrying out DPR/PMC work. Act as a consultant for bringing in best practises in areas of IT, procedures, systems, and other areas relevant to evacuation of cargo.
- The Ministry of Ports, Shipping and Waterways (Formerly Ministry of Shipping), Major Ports, and RVNL are just a few of the entities IPRCL can draw on for experience, expertise, and connections in order to establish a solid foundation during its early years of operation.
- Contribute to the Think-tank role in developing scalable, practical models for port infrastructure for cargo evacuation.

CHAPTER 3

3. IDEATION & PROPOSED SOLUTION



3.2 IDEATION AND BRAINSTORMING



3.3 PROPOSED SOLUTION

Project team shall fill the following information in proposed solution template.

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
•	Problem Statement (Problem to be solved)	Delays in importing and exporting products because of port congestion business losses owing to customer losses
•	Idea / Solution description	Digitizing the port improves productivity, and sensors are installed at ports to reduce risks.
•	Novelty / Uniqueness	Cheaper and more approachable with less effort spent

•	Social Impact / Customer Satisfaction	Increasing competition is forcing businesses to pay much more attention to satisfying customer needs tangible, responsive, assurance, empathy and reliable are also customers satisfaction
•	Business Model (Revenue Model)	They need to continuously analyse their expertise in order to maximise the effectiveness of their activities at both the strategic and operational levels.
•	Scalability of the Solution	The maximum throughput in tonnes, TEUs, or other units that a port and its terminals can handle over a specific time period is defined as port capacity in principle. Physical limitations or economic situations that make the marginal cost of further throughput impractical might establish this threshold.

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP

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.

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

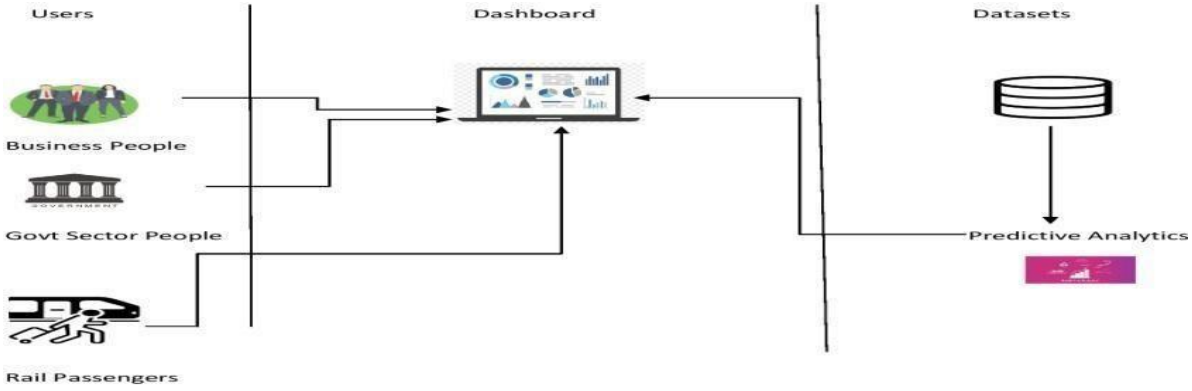
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The dashboard is able to provide the user the consistency and the aesthetic they expect.The user can constantly use the dashboard without any flow in the visual quality.
NFR-2	**Security**	The dashboard is much secured that the data of 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.Thus 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.

CHAPTER 5

PROJECT DESIGN

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.

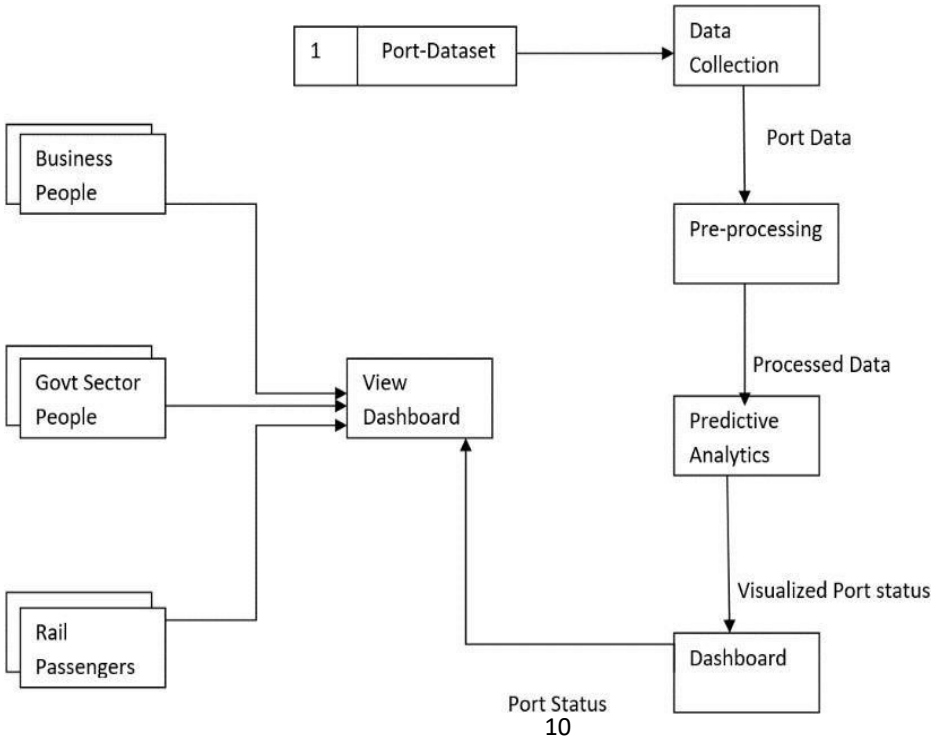


1.) Predictive analytics will be done from collected dataset and it will be updated in dashboard.

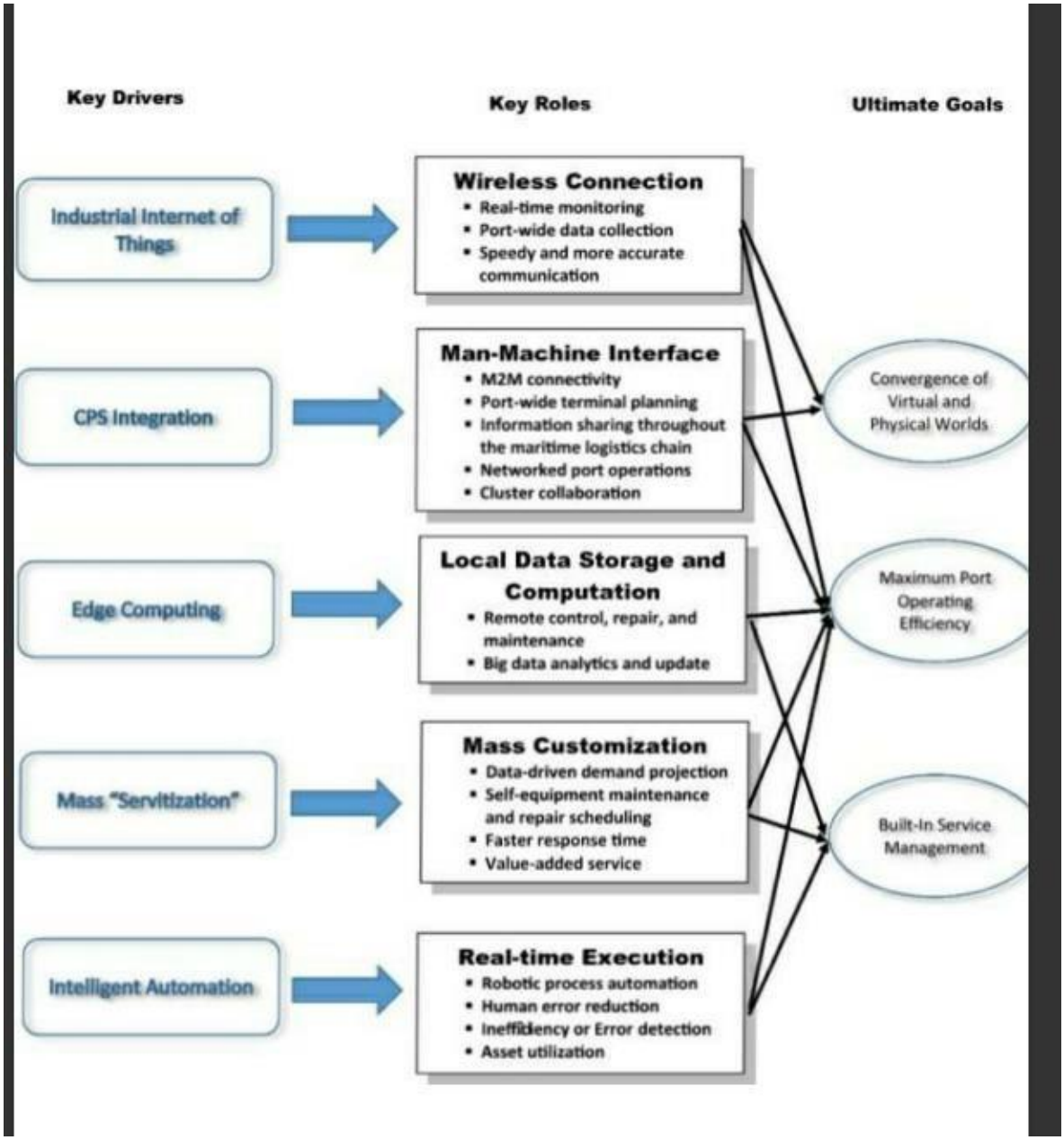
2.) Business People can able to view the dashboard to track their goods.

3.) Govt Sector People can able to predict the congestion in ports by viewing the dashboard and it helps to avoid congestion in future .

4.) Rail Passengers can able to track the correct time of rail in ports.



5.2.1 TECHNOLOGY ARCHITECTURE



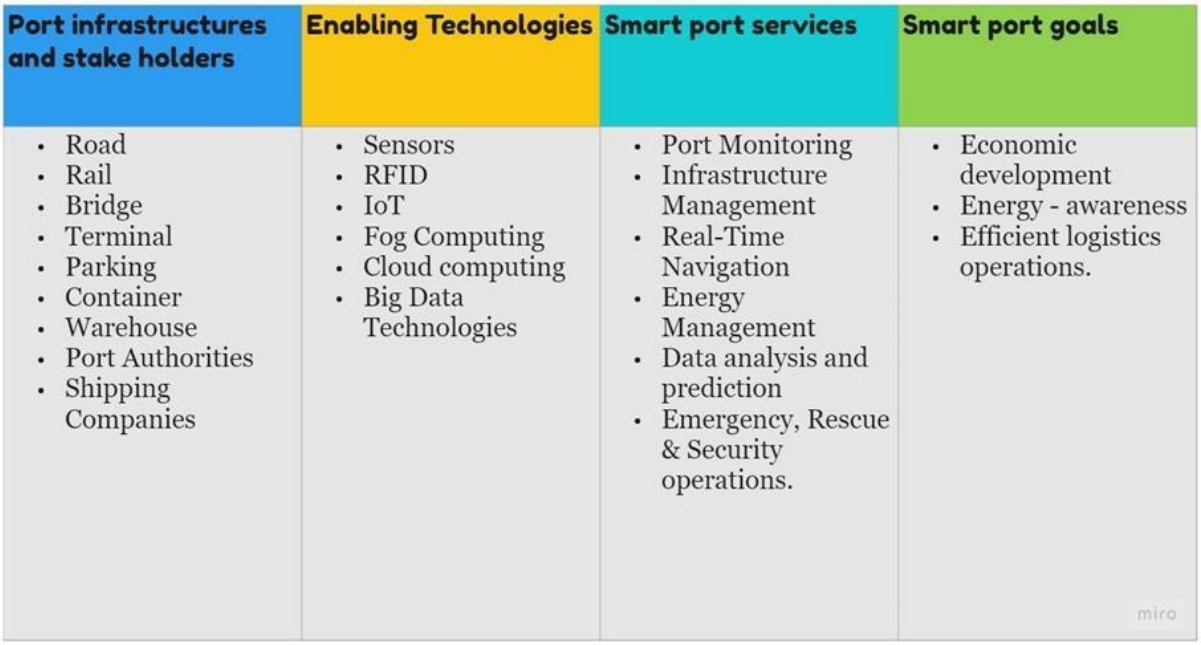


Table-1 : Components & Technologies:

S. No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem

8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes,

Table-2: Application Characteristics:

S. No	Description	Characteristics	Tech
1.	List the open-source frameworks used	Open-Source Frameworks	Djan
2.	List all the security / access controls implemented, use of firewalls etc.	Security Implementations	e.g. S
3.	Justify the scalability of architecture (3 – tier, Micro-services)	Scalable Architecture	3-tier
S. No	**Description**	**Characteristics**	**Tech**
4.	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Availability	(e.g.
5.	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Performance	numb

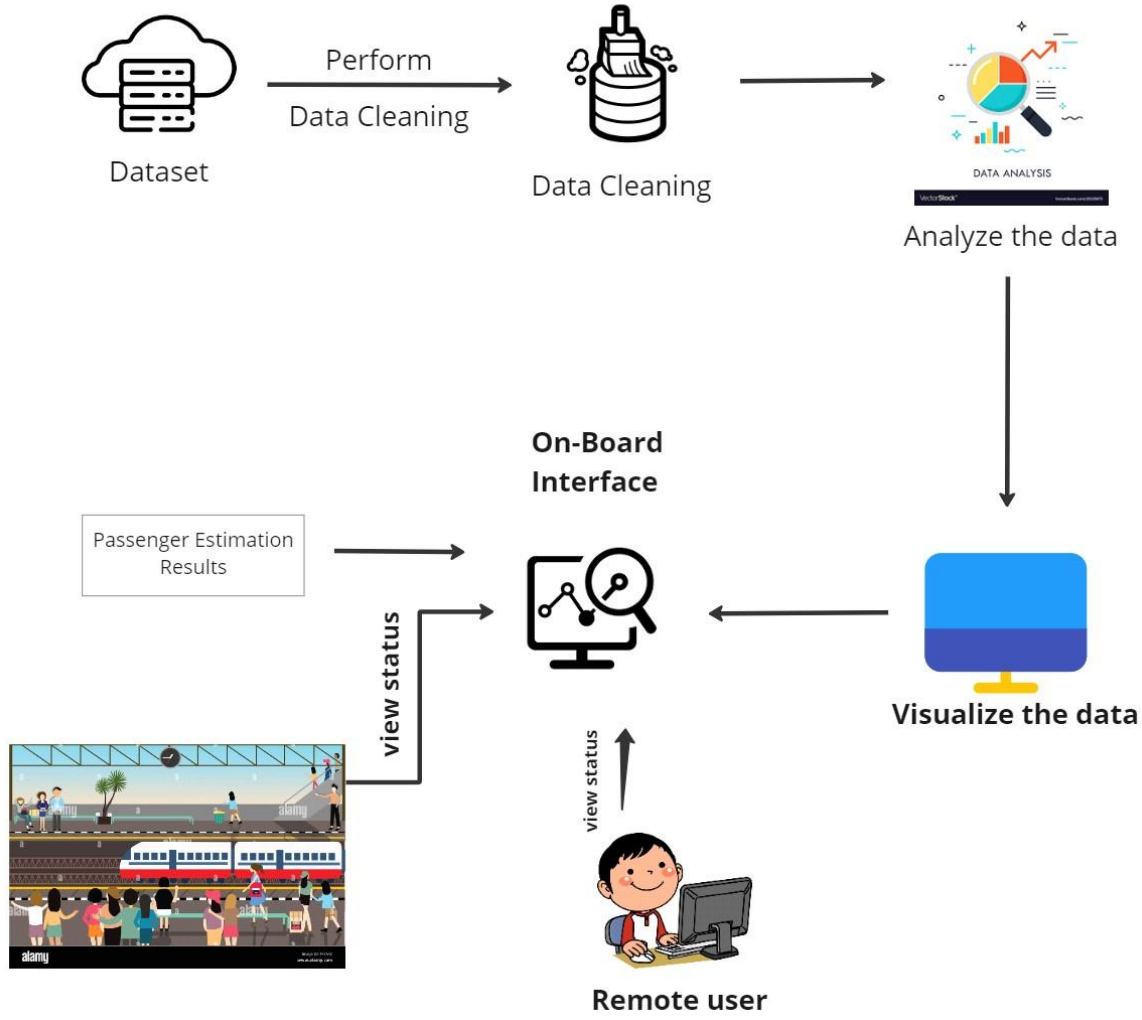
5.2.2 SOLUTION ARCHITECTURE

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

Example - Solution Architecture Diagram:



User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority
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
	Tracking	USN-2	As a user,I can track the goods.	I can track the goods by it's arrival/departure time	High
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
	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
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

CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING AND SCHEDULING

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

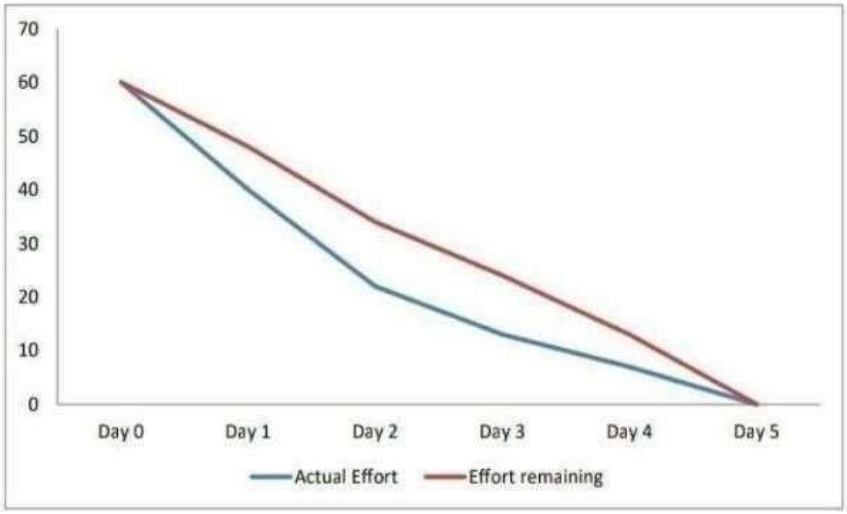
Velocity:

Imagine we have a 6-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

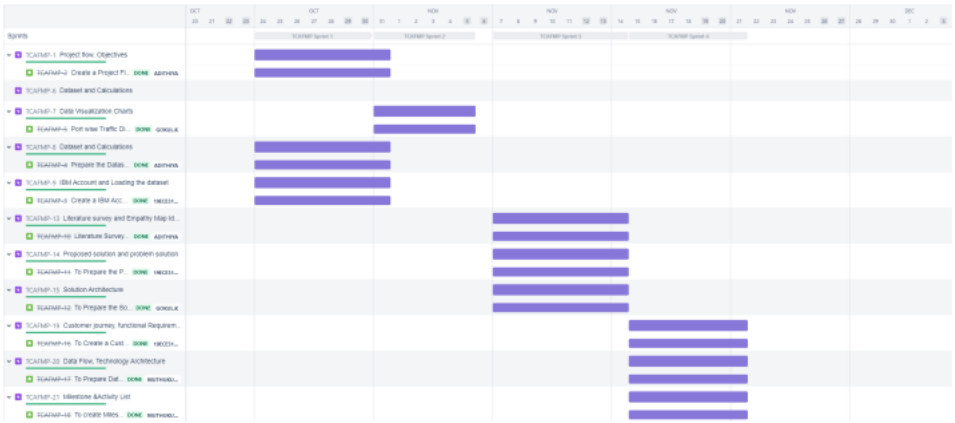
$$\text{Average Velocity} = \frac{\text{Sprint Duration}}{\text{Velocity}} = 20/6 = 3.33$$

Burndown Chart:

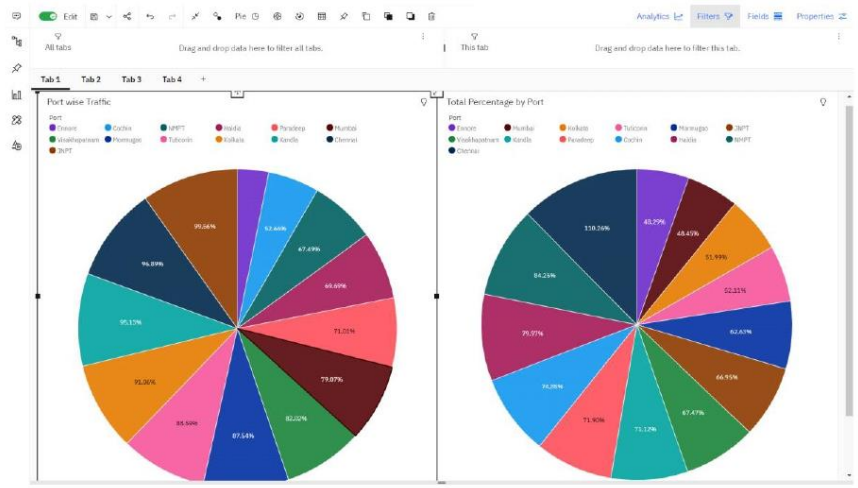
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum.However, burn down charts can be applied to any project containing measurable progress over time.

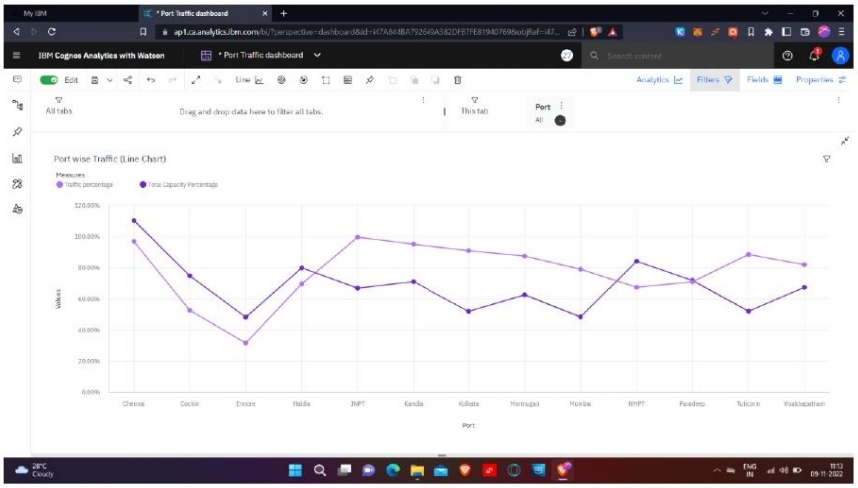


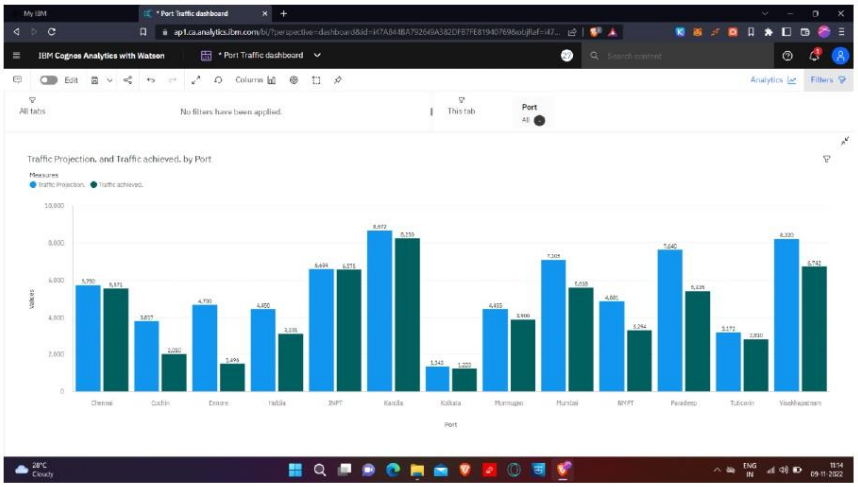
6.2 REPORT FROM JIRA



CHAPTER 7
RESULTS



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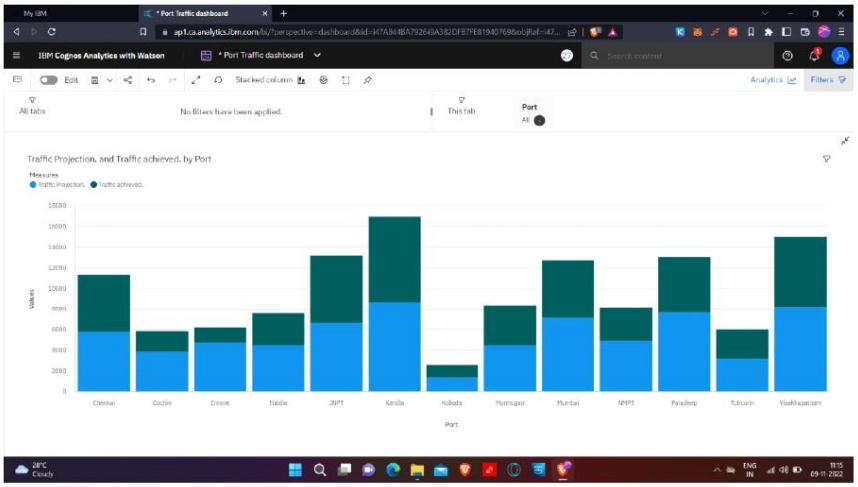
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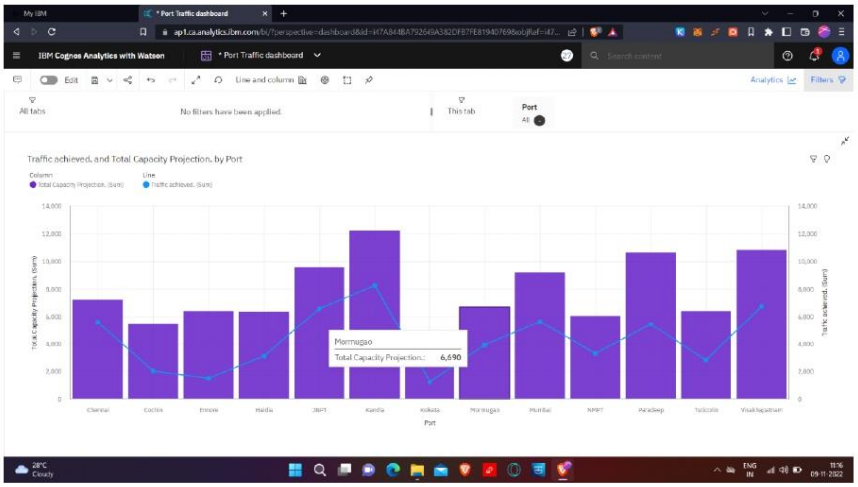
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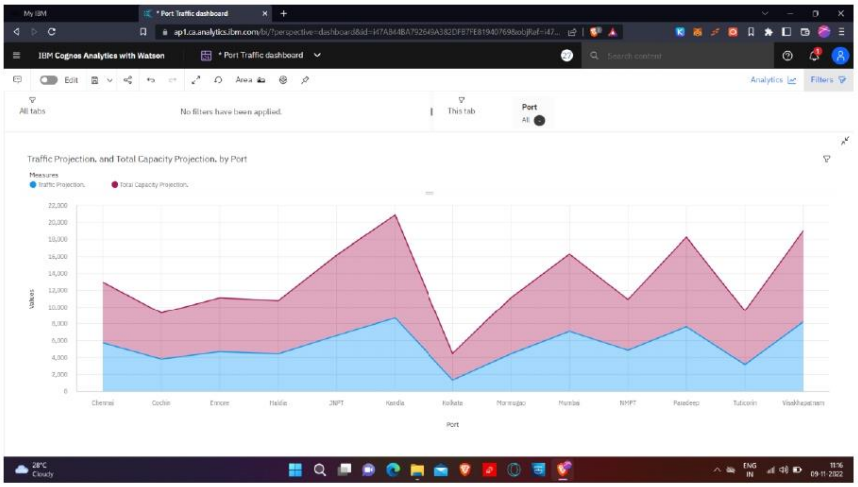
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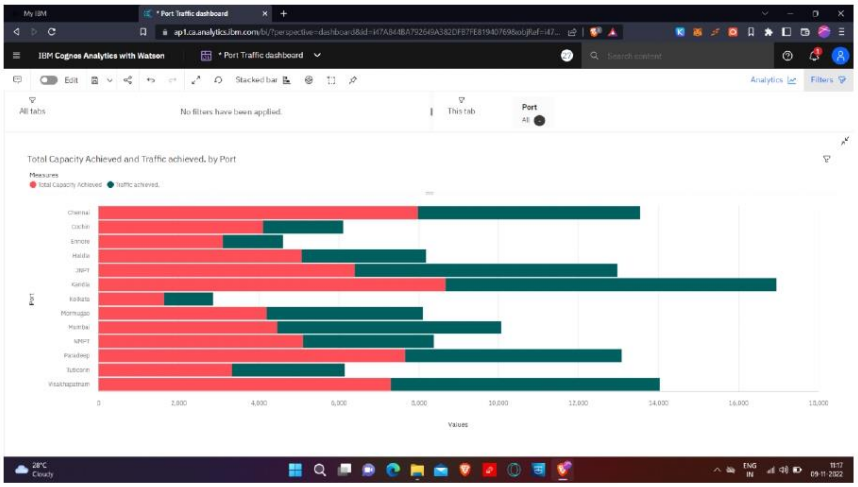
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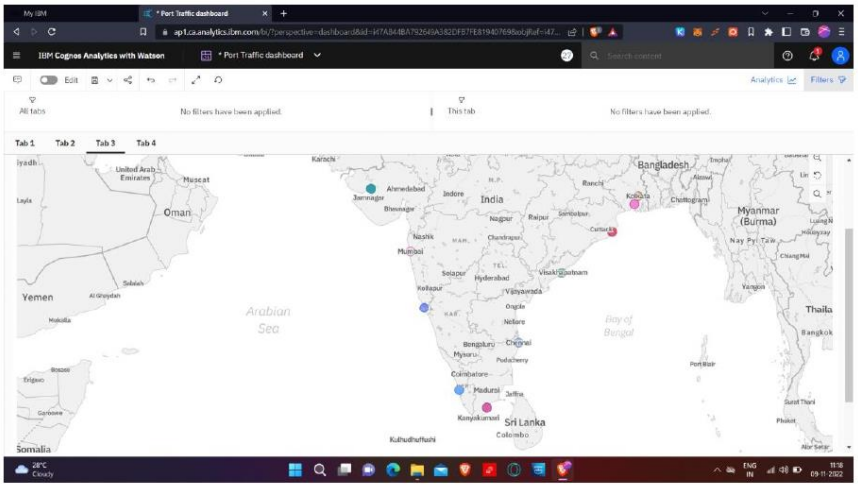
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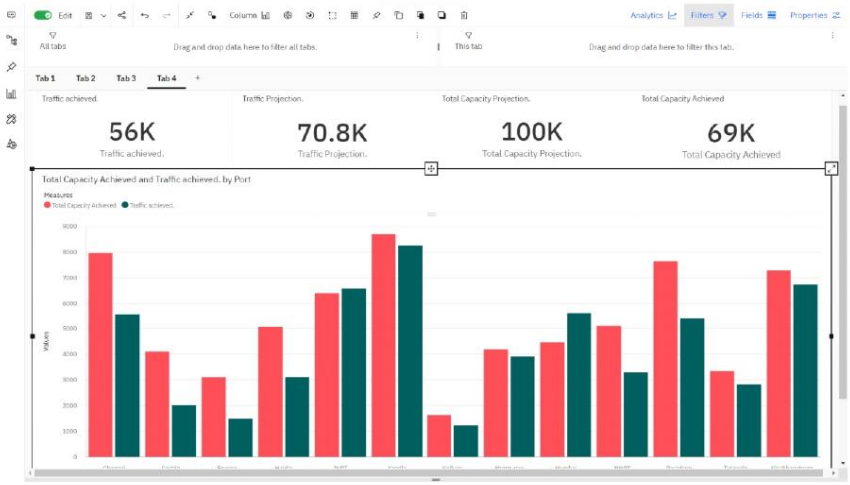
Yemen
Somalia
Bangladesh
Myanmar (Burma)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CHAPTER 8

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

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