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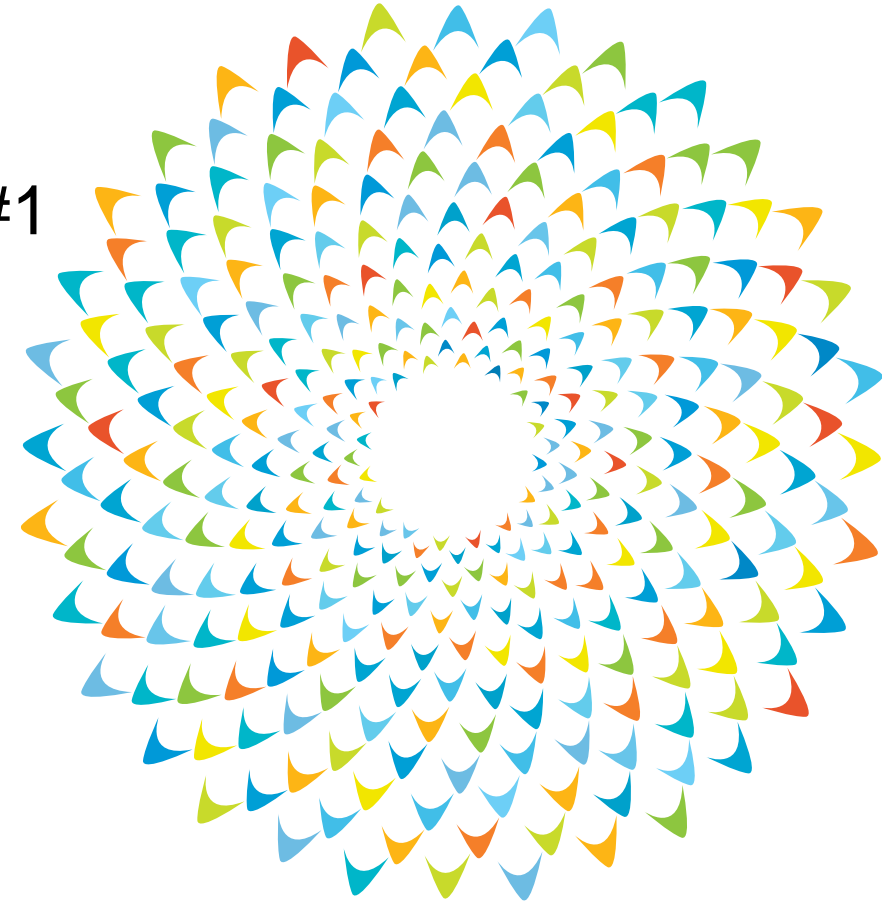
TRANSPORT KNOWLEDGE SEMINAR SERIES #1

Forecasting the Future of Transport with the Strategic Investment for Transport (SIFT) Initiative

May 19, 2021

Kuancheng Huang (Senior Transport Specialist)
Len Johnstone (Senior Transport Planning Consultant)
Chihyu Lee (Senior GIS Consultant)

Transport Sector Group
Sustainable Development and Climate Change Department
Asian Development Bank

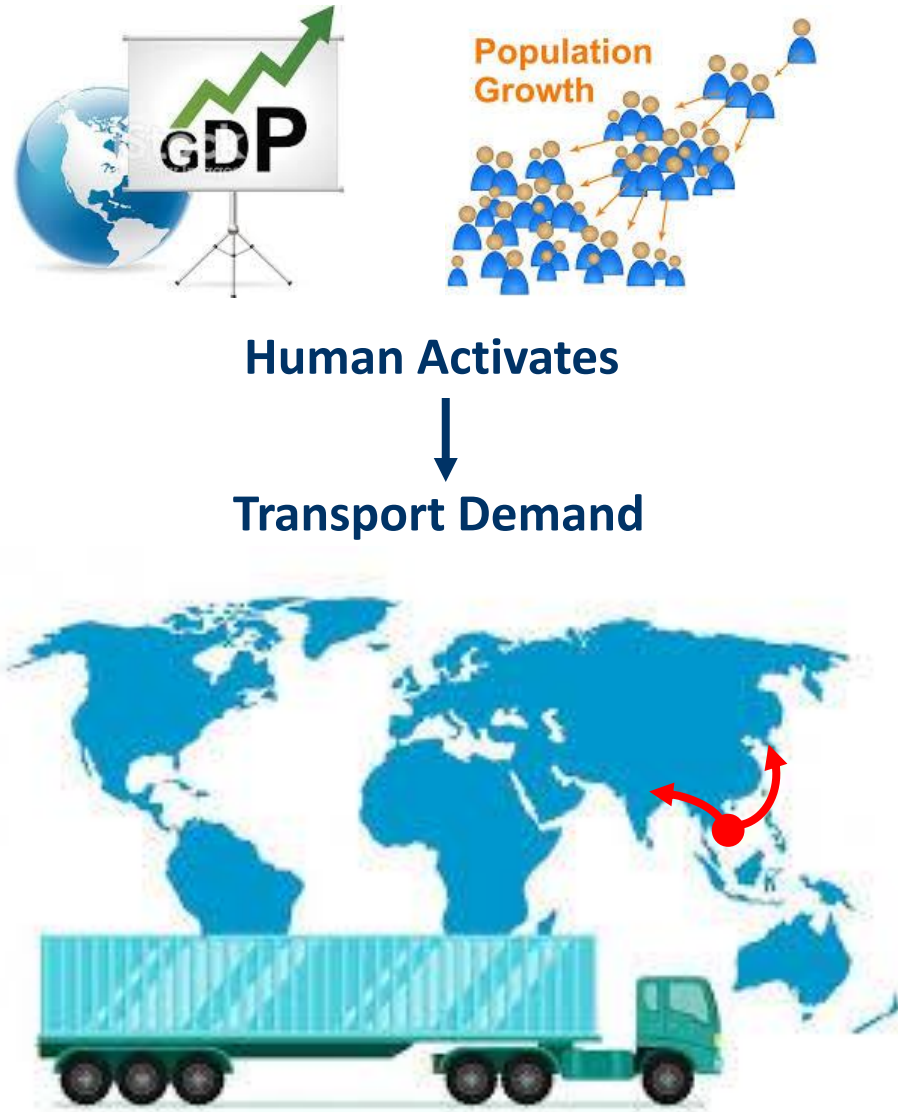


- SIFT (Strategic Investment for Transport) Initiative Background (Kuancheng Huang)
- Modeling Principles and Model Implementation (Len Johnston)
- Pilot GIS Platform (Chihyu Lee)
- Illustrative Example for Model Application (Kuancheng Huang)
- Question and Answer
- Concluding Remarks (Kuancheng Huang)

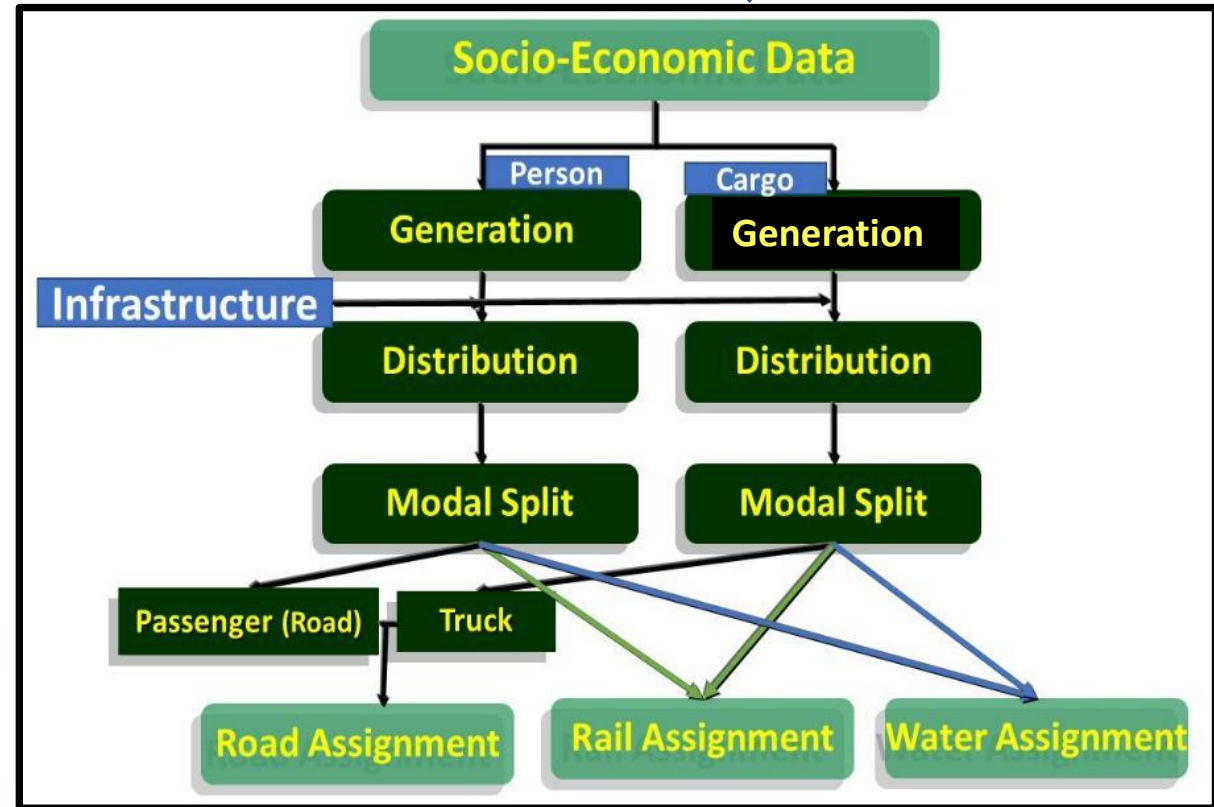


SIFT
STRATEGIC INVESTMENT FOR TRANSPORT

INTRODUCTION TO STRATEGIC TRANSPORT PLANNING

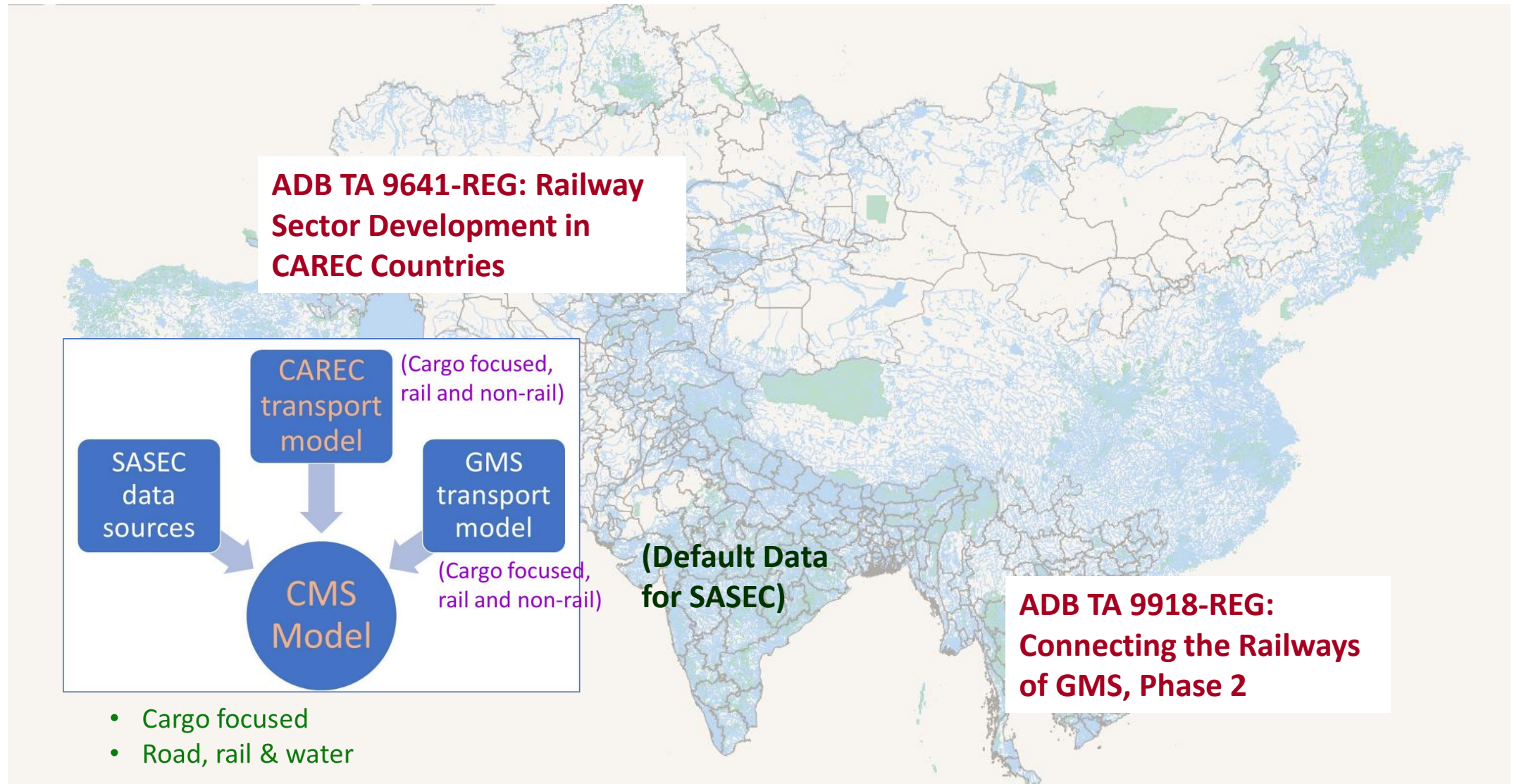


**INPUT: GDP, Population, Transport Networks,
Transport Cost & Time (and trade, traffic counts etc.)**



OUTPUT: Simulated Flows on Transport Networks

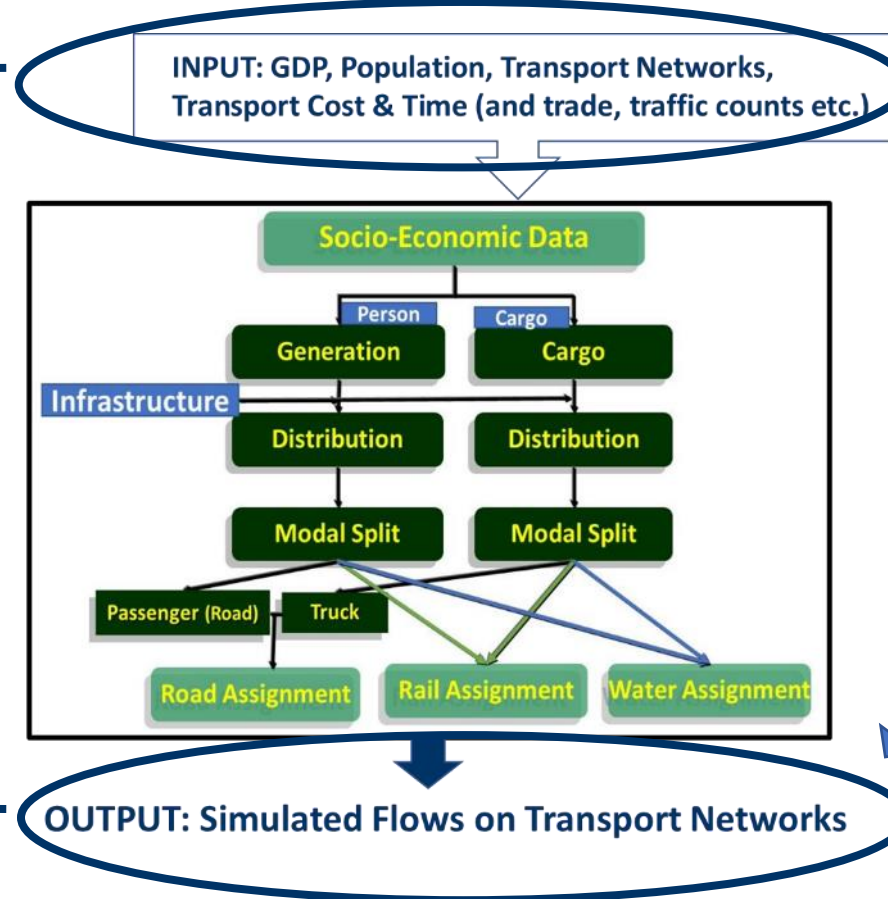
HISTORY AND COVERAGE OF PILOT SIFT MODEL



COMPONENTS AND OBJECTIVE OF SIFT INITIATIVE

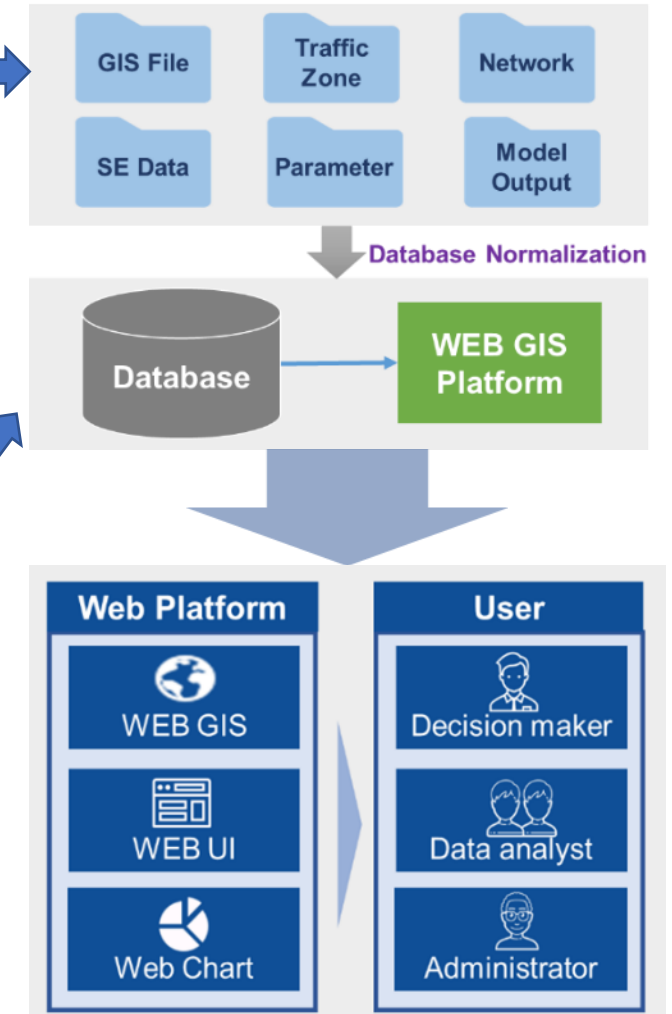
Investments (and policies) are analyzed by manipulating the inputs and evaluating the associated outputs.

Planning Models



Decision Support Analyses

Database & GIS



INTRODUCTION TO THE FIRST RELEASE OF SIFT MODEL

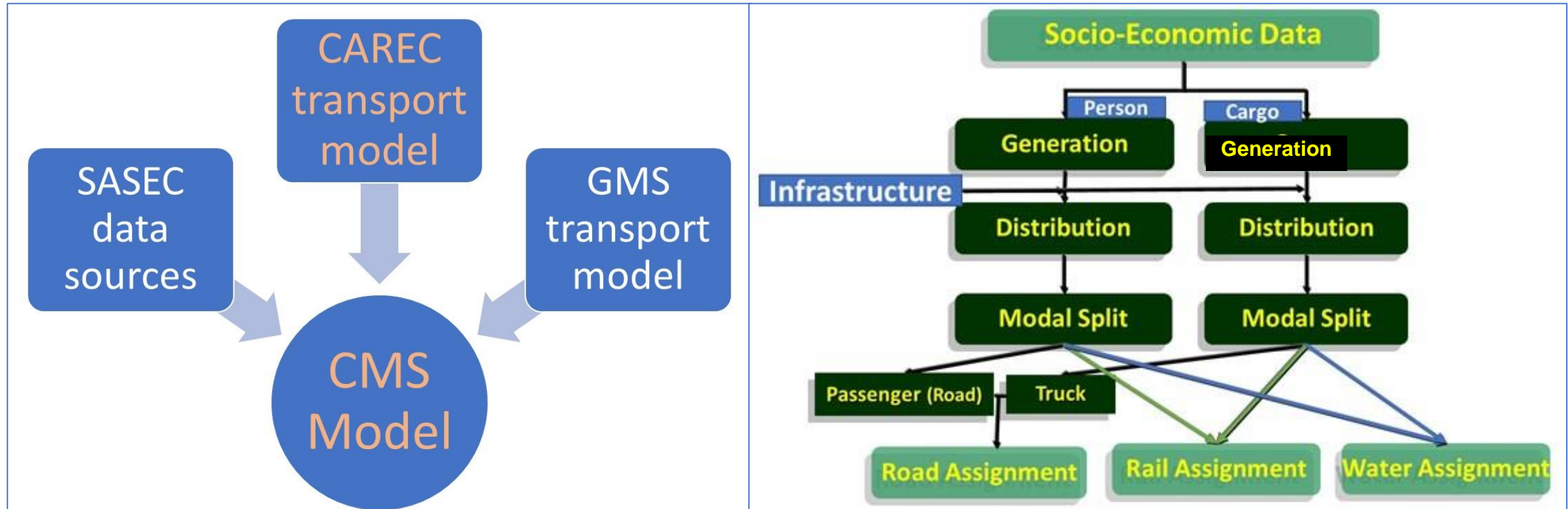
- Model Structure
- Geographic Extent
- Socio Economic Module
- Basic Planning data
- Zoning System
- Validation



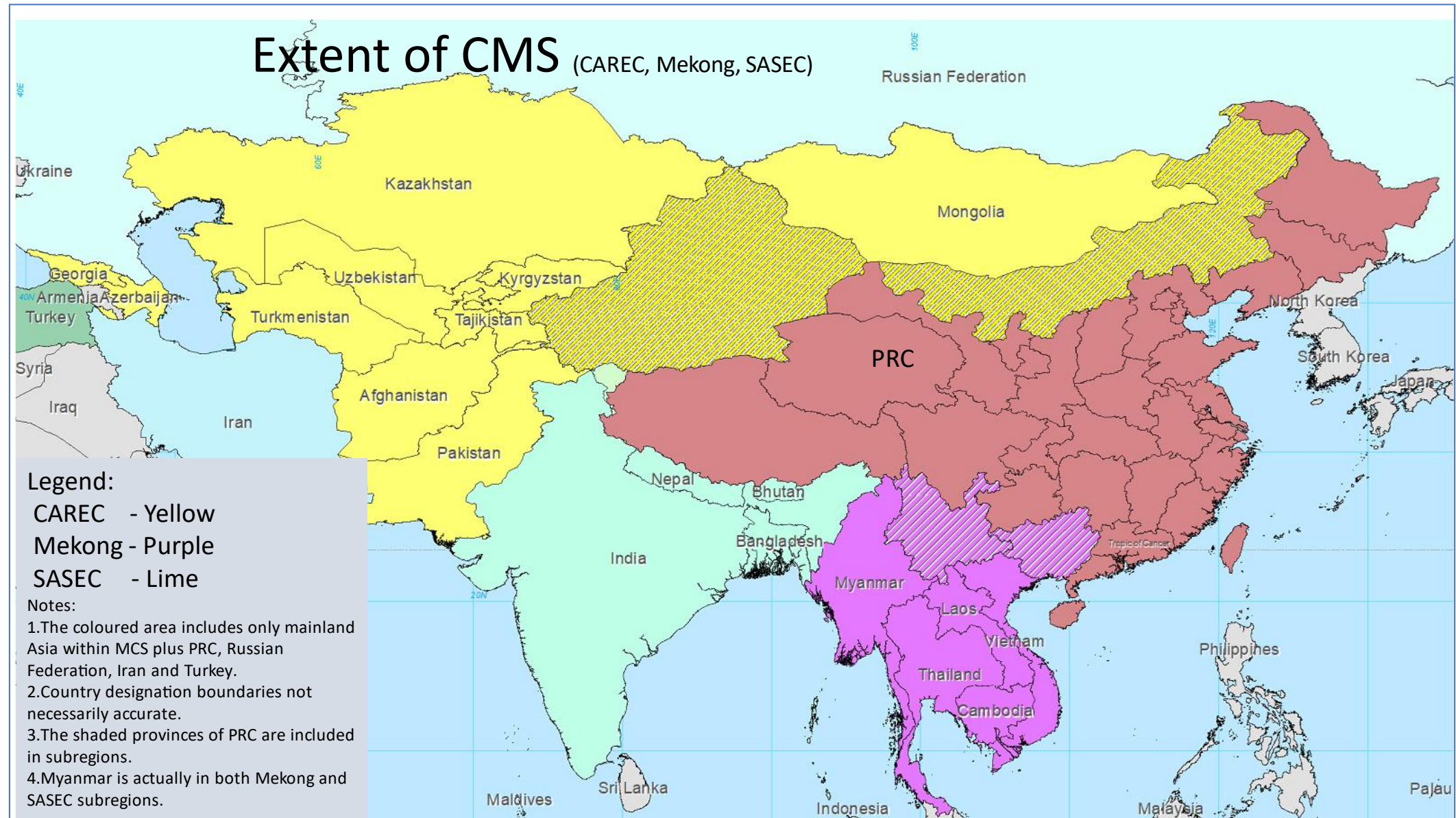
SIFT

STRATEGIC INVESTMENT FOR TRANSPORT

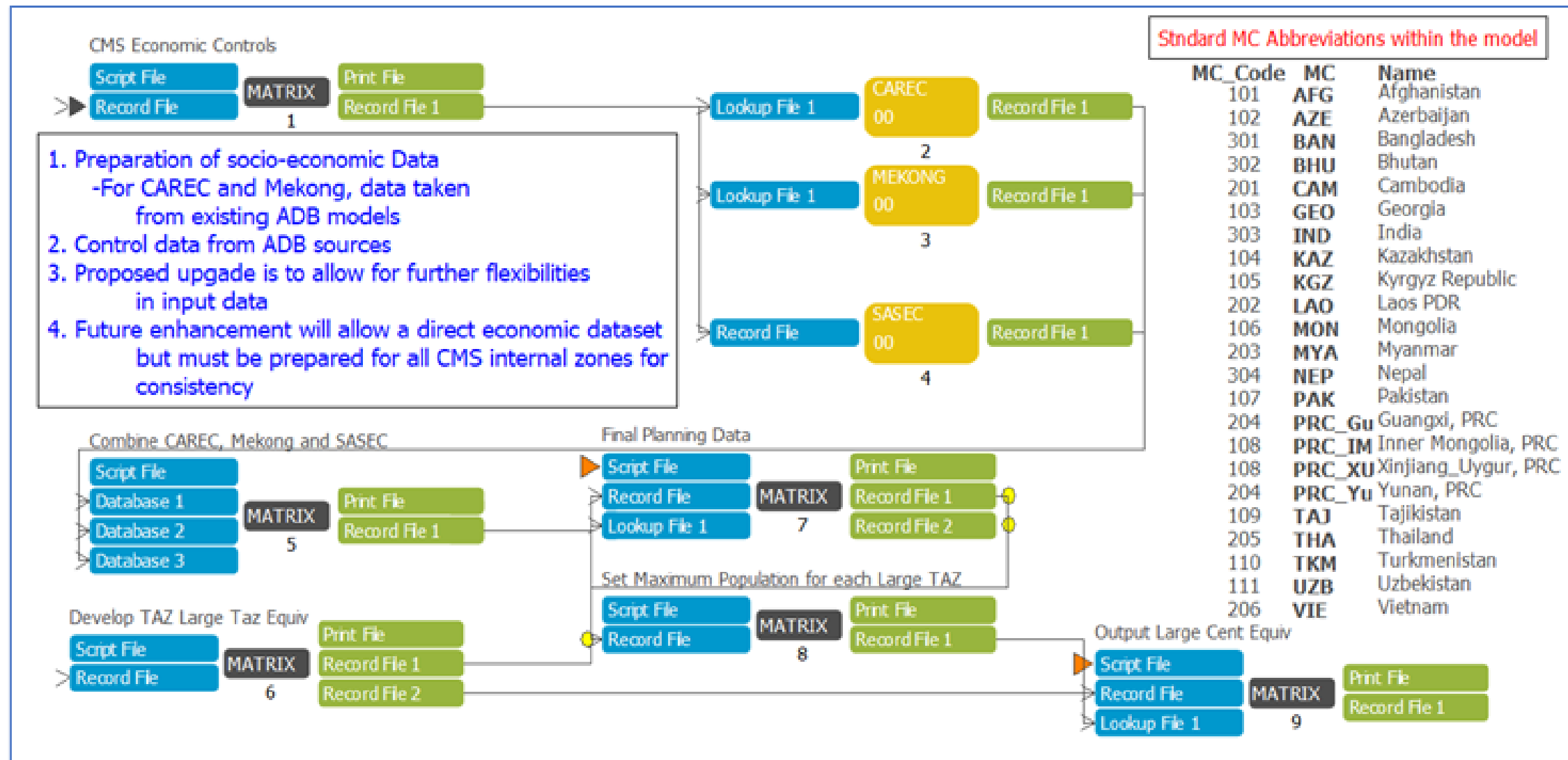
OVERALL MODEL STRUCTURE & MODELLING STEPS



GEOGRAPHIC EXTENT

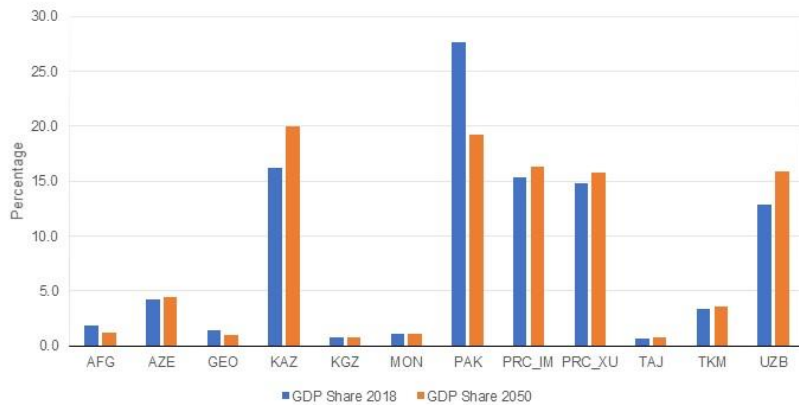


SOCIO-ECONOMIC MODULE IN RELEASE I

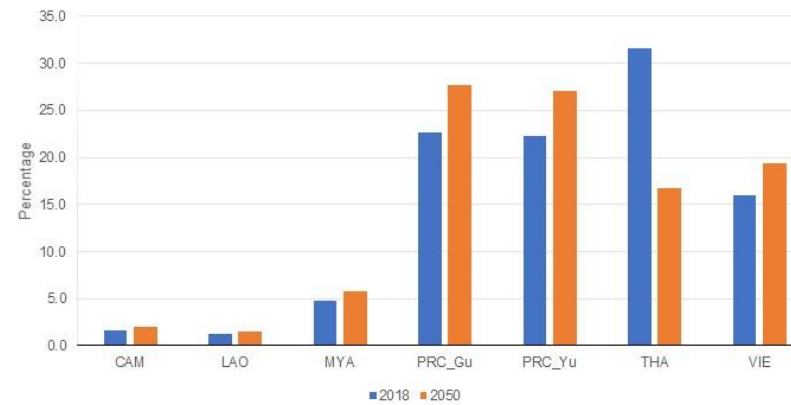


SOCIO-ECONOMIC DISTRIBUTIONS

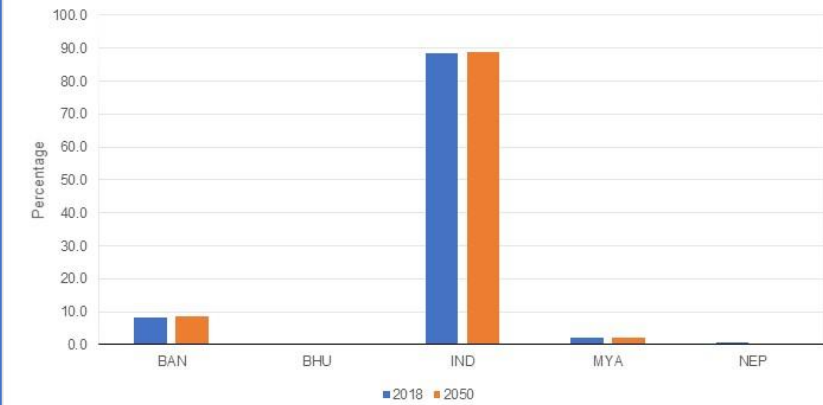
GDP Share in CAREC (Present and Future)



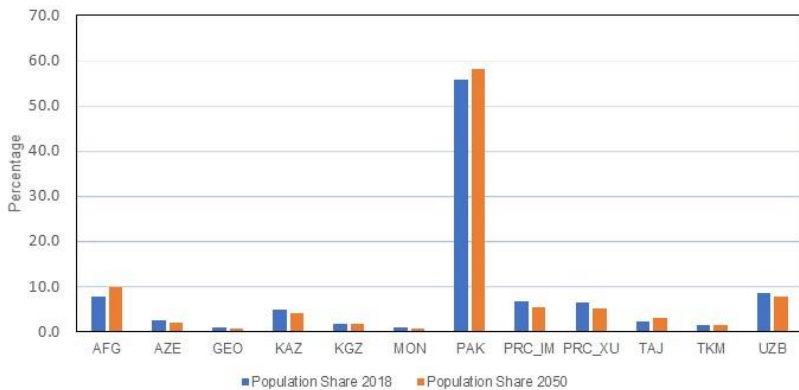
GDP Share in Mekong (Present and Future)



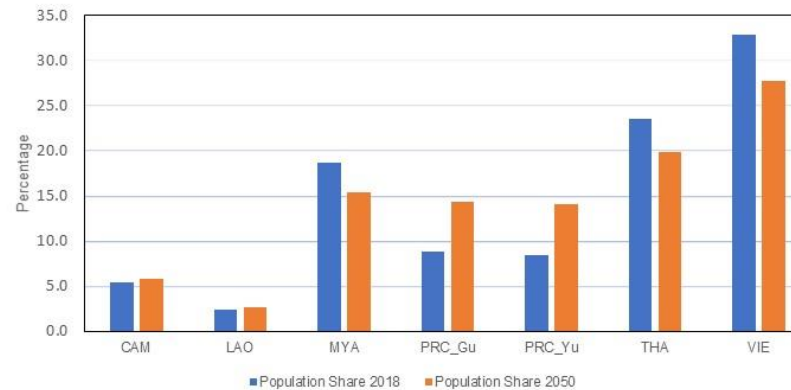
GDP Share in SASEC (Present and Future)



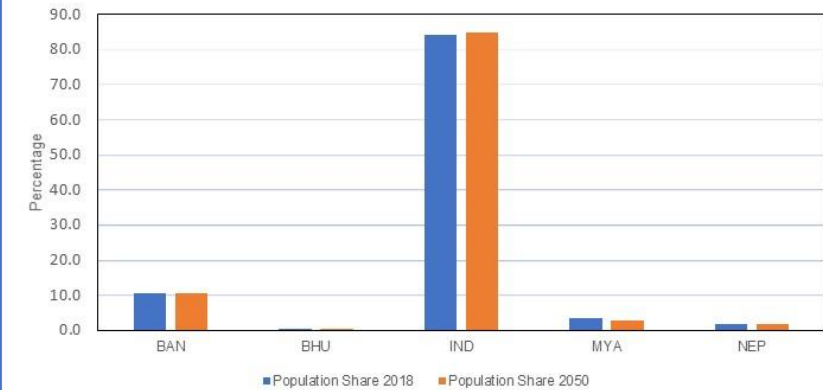
Population Share in CAREC (Present and Future)



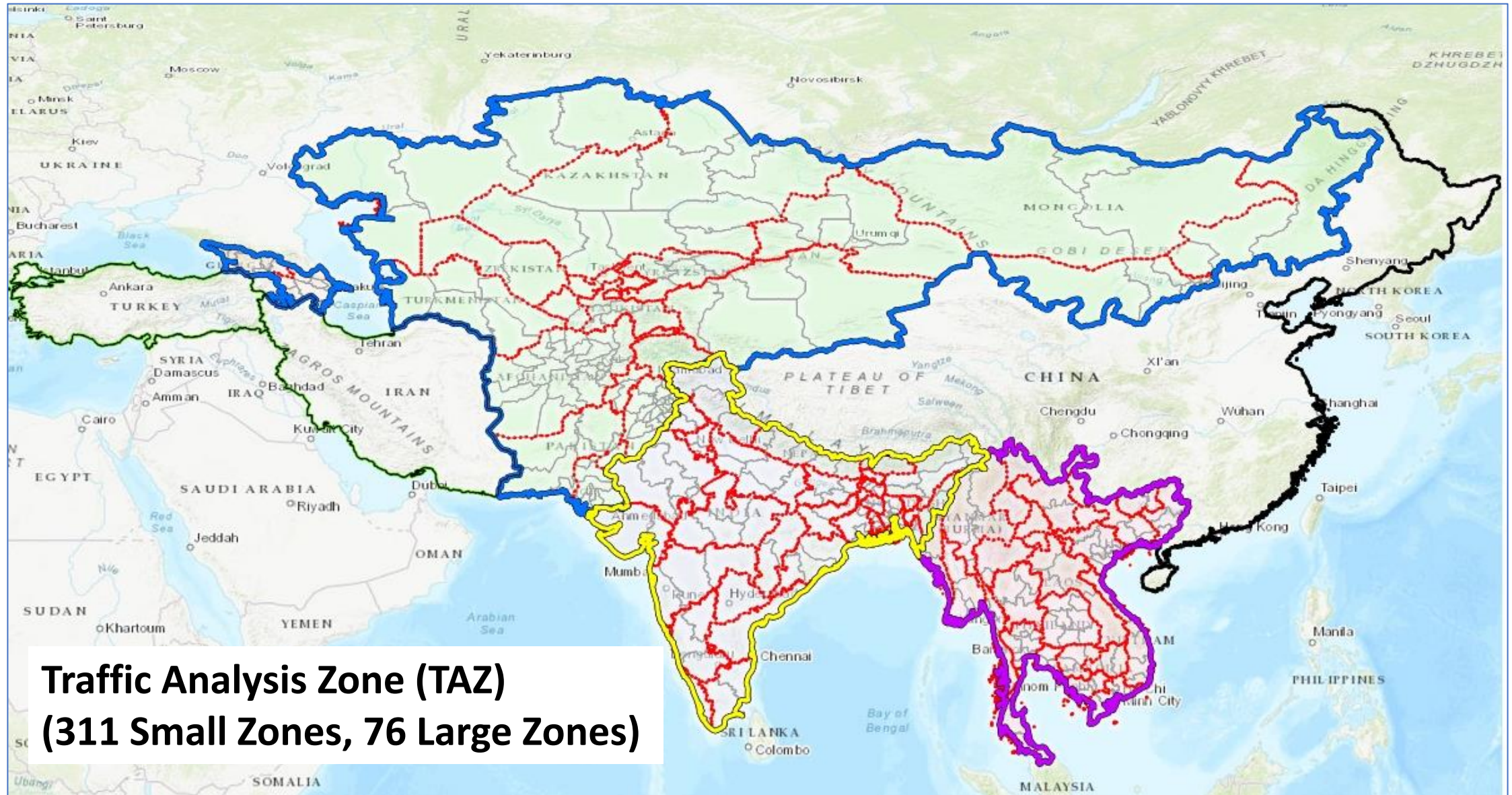
Population Share in Mekong (Present and Future)



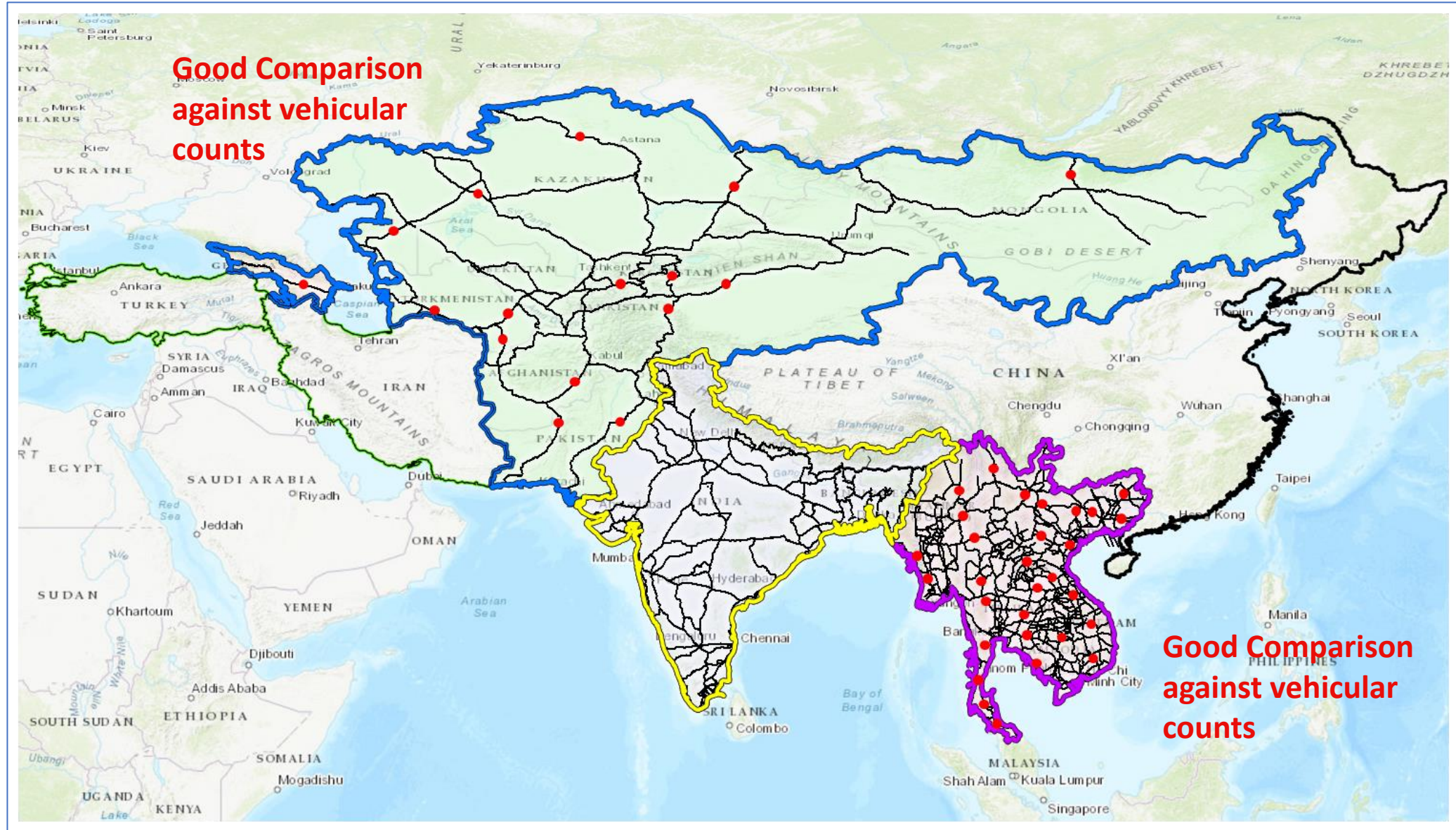
Population Share in SASEC (Present and Future)



ZONING SYSTEM

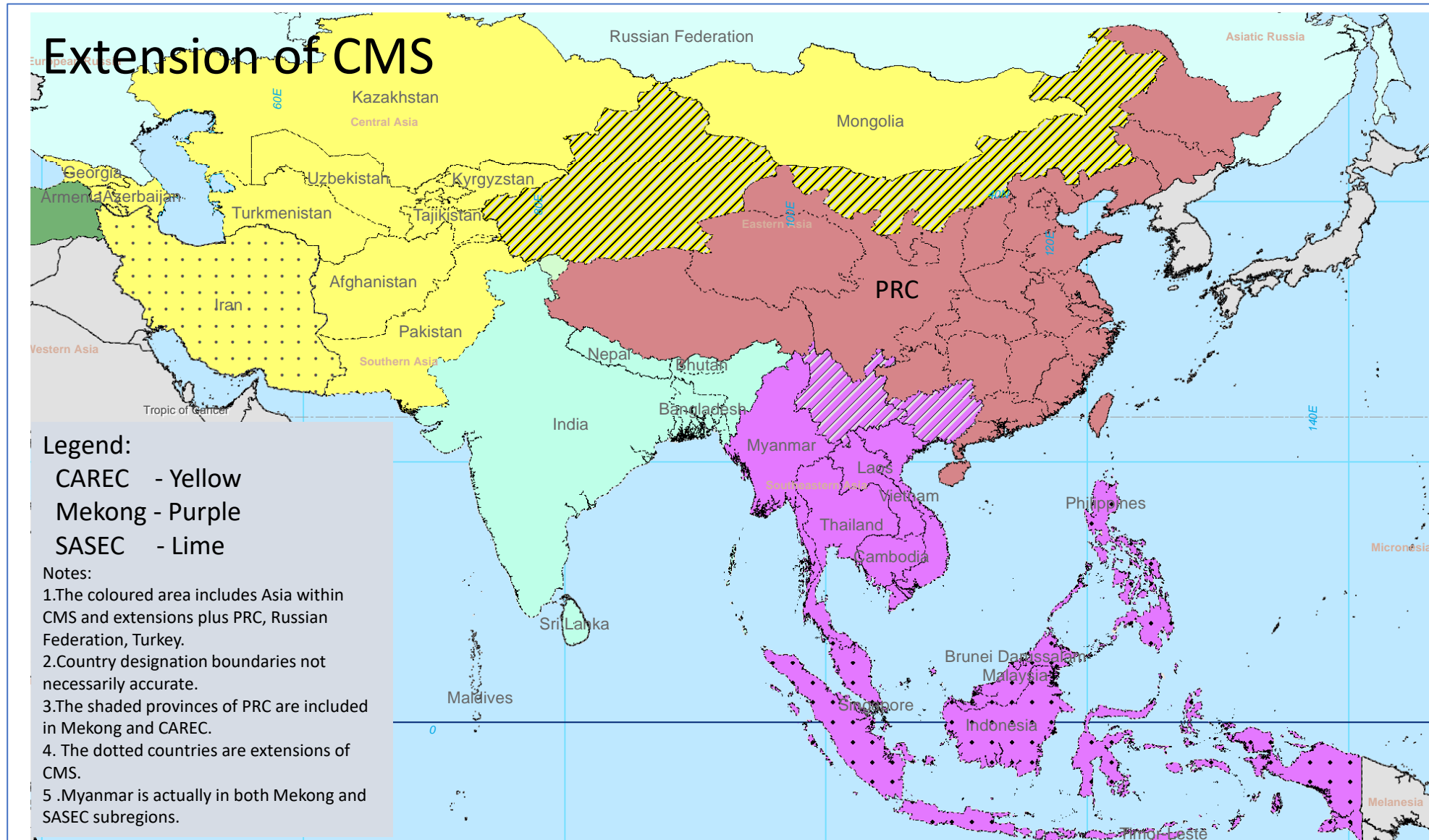


COMPARISON WITH OBSERVED DATA



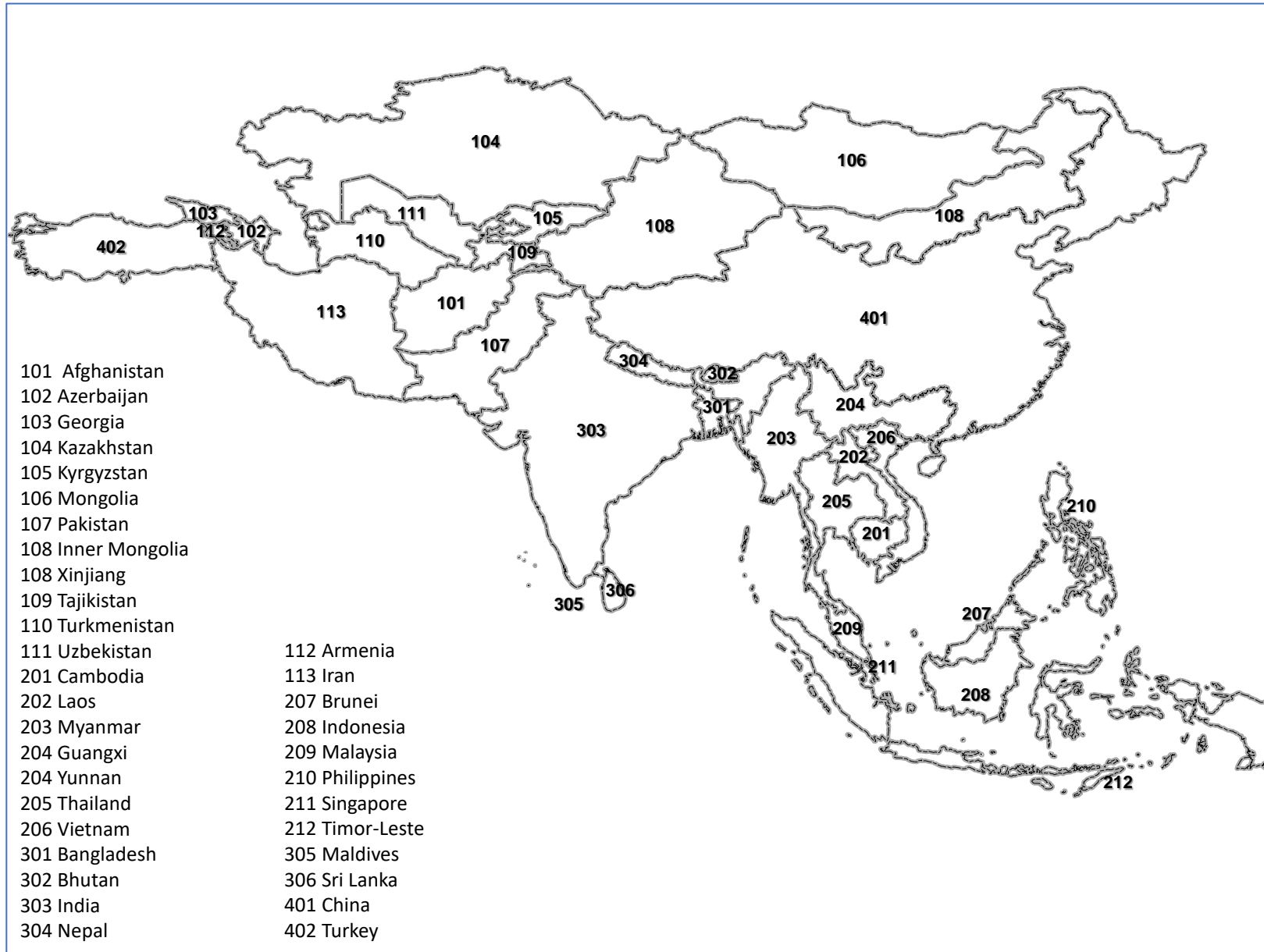
- Key Economic Indicators from ADB
 - Control totals plus historical trends
 - Secondary Control Data
 - [//statisticstimes.com/economy/gdp-of-indian-states.php](http://statisticstimes.com/economy/gdp-of-indian-states.php)
- Network and Zone Boundaries
 - <https://www.diva-gis.org/gdata>
 - Also see Appendix B of report for agglomeration of districts
- Equation Parameters based on weighted averages
- All are variable inputs that can be modified if better data sets available.

GEOGRAPHIC EXTENT OF SECOND RELEASE



Inception Report has been prepared and will concentrate on geographic extent and upgrading of validation where data is available.

EXTENDED MC DESIGNATION



MC SUMMARY OF RELEASE II

Name	MC	MC Code	CAREC	Mekong	SASEC	CWRD	SARD	SERD
Afghanistan	AFG	104	Yes			Yes		
Azerbaijan	AZE	105	Yes			Yes		
Georgia	GEO	106	Yes			Yes		
Kazakhstan	KAZ	107	Yes			Yes		
Kyrgyz Republic	KGZ	108	Yes			Yes		
Mongolia	MON	108	Yes					
Pakistan	PAK	109	Yes			Yes		
Autonomous Region of Inner Mongolia within the People's Republic of China	PRC_CAREC	110	Yes					
Autonomous Region of Xinjiang within the People's Republic of China	PRC_CAREC	111	Yes					
Tajikistan	TAJ	201	Yes			Yes		
Turkmenistan	TKM	202	Yes			Yes		
Uzbekistan	UZB	203	Yes			Yes		
Cambodia	CAM	204		Yes				Yes
Lao People's Democratic Republic	LAO	204		Yes				Yes
Myanmar	MYA	205		Yes	Yes			Yes
Province of Guangxi within the People's Republic of China	PRC_Mekong	206		Yes				
Province of Yunnan within the People's Republic of China	PRC_Mekong	301		Yes				
Thailand	THA	302		Yes				Yes
Vietnam	VIE	303		Yes				Yes
Bangladesh	BAN	304			Yes		Yes	
Bhutan	BHU	112			Yes		Yes	
India	IND	113			Yes		Yes	
Nepal	NEP	207			Yes		Yes	
Armenia	ARM	208	Extended			Yes		
Iran	IRN	209	Extended					
Brunei	BRU	210		Extended				Yes
Indonesia	INO	211		Extended				Yes
Malaysia	MAL	212		Extended				Yes
Philippines	PHI	305		Extended				Yes
Singapore	SIN	306		Extended				Yes
Timor-Leste	TIM	104		Extended				Yes
Maldives	MLD	105			Extended		Yes	
Sri Lanka	SRL	106			Extended		Yes	

Release II results in an Increase of
Area - 26 %
Population - 23 %
GDP - 44 %

MODEL STRUCTURE AND BUILDING SOFTWARE TOOL

Scenario

- Scenario
 - Yr2018
 - Yr2030
 - Yr2050

Data

Reports

- Socio
 - socio
- Person
 - MS_Person
- Cargo
 - Gen_Cargo
 - MS_Cargo
- Assignment
 - Assignment
 - Rail_Sum

App

SIFT Model

Keys

Key	Value
Scen. Name	Scenario
Note1	(Note)
Title	CMS Modelling Anz
Zones	394
Zones_L	113
Extern	20
No_of_Iteration	5
Econ_Control	CMS_Control_Rel_

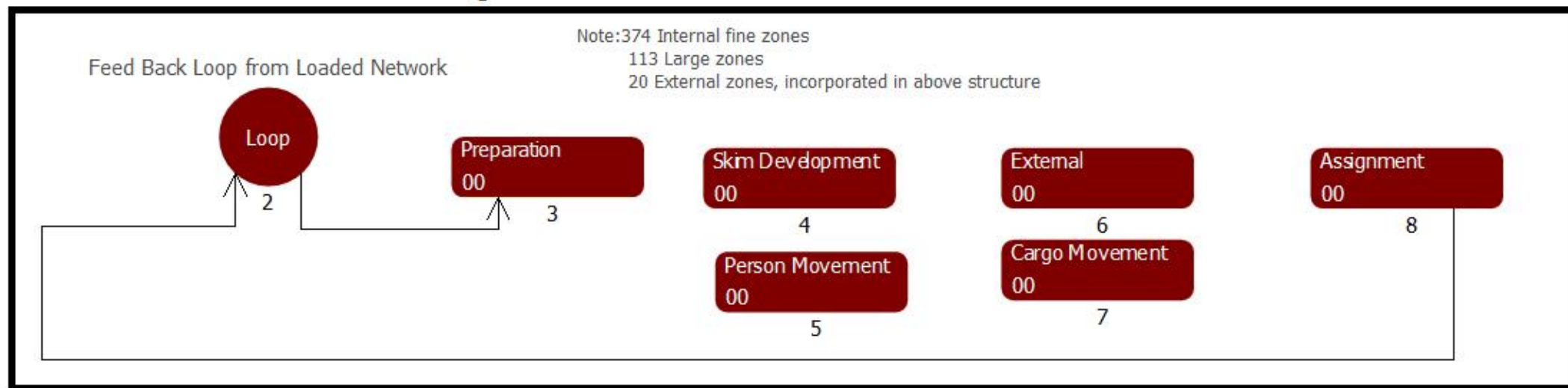


STRATEGIC INVESTMENTS FOR TRANSPORT (THE SIFT MODEL)

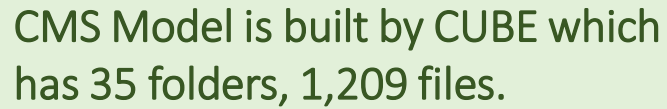
INCORPORATING THE CMS MODEL



Release I (CMS) --- December, 2020
Release II --- October, 2021



Current Issues



The incapability of data compatibility and circulation is due to the **differences in definitions and formats of model data and the differences of coordinates.**

The diagram illustrates the data flow for the model. It consists of two rows of blue folder icons. The top row contains three folders labeled 'GIS File', 'Traffic Zone', and 'Network'. The bottom row contains three folders labeled 'SE Data', 'Parameter', and 'Model Output'. Arrows indicate the flow of data from the top row to the bottom row: 'GIS File' to 'SE Data', 'Traffic Zone' to 'Parameter', and 'Network' to 'Model Output'.



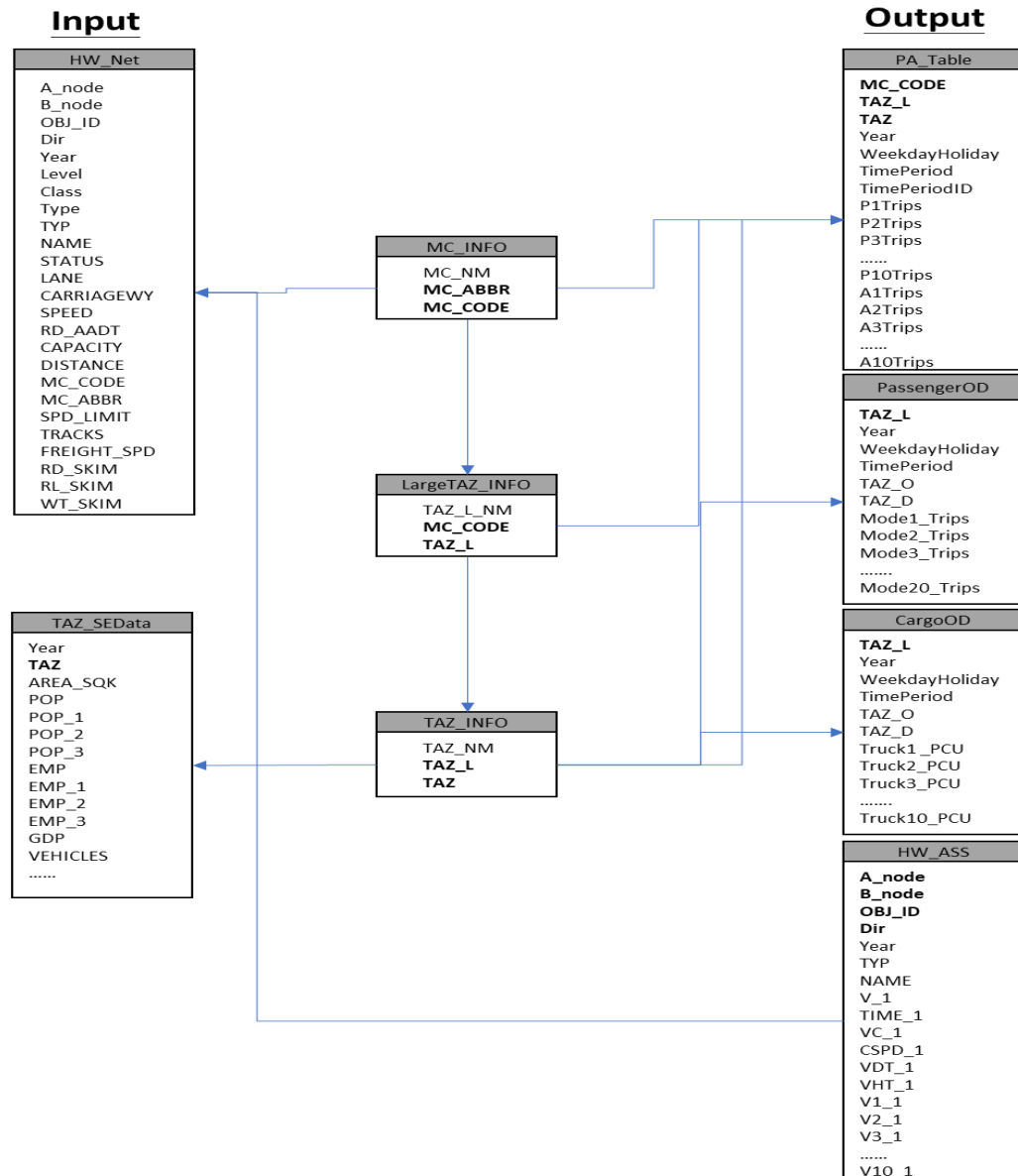
1. Summarize and organize the information provided by ADB
2. **Normalize the database tables** based on the results of the data summary
3. **Import such data into the database for storage and display of basic visual images** using the Web GIS platform

Web Platform



Which could be carried out with separate assignments and tenders will be on **system improvement and expansion** tailored for **additional requirements and different system users** such as local decision makers, ADB data analysts, system administrators, etc.

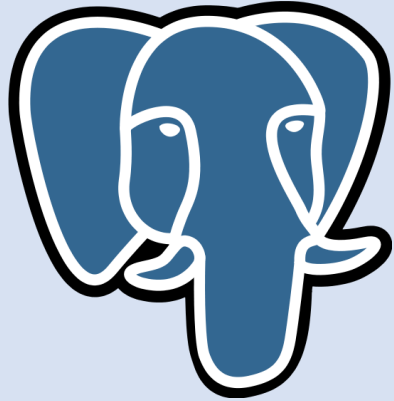
DATABASE: ENTITY RELATIONSHIP DIAGRAM



ID	Table Name	Table Description
1	HW_Net	Highway Network Link Table
2	MC_INFO	Member Country Code Table
3	LargeTAZ_INFO	Large Traffic Analysis Zone Code Table
4	TAZ_INFO	Traffic Analysis Zone Code Table
5	TAZ_SEData	Socio-Economic Information of Traffic Analysis Zone
6	PA_Table	Trip Production-Attraction Table
7	PassengerOD	Passenger OD Matrix
8	CargoOD	Cargo OD Matrix
9	HW_ASS	Highway Assignment Output

DATABASE SYSTEM IMPLEMENTATION - TABLES IN DATABASE

PostgreSQL

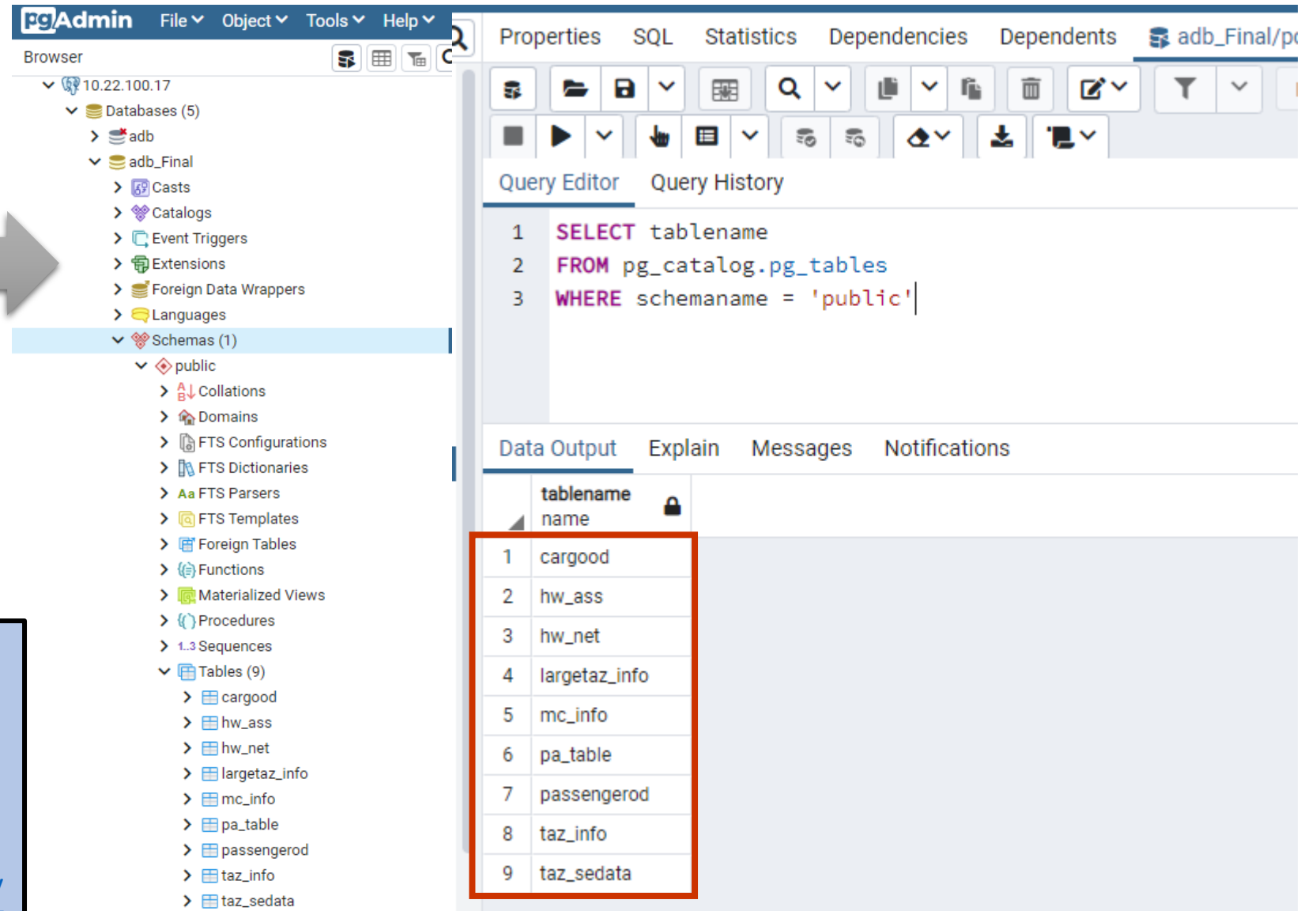


The World's Most Advanced
Open Source Relational
Database

License: Permission to use, copy, modify,
and distribute this software and its
documentation **for any purpose, without
fee, and without a written agreement is
hereby granted**

Reference:

<https://www.postgresql.org/about/licence/>



The screenshot shows the pgAdmin interface. On the left, the 'Browser' pane displays the database structure for '10.22.100.17'. Under 'Databases (5)', 'adb' and 'adb_Final' are listed. 'adb_Final' is expanded, showing 'Schemas (1)' with 'public' selected. Under 'public', 'Tables (9)' are listed: 'cargood', 'hw_ass', 'hw_net', 'largetaz_info', 'mc_info', 'pa_table', 'passengerod', 'taz_info', and 'taz_sedata'. On the right, the 'Query Editor' shows a SQL query:

```
1 SELECT tablename
2 FROM pg_catalog.pg_tables
3 WHERE schemaname = 'public'
```

. Below the query editor, the 'Data Output' pane shows the results of the query, which are the names of the tables in the 'public' schema. The results are listed in a table with two columns: 'tablename' and 'name'. The table is highlighted with a red border.

tablename	name
1	cargood
2	hw_ass
3	hw_net
4	largetaz_info
5	mc_info
6	pa_table
7	passengerod
8	taz_info
9	taz_sedata

GIS PLATFORM

Front-end



Interactive functions

- Zoom in/out
- Panning
- Info popup
- Static map production
- Data download



Thematic maps

- The Density of Population
- The density of employed population
- Gross domestic product
- Transport network
- Trip Generation and Attraction
- Desire line cargo
- Desire line passenger
- Desire line commodity
- Road Segment Speed
- Volume to capacity (V/C) ratio
- Traffic Volume

Back-end



Account management

- Login page
- Add user
- Delete user
- Edit account

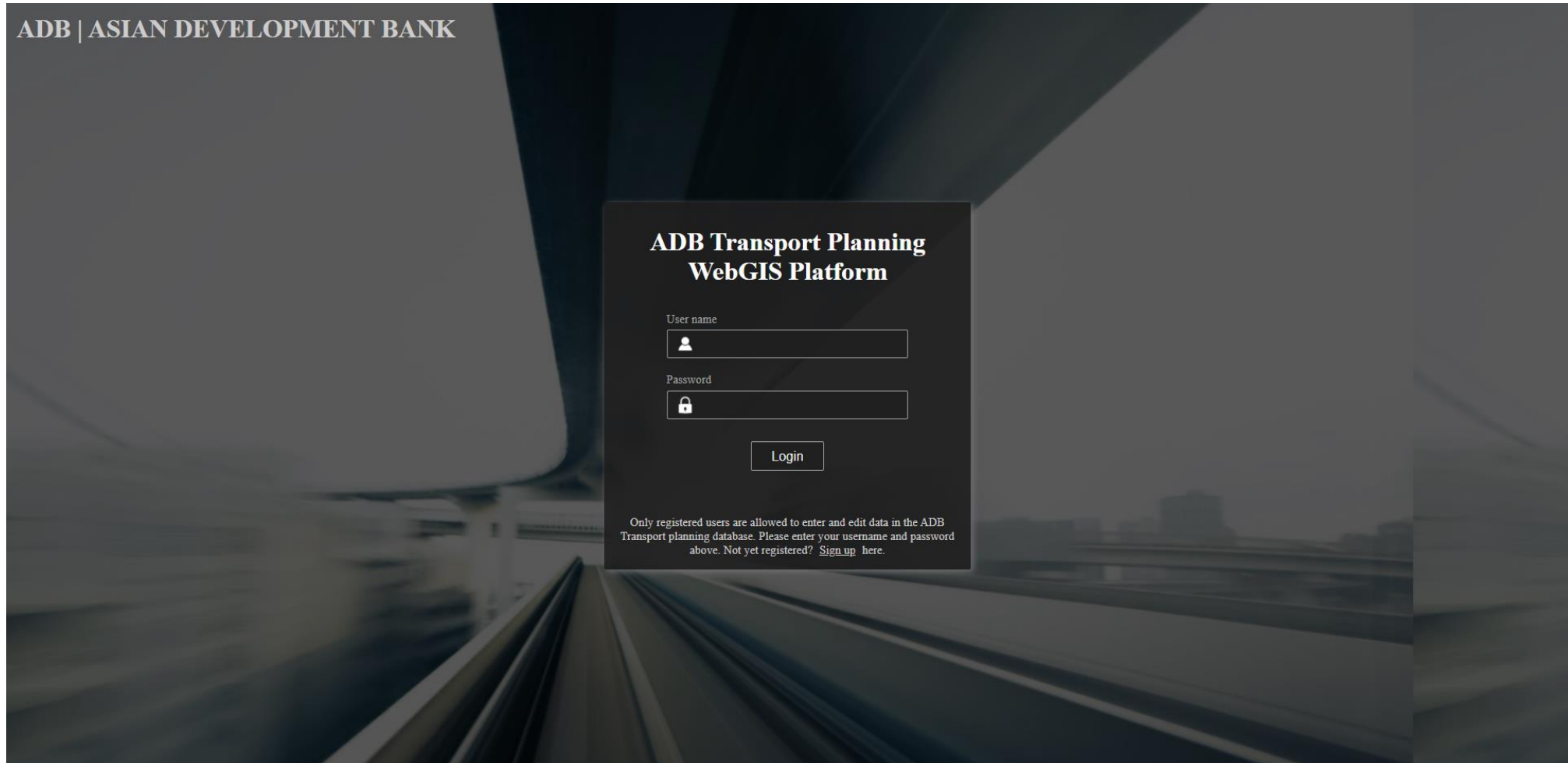


Data Management

- Upload data
- Delete data
- Version control

FRONT-END LOGIN PAGE

- Only registered users are allowed to access the system.
- Sign up via the post-event survey email.



The screenshot shows a login interface for the ADB Transport Planning WebGIS Platform. The background is a dark, blurred image of a modern building with curved lines. In the top left corner, the text "ADB | ASIAN DEVELOPMENT BANK" is displayed in a light gray font. The login form is a dark gray rectangular box centered on the page. It contains the title "ADB Transport Planning WebGIS Platform" in bold white text. Below the title are two input fields: "User name" with a person icon and "Password" with a lock icon. A "Login" button is positioned below the password field. At the bottom of the form, a small white text block states: "Only registered users are allowed to enter and edit data in the ADB Transport planning database. Please enter your username and password above. Not yet registered? [Sign up](#) here."

ADB | ASIAN DEVELOPMENT BANK

**ADB Transport Planning
WebGIS Platform**

User name

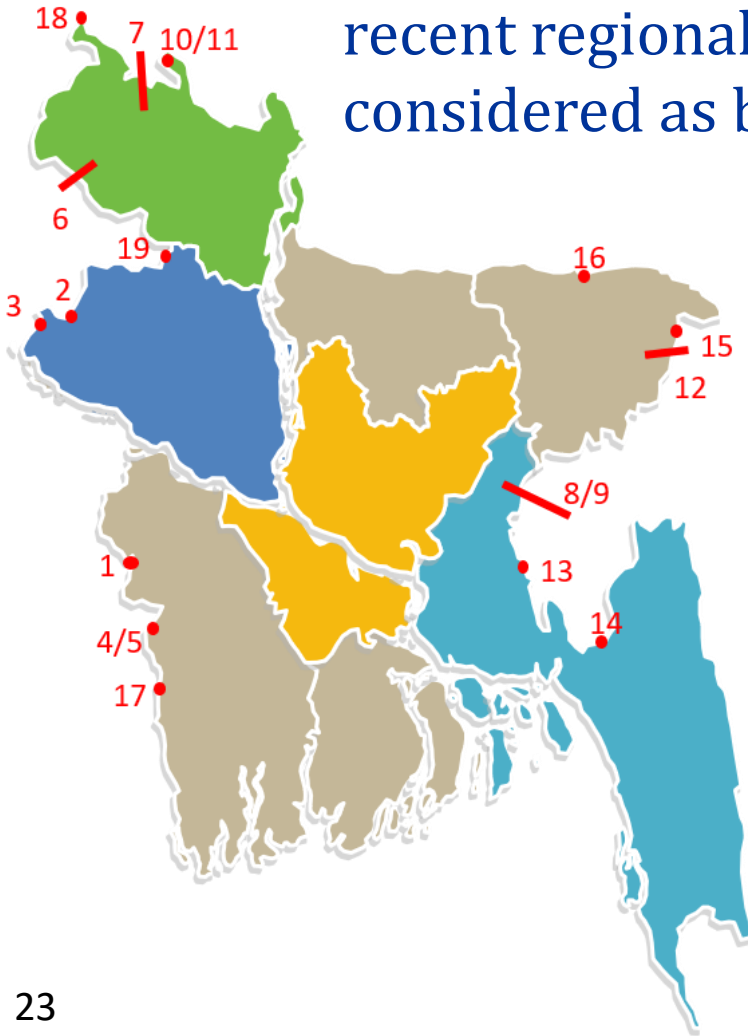
Password

Login

Only registered users are allowed to enter and edit data in the ADB Transport planning database. Please enter your username and password above. Not yet registered? [Sign up](#) here.

ILLUSTRATIVE EXAMPLE FOR MODEL APPLICATION

- Focus - Bangladesh in the BBIN area
- 19 decision cross-border points, from recent regional cooperation programs, are considered as binary (0-1) decisions.



#	India	Bangladesh	Mode
1	Gede	Darshana	Railway
2	Singhabad	Rohanpur	Railway
3	Mahadipur	Sonamasjid	Road
4	Petrapole	Benapole	Railway
5	Petrapole	Benapole	Road
6	Radhikapur	Birol	Railway
7	Haldibari	Chilihati	Railway
8	Agartala	Akhaura	Railway
9	Agartala	Akhaura	Road
10	Changrabandha	Burimari	Railway
11	Changrabandha	Burimari	Road
12	Mahishasan	Shahbazpur	Railway
13	Srimantpur (Tripura)	Bibirbazar	Road
14	Sabroom	Ramgarh	Road
15	Sutarkandi	Sheola	Road
16	Dawki	Tamabil	Road
17	Ghojadanga	Bhomra	Road
18	Fulbari	Banglabandha	Road
19	Balurghat	Hili	Road

LINK CHARACTERISTICS CHANGES DUE TO INVESTMENT

Cross-border points	Customs Facilities	Land Ports	Access Roads	Railway Cargo Facilities
Road	DO	DO	DO	
Rail	DO			DO

Cross-border points	Additional capacity	Cargo clearance time reduction
Road	√	√
Rail		√

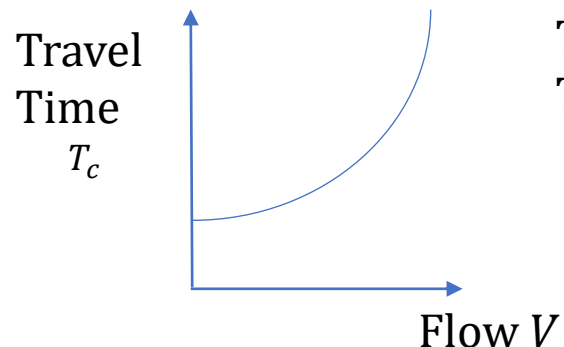
Fixed border crossing time

	Before	After
NO eCustom	18hrs	8hrs
eCustom	2hrs	0.5hrs

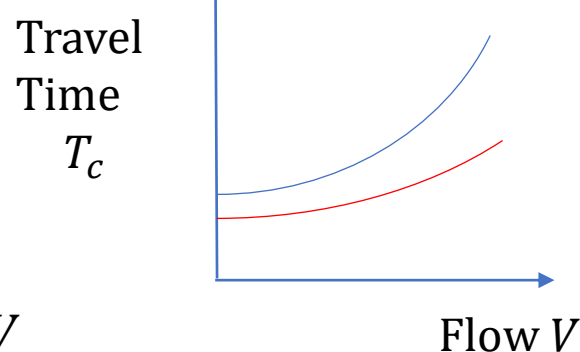
Link cost function

$$T_c = T_0 * \left[1 + 0.15 \left(\frac{V}{C_0 + C_{add} * y_a} \right)^4 \right] + time_a * y_a$$

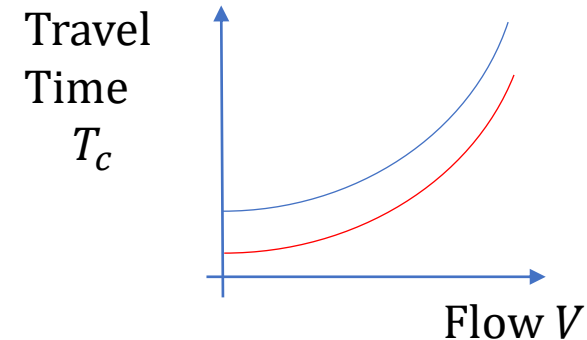
General



Road



Rail



BI-LEVEL PROGRAMMING STRUCTURE

Upper-level

Search the investment combinations by **the knapsack problem** to maximize the benefit, given budget limitation.

Lower-level

A combined modal split-user equilibrium model under multimodal multicommodity consideration.

Objective

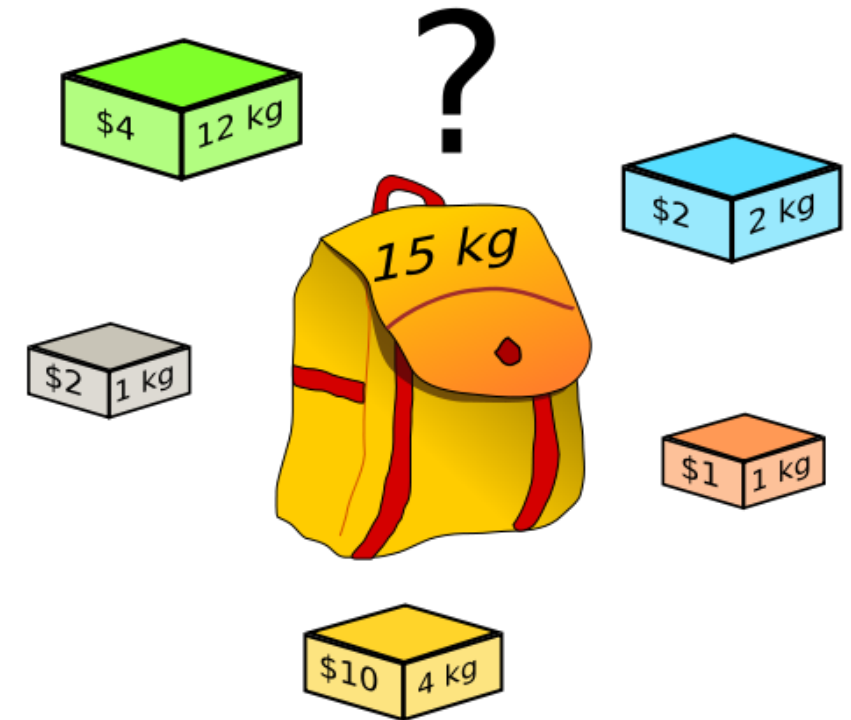
MAX. Benefit = reduced travel time by implementing the investment decision

Based on the “**time value**” of all links

Time
value
items

- By person (min)
- By vehicle: car/bus/truck (min)
- Cargo by vehicle: truck/train

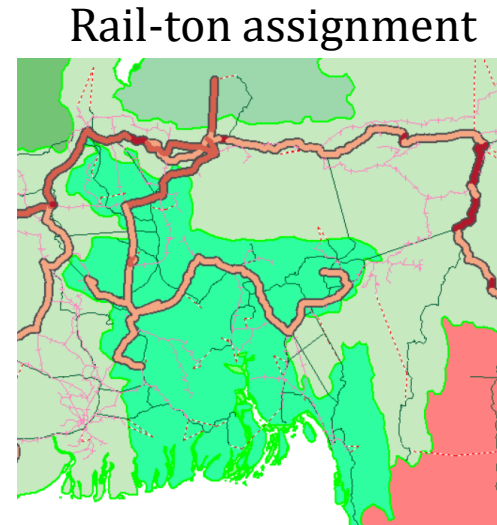
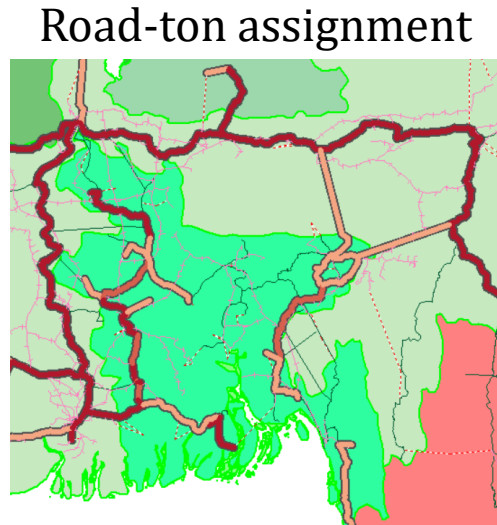
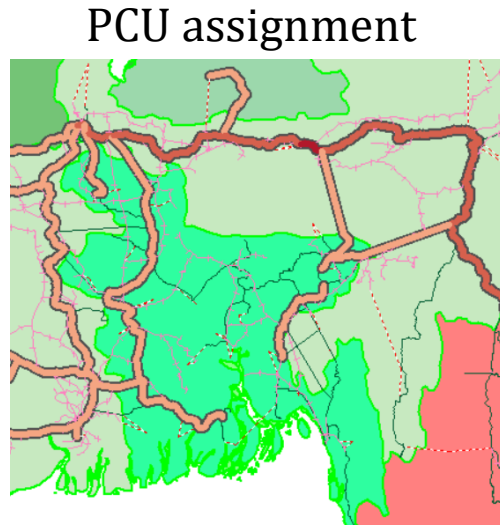
Knapsack Problem (KP) Concept



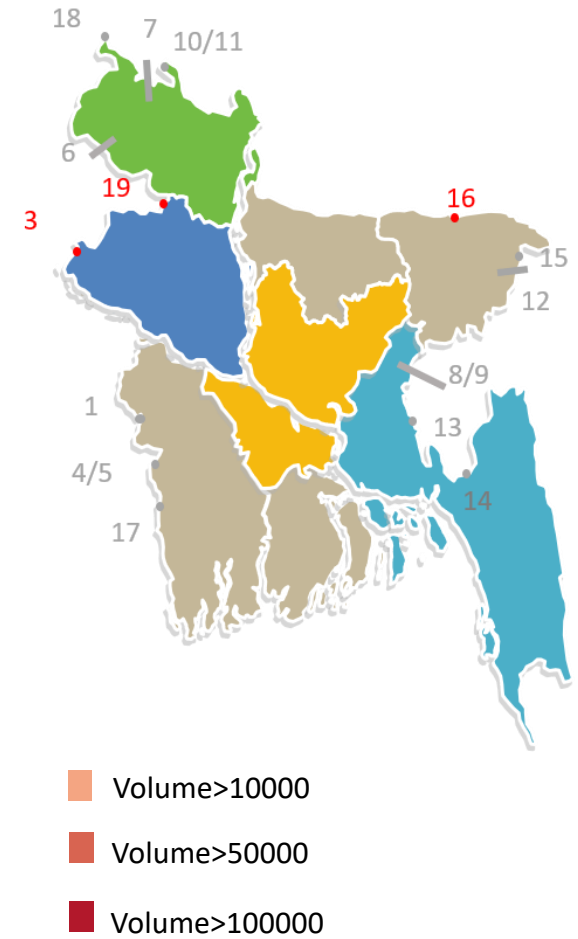
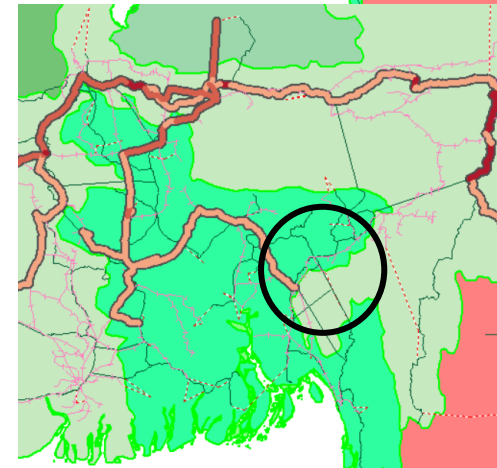
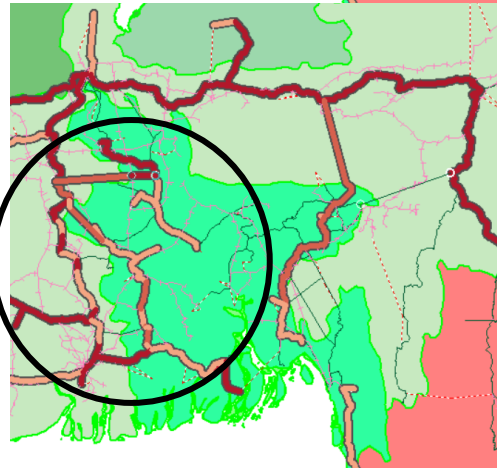
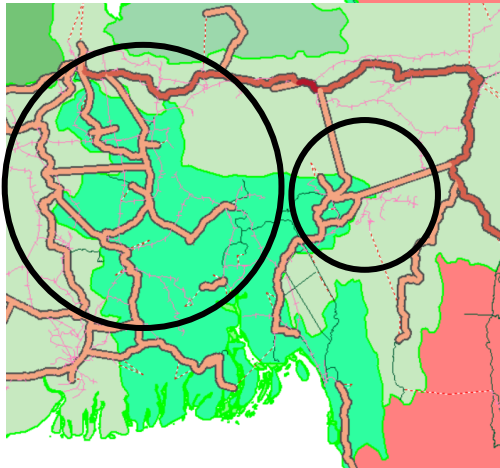
ILLUSTRATIVE RESULTS

- **No e-customs & Low budget (three points allowed)**

Base case
network
flows



(3,16,19)
Invested



Thank you for your attention!

Question and Answer



SIFT

STRATEGIC INVESTMENT FOR TRANSPORT

THEMATIC MAP SELECTION

- Thematic map:

- a.Input data: **The density of population; The density of employed; Gross domestic product (GDP); Transport network**

- b.Output data: **Trip generation and attraction; Desire line cargo; Desire line passenger; Desire line commodity; Road segment speed; Volume to capacity (v/c) ratio; Traffic volume**

- Year: 2018/2030/2050/2050_carbon_red

ADB ASIAN DEVELOPMENT BANK

Welcome, first admin
Setting Logout

Choose a project to display
CMS Model

Select a thematic map

Select year

2018
2030
2050
2050_carbon_red

Click the icon to get the coordinate

Input data

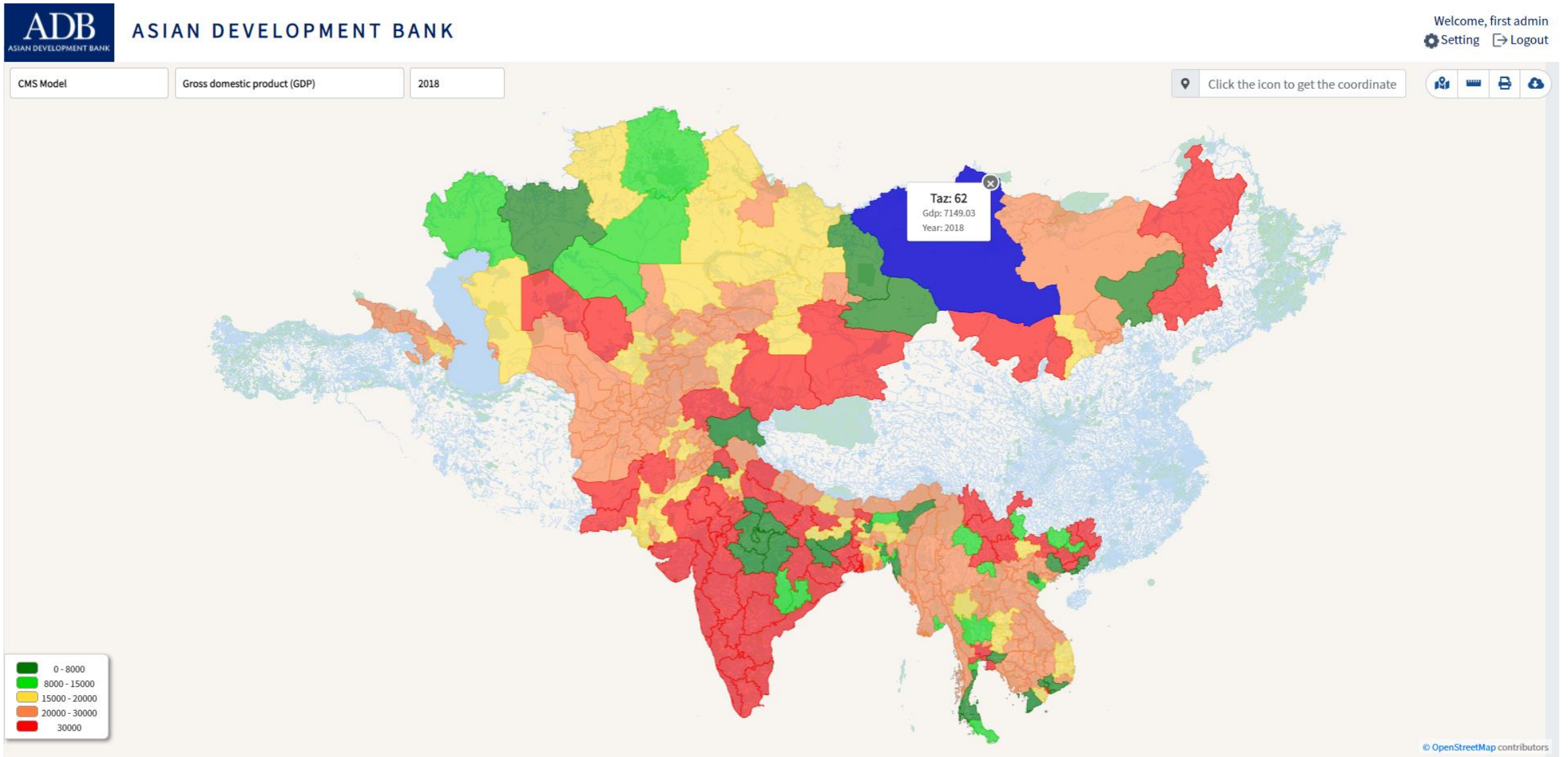
- The Density of Population
- The Density of Employed Population
- Gross domestic product (GDP)
- Transport Network

Output data

- Trip Generation and Attraction
- Desire Line Cargo
- Desire Line Passenger
- Desire Line Commodity
- Road Segment Speed
- Volume to capacity (V/C) ratio
- Traffic Volume

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THEMATIC MAP – GROSS DOMESTIC PRODUCT (GDP)



THEMATIC MAP – TRANSPORT NETWORK



ASIAN DEVELOPMENT BANK

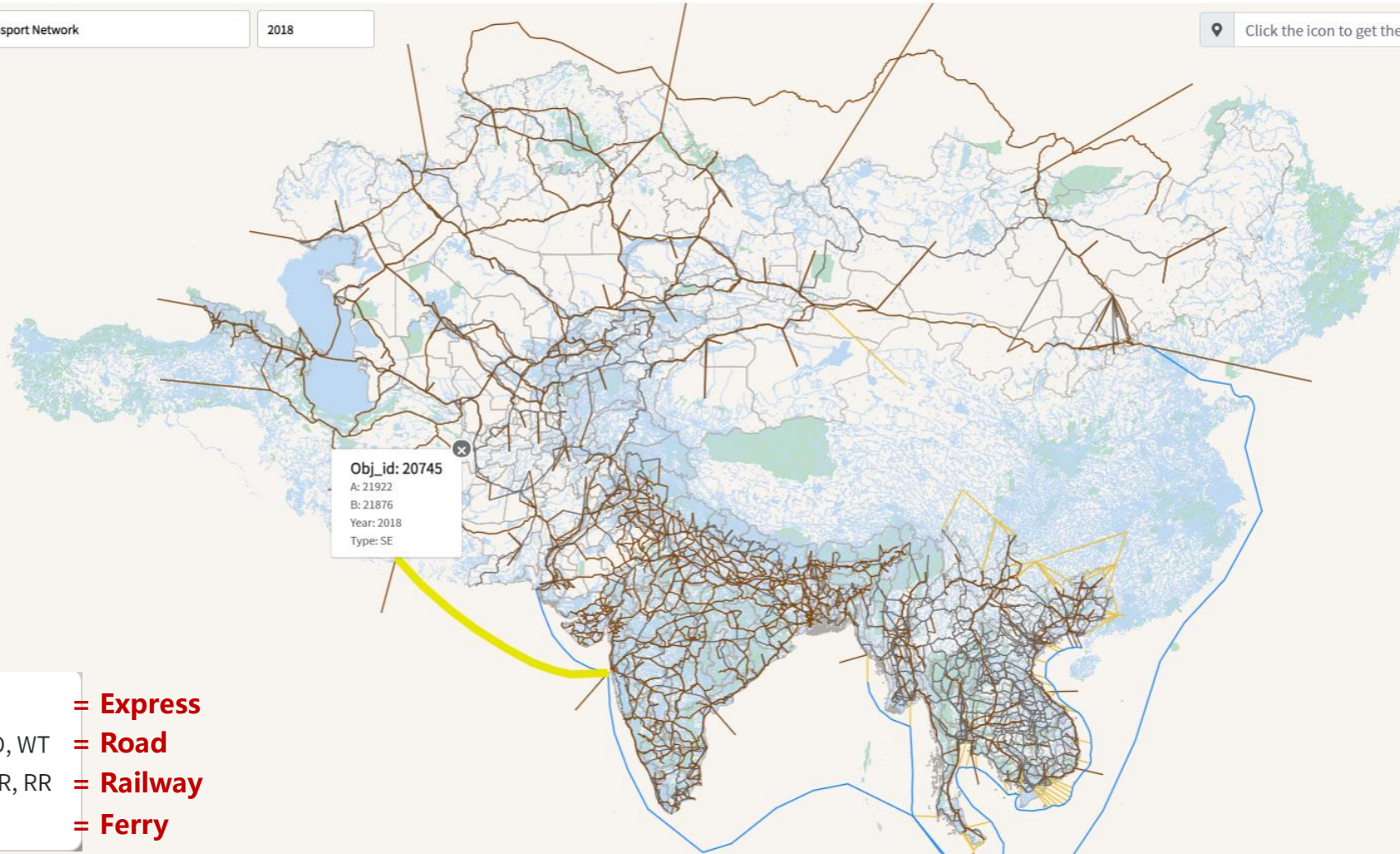
Welcome, first admin
Setting Logout

CMS Model

Transport Network

2018

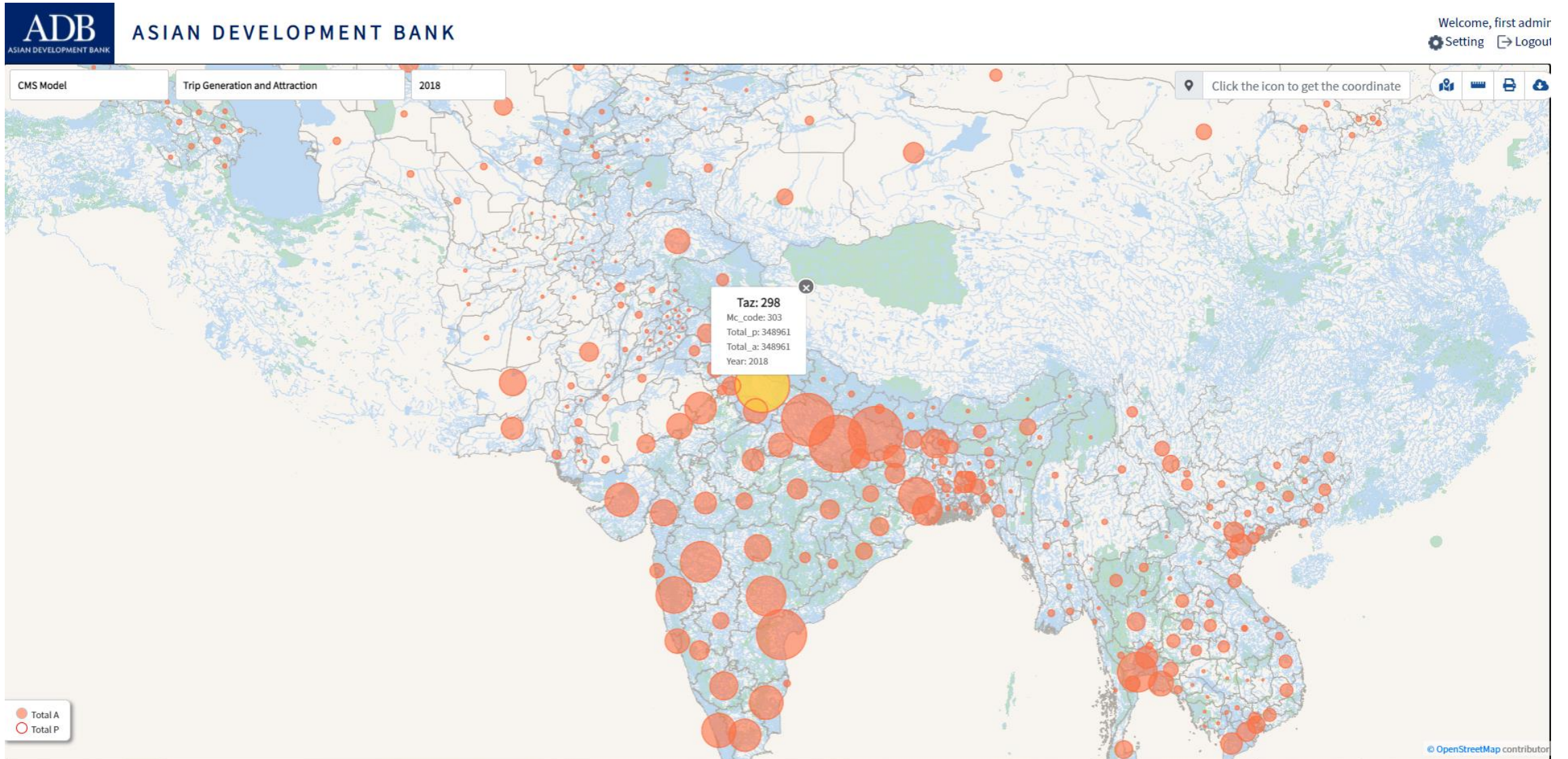
Click the icon to get the coordinate



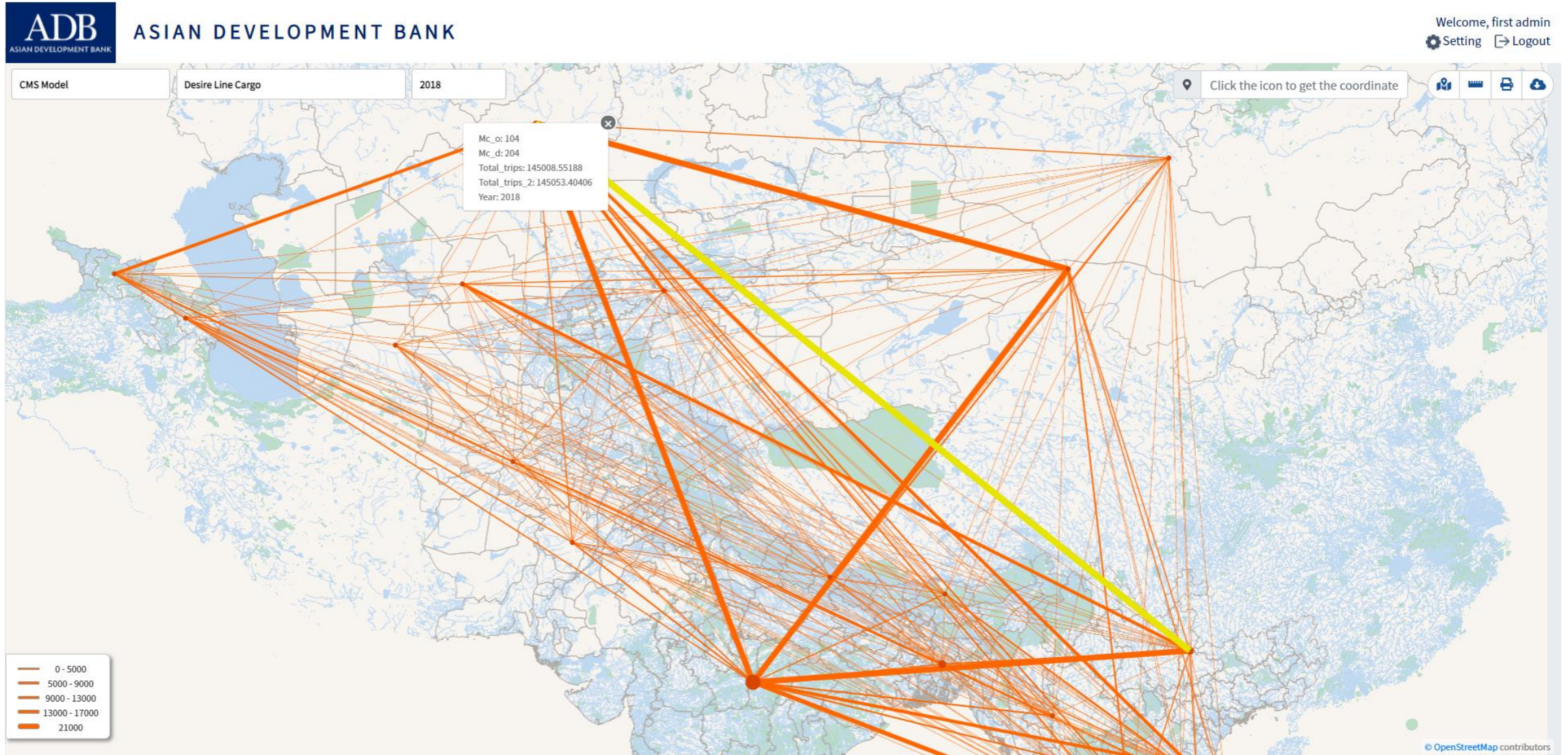
- | | |
|--------------------|-----------|
| EX | = Express |
| RD, BD, CG-RD, WT | = Road |
| RL, CG-RL, HSR, RR | = Railway |
| SE | = Ferry |

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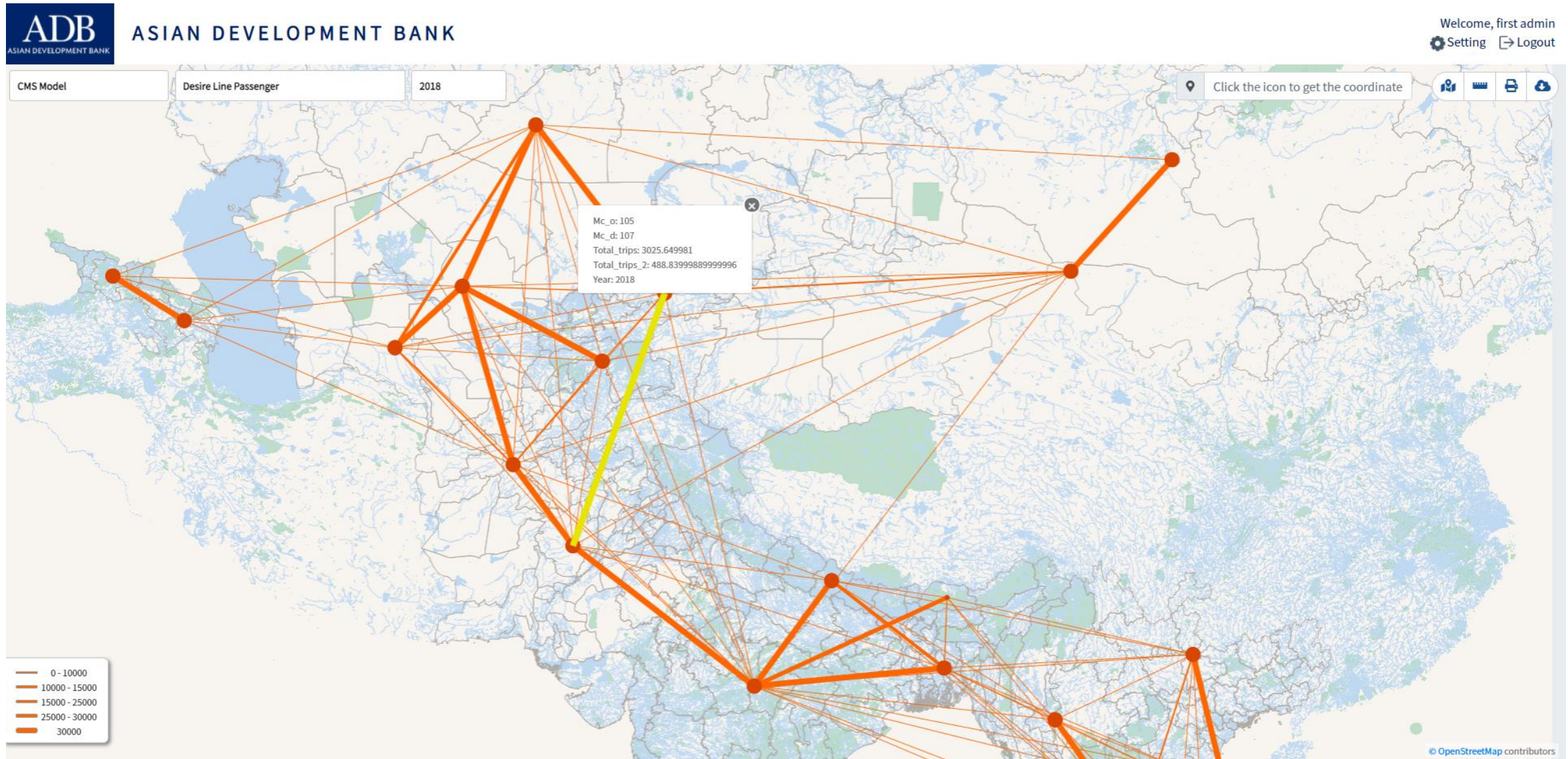
THEMATIC MAP – TRIP GENERATION (TRIP PRODUCTION AND ATTRACTION)



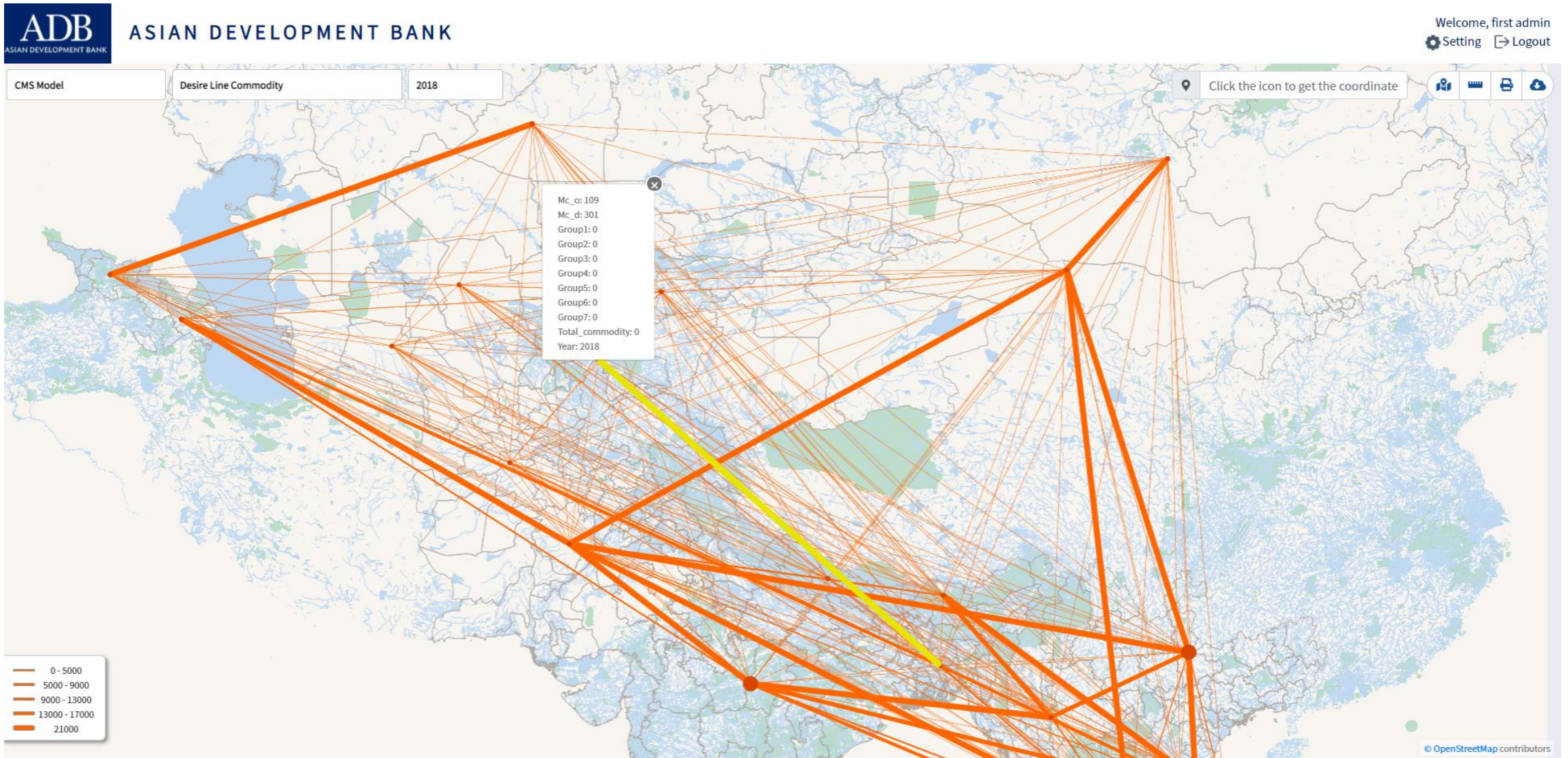
THEMATIC MAP – TRIP DISTRIBUTION (DESIRE LINE) FOR CARGO DEMAND



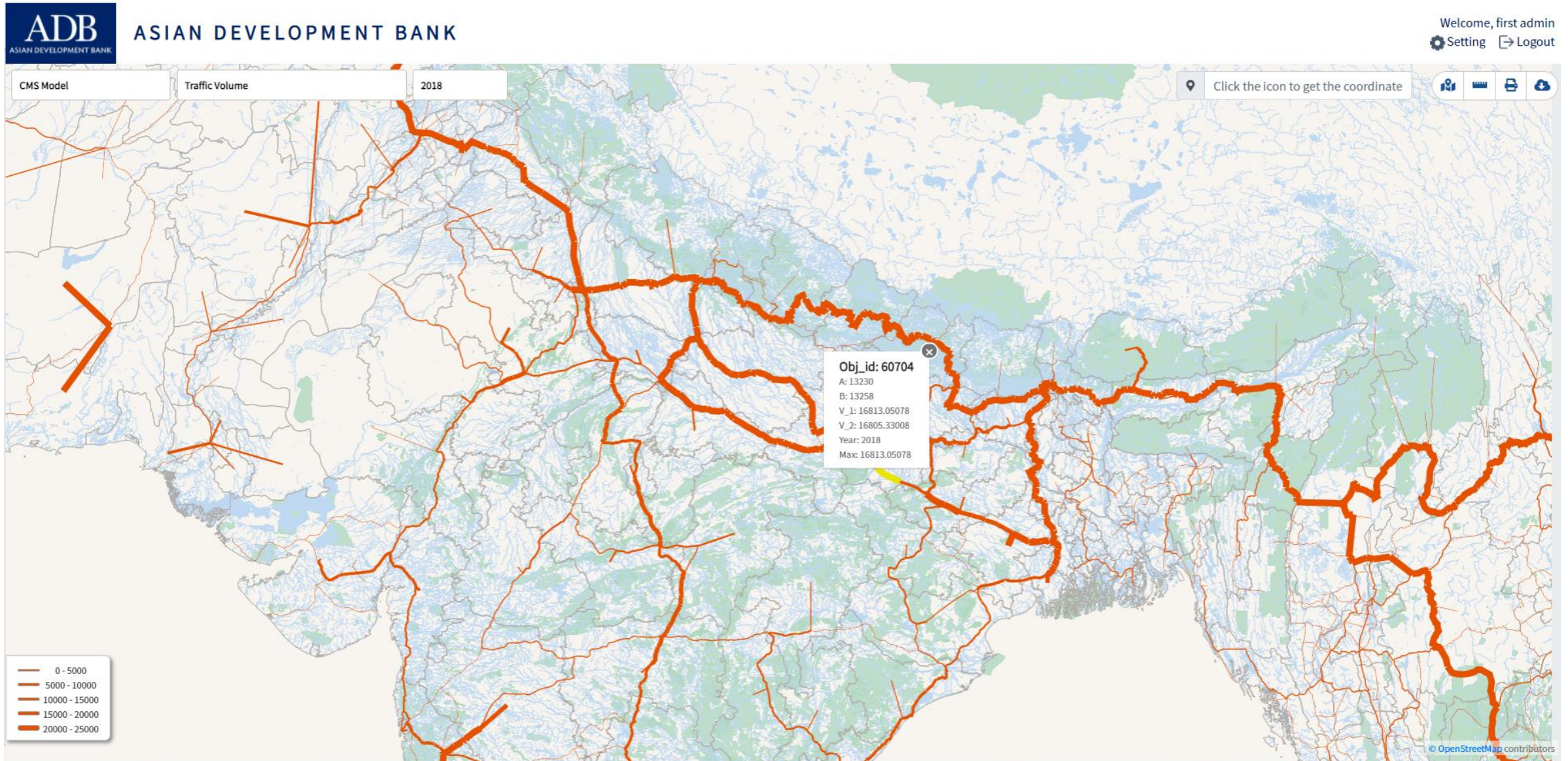
THEMATIC MAP – TRIP DISTRIBUTION (DESIRE LINE) FOR PASSENGER DEMAND



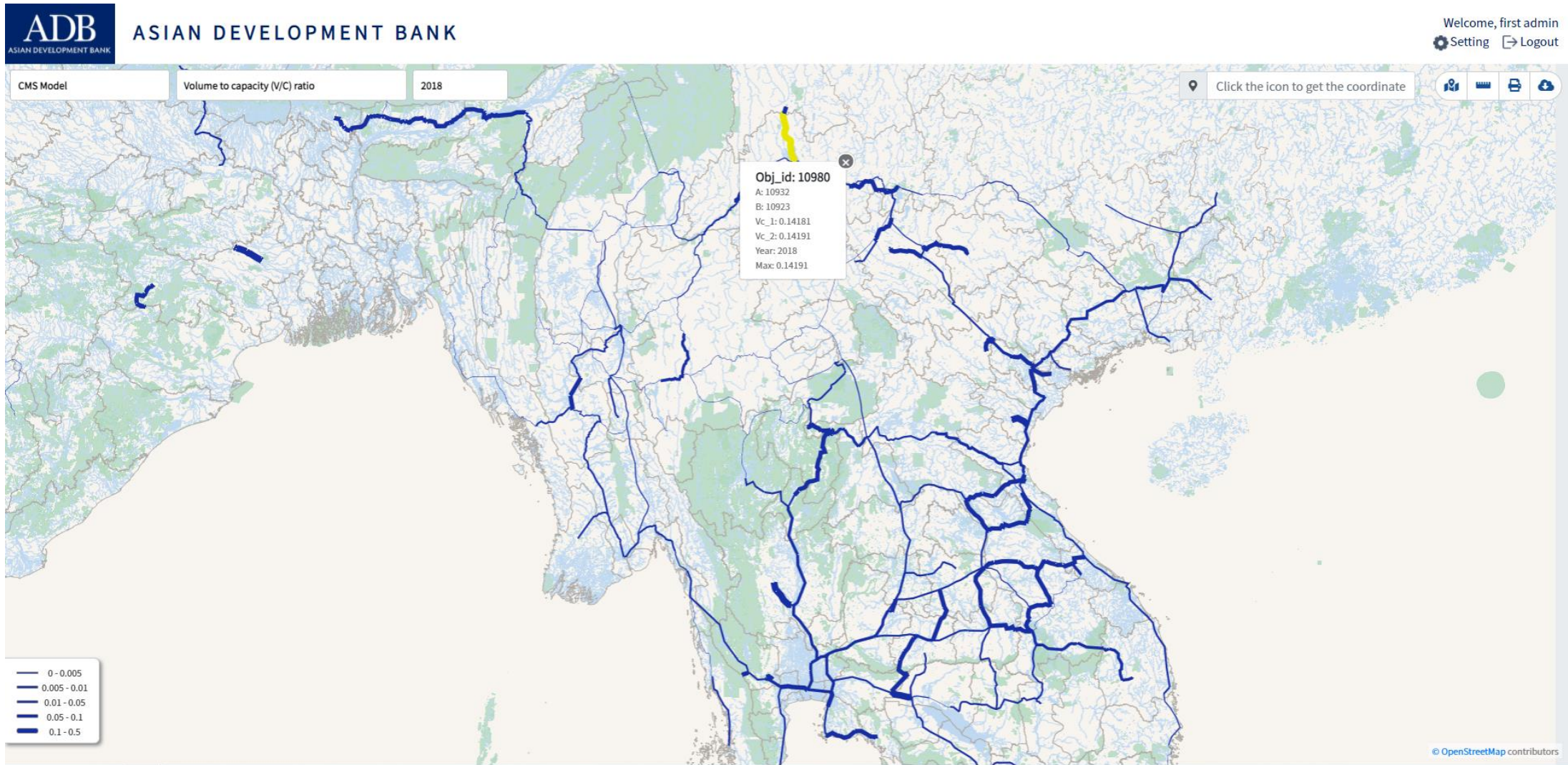
THEMATIC MAP – TRIP DISTRIBUTION (DESIRE LINE) FOR COMMODITY DEMAND



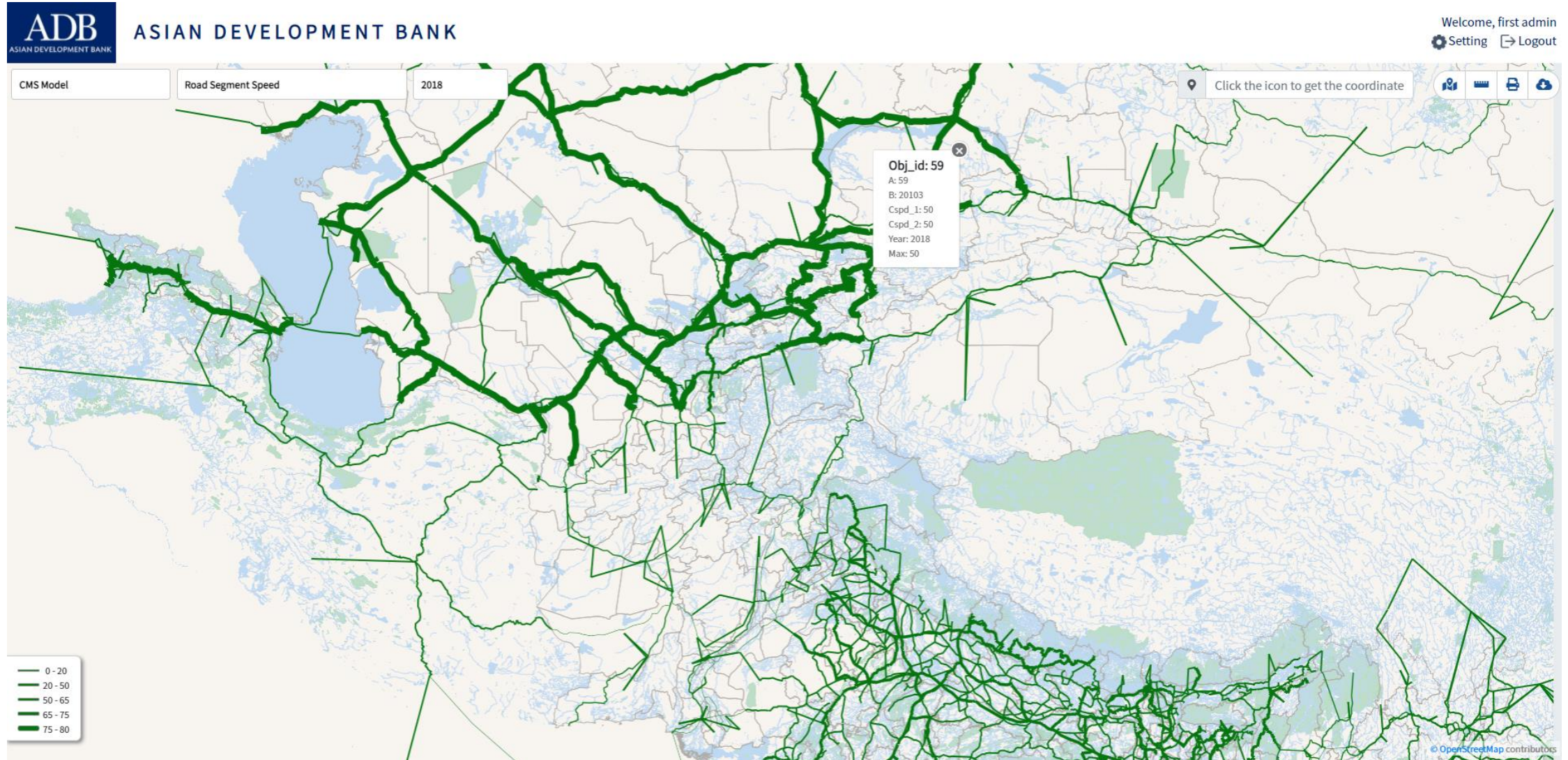
THEMATIC MAP – TRAFFIC VOLUME



THEMATIC MAP – VOLUME TO CAPACITY (V/C) RATIO



THEMATIC MAP – ROAD SEGMENT SPEED



ACCOUNTS MANAGEMENT

- Add user
- Edit account
- Delete user

ADB ASIAN DEVELOPMENT BANK

Welcome, first admin
Home Logout

Accounts Management Data Management

Add Account

ID	Account	Email	User Name	Department	Mobile	Access Authority	Status	Editing
1	first admin	test@email.1	admin	null	null	admin	active	
2	first user blocked	test@email.4	user_blocked	null	null	user	blocked	
3	first user	test@email.2	user	null	null	user	active	
4	first admin blocked	test@email.3	admin_blocked	null	null	admin	blocked	

Account editing

Account *

Email *

UserName *

Department

Mobile

Authority *

Status *

Password *

Confirm Password *

Delete User

Confirm

Cancel

ADB ASIAN DEVELOPMENT BANK

Accounts Management Data Management

Account editing

Account *

Email *

UserName *

Department

Mobile

Authority *

Status *

Password *

Confirm Password *

Delete User Confirm Cancel

DATA MANAGEMENT

- A. Download all: download all relevant information with one click
- B. Upload data: The system provides administrators to upload files. File upload restrictions are described below:
 - Maximum upload file size: 10GB
 - Max file number for one project: 15
 - Accept only following file types: Word, Excel, Ppt, Csv, Pdf, Zip
- C. Download file
- D. Delete data

ADB

ASIAN DEVELOPMENT BANK

Welcome, first admin
Home Logout

Accounts Management

Data Management

Select Project

Download all

Select file

Upload

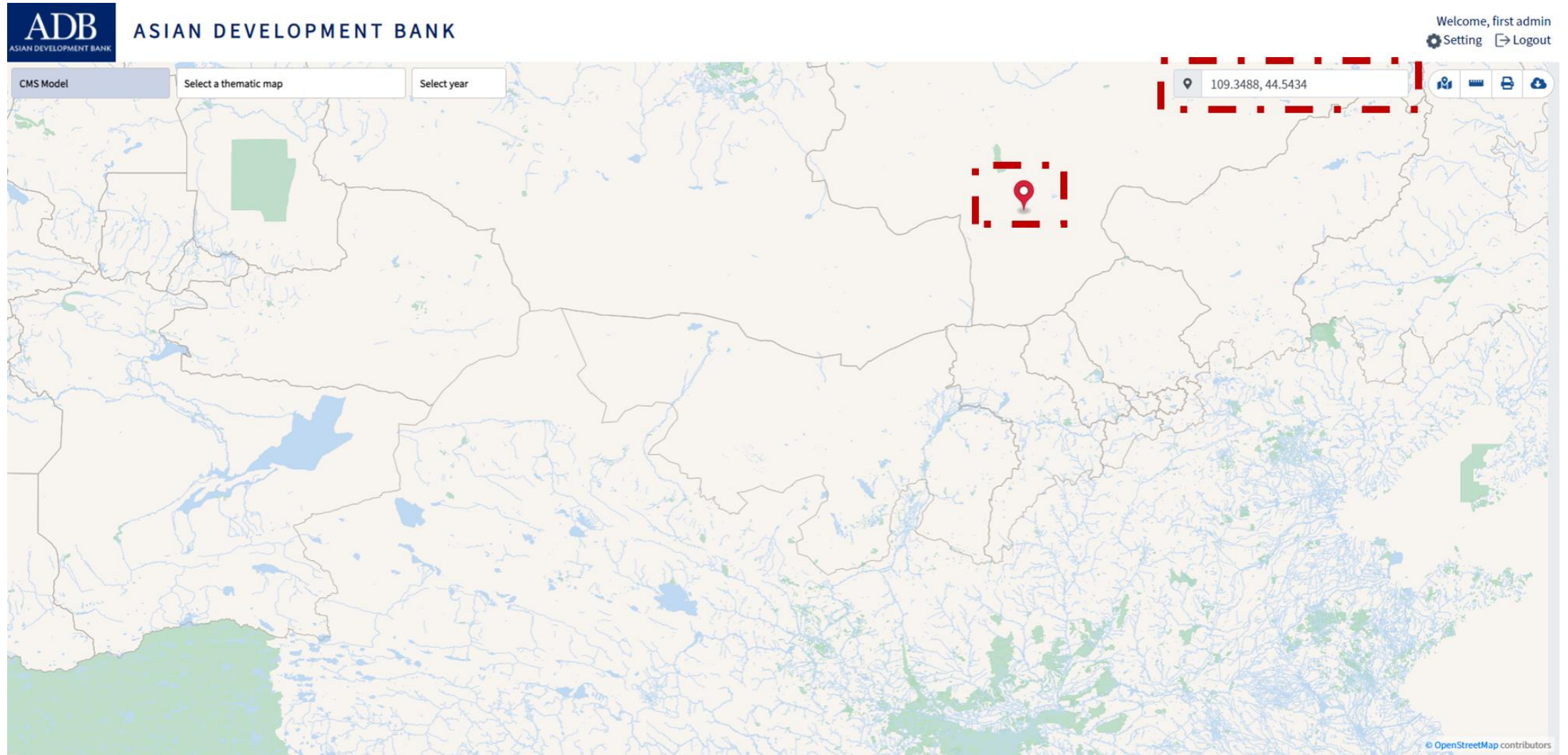
Maximum upload file size: 10GB

Max file number: 15

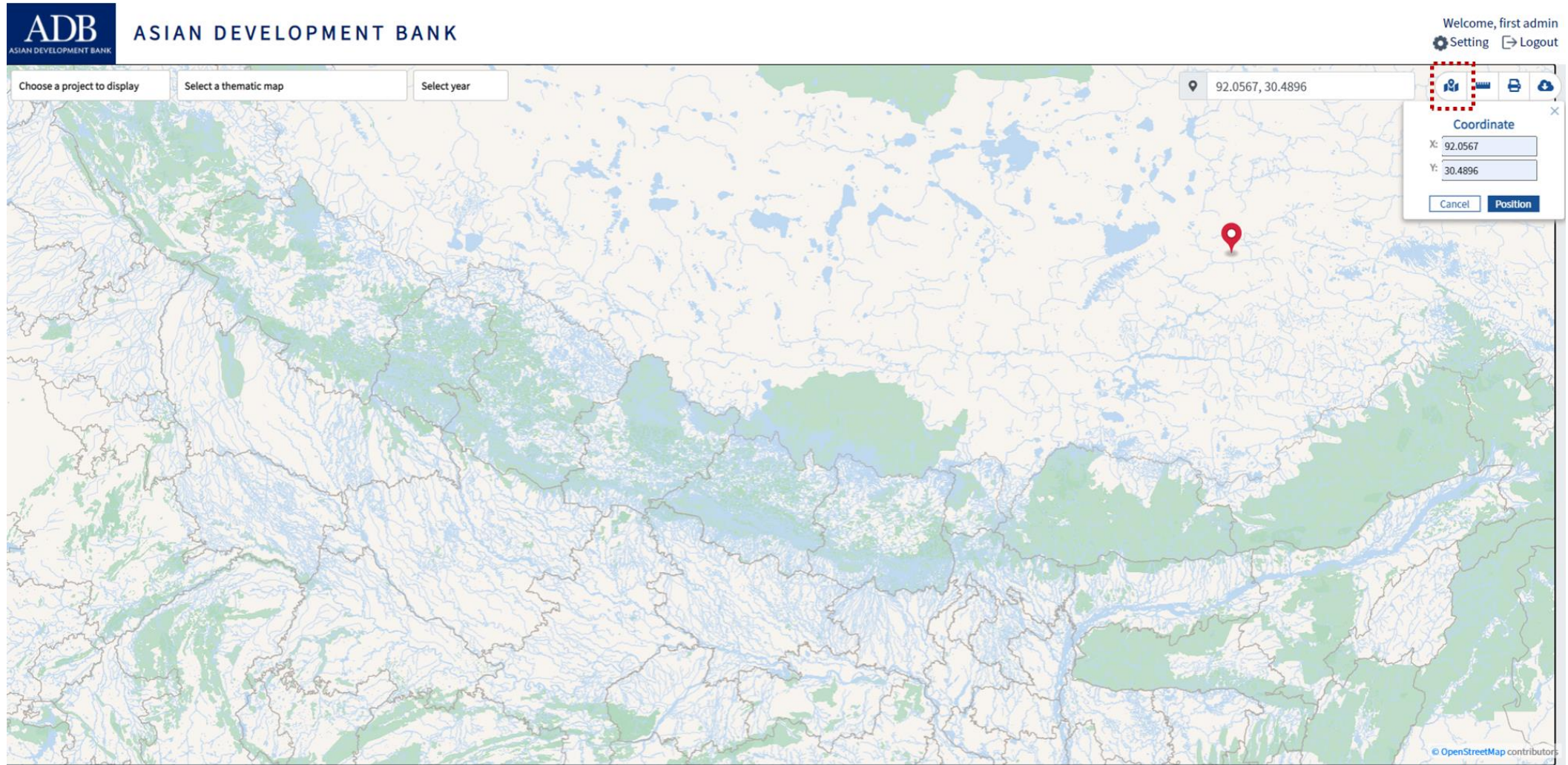
Accept only follow file types: Word, Excel, Ppt, Csv, Pdf, Zip

ID	Name		
1	raw_data.zip	<div>Download</div>	
2	Testing file.docx	<div>Download</div>	<div>Delete</div>

INTERACTIVE FUNCTIONS — COORDINATE TOOL (1)

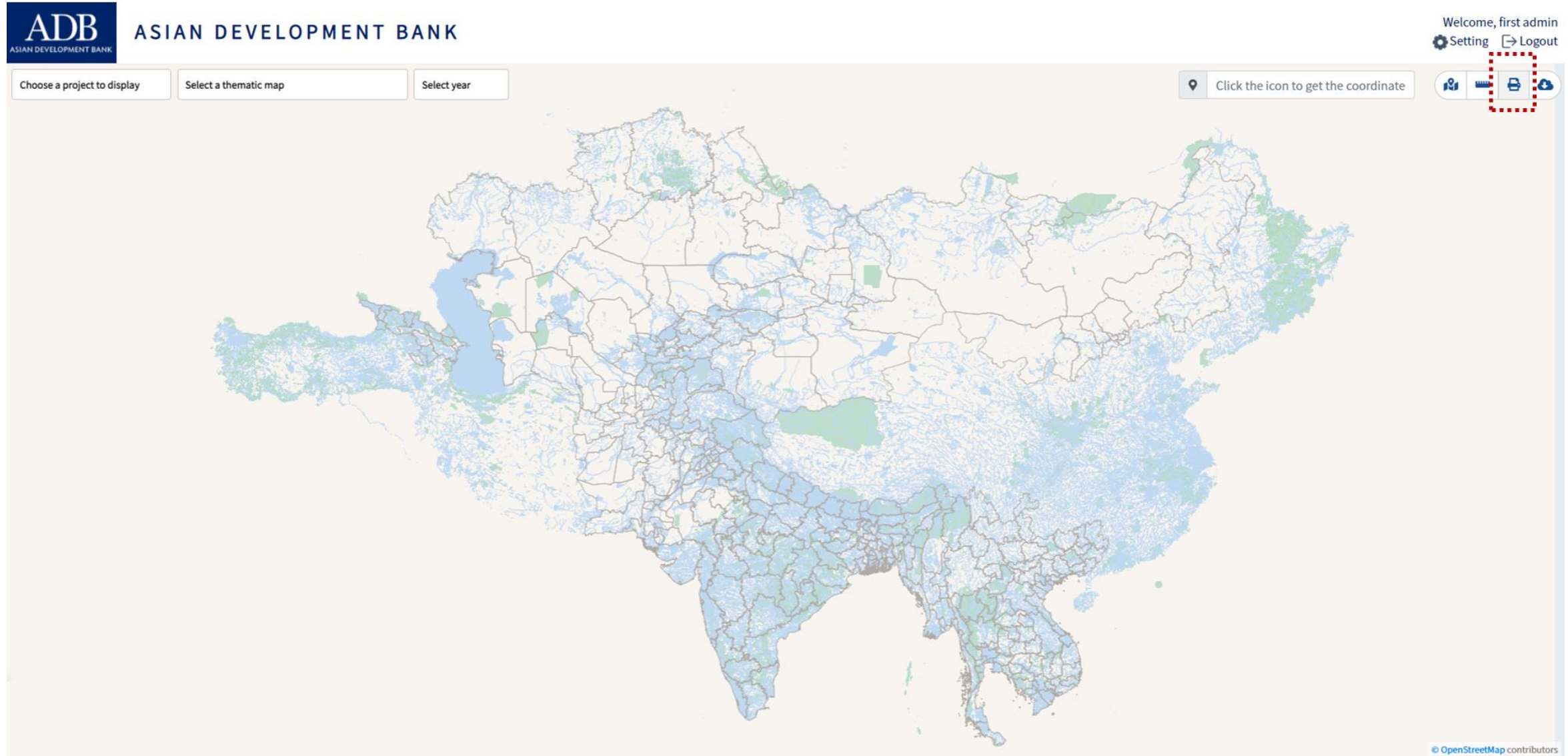


INTERACTIVE FUNCTIONS – COORDINATE TOOL (2)




INTERACTIVE FUNCTIONS – STATIC MAP PRODUCTION TOOL

- One-click automatic static map production function



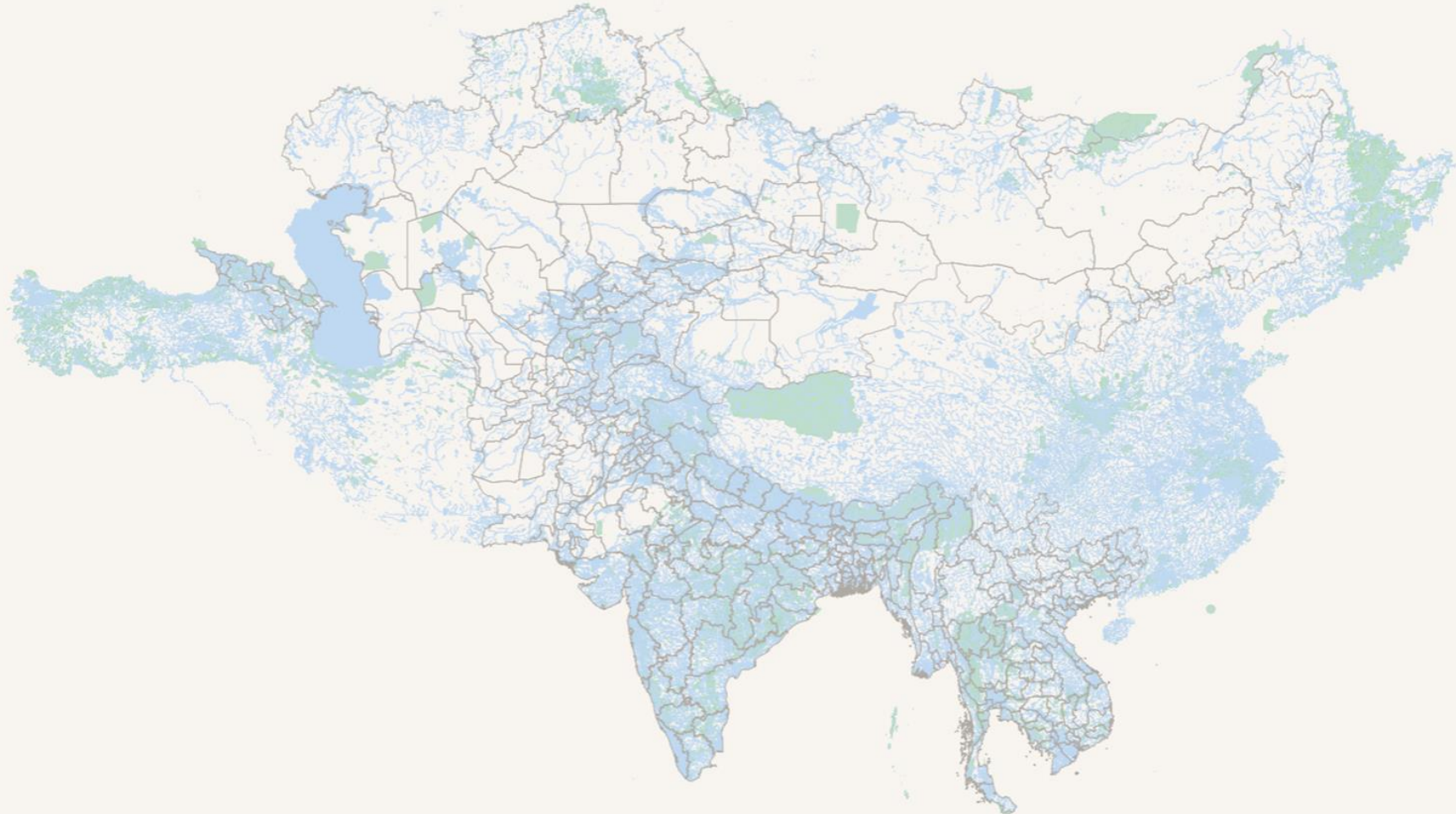
INTERACTIVE FUNCTIONS – DATA DOWNLOAD

**ADB**
ASIAN DEVELOPMENT BANK

Welcome, first admin
[Setting](#) [Logout](#)

Choose a project to displaySelect a thematic mapSelect year

Click the icon to get the coordinate



Click to download
raw_data.zip

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