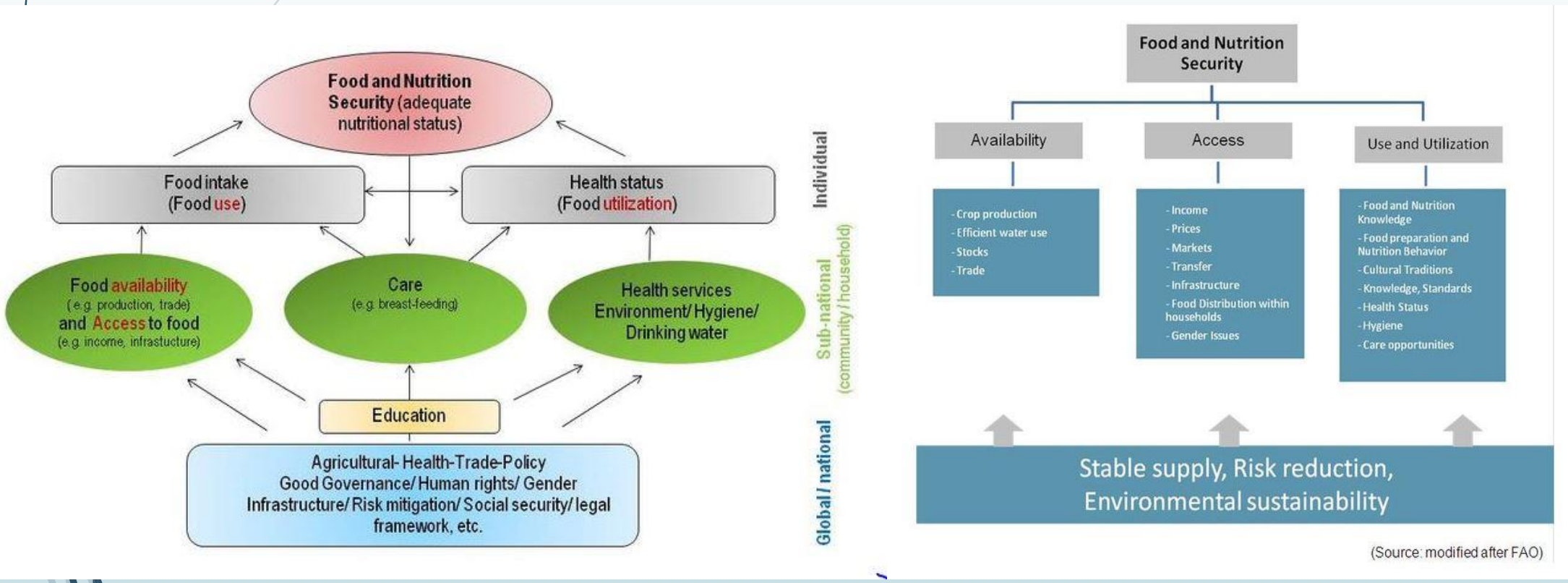
Prediction and Recommendation engine with Data crunching and Causal models for Demand Analysis of food grains

Project Coordinator- Sankaranarayanan.G

Project Members: Anjali Chauhan, Keerthana.S, Kasyap Varanasi, Nikunj Bansal, Praveen Malla (Members of Cord.Ai)

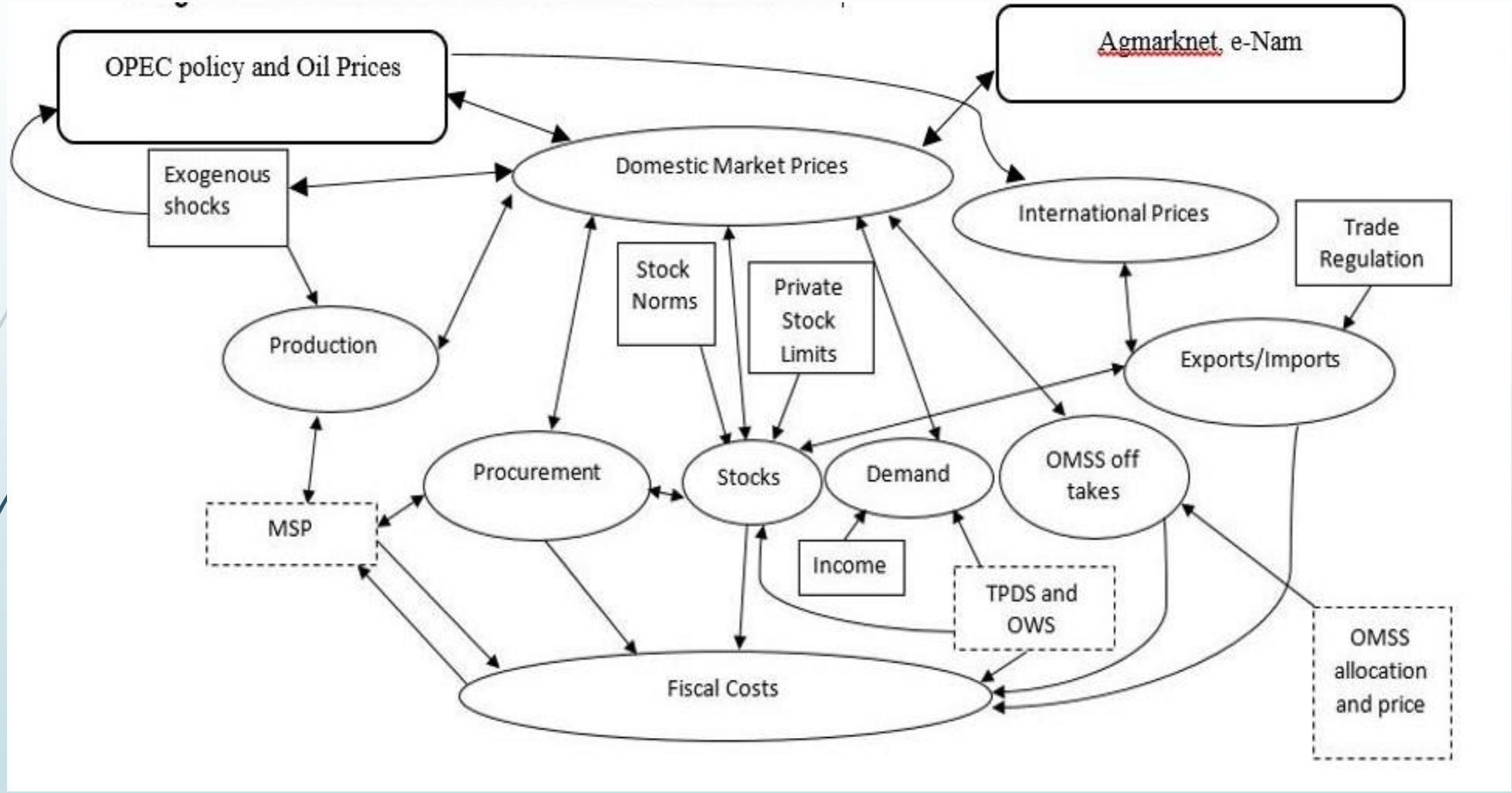
Food Security



Food Security

- Quantity of certain food grains copious
- Other aspects need to be considered
- The Health dimensions and Inclusive dimension
- Availability part has been met with volatility and procurement challenges
- Actual or Near Actual Demand Assessment essential.
- Intelligent market system design-Need of the hour
- Information sharing done between stakeholders and misinformation reduced.
- Policies considered- Doubling farmers income, National Logistics Policy

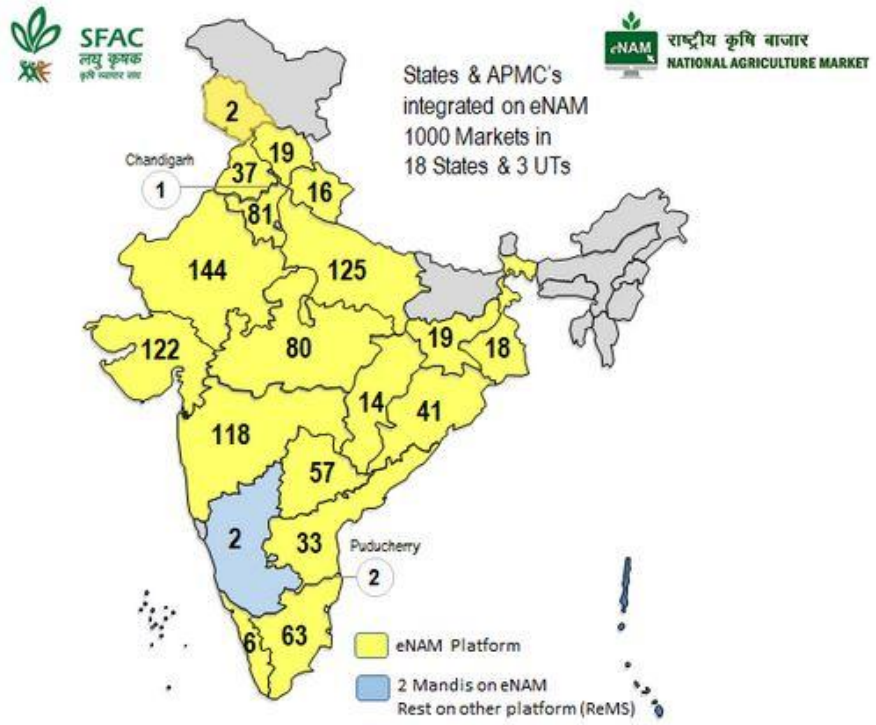
Working and Dynamics of Domestic Market



Effect of International Markets on Domestic Markets

- Fuel price dynamics and Energy Crisis
- Currency Value dynamics (Appreciation and Depreciation of exchange rate)
- Geopolitical changes
- Famines/Drought around the world and consequent demand variation.
- Climate change and volatility-El-nina, La-Nina Effects and intersection with minor oscillations.
- World food grain and commodity prices
- Demand for substitute products or economic alternatives
- Demand for food grain derivatives – Eg. Atta, Other Consumables

APMC Maps



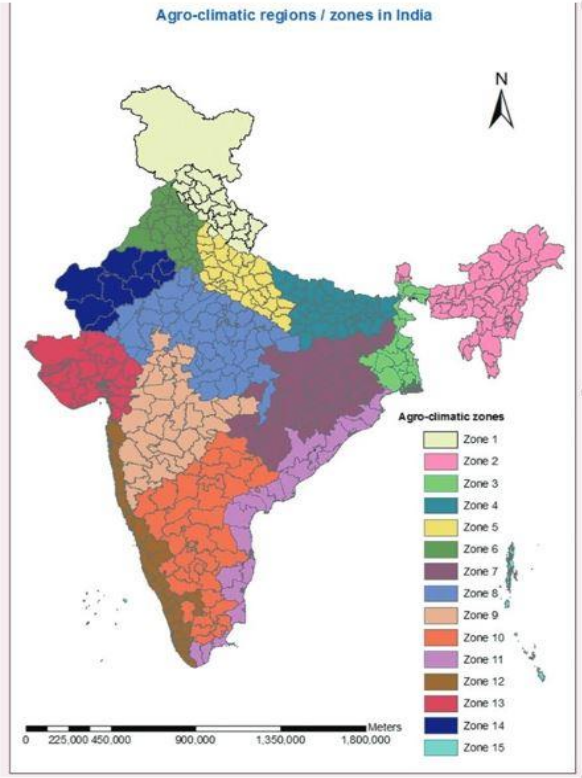


Table 1.2: Agro-climatic regions/zones in India

S.No.	Agro-climatic regions/zones	States represented
I	**Western Himalayan region**	Himachal Pradesh, Jammu & Kashmir, Uttarakhand
II	**Eastern Himalayan region**	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, West Bengal
III	**Lower Gangetic plain region**	West Bengal
IV	**Middle Gangetic plain region**	Uttar Pradesh, Bihar
V	**Upper Gangetic plain region**	Uttar Pradesh
VI	**Trans Gangetic plain region**	Chandigarh, Delhi, Haryana, Punjab, Rajasthan
VII	**Eastern plateau and hills region**	Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, West Bengal
VIII	**Central plateau and hills region**	Madhya Pradesh, Rajasthan, Uttar Pradesh
IX	**Western plateau and hills region**	Madhya Pradesh, Maharashtra
X	**Southern plateau and hills region**	Andhra Pradesh, Karnataka, Tamil Nadu
XI	**East coast plains and hills region**	Andhra Pradesh, Odisha, Puducherry, Tamil Nadu
XII	**West coast plains and ghat region**	Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu
XIII	**Gujarat plains and hills region**	Gujarat, Dadra & Nagar Haveli, Daman & Diu
XIV	**Western dry region**	Rajasthan
XV	**Island region**	Andaman & Nicobar Islands, Lakshadweep

Problems, Issues and Challenges-Supply

- **Major market forces (Government or Government Allied Channel Pricing and Private/Open Market Channel Pricing)**
- Yield Prediction
- Volatility in Yield, Produce and Procurement- Forced Imports to compensate for supply shortage.
- Climate related risks
- Labour related risks
- Soil related risks
- Water related risks
- Availability of raw materials

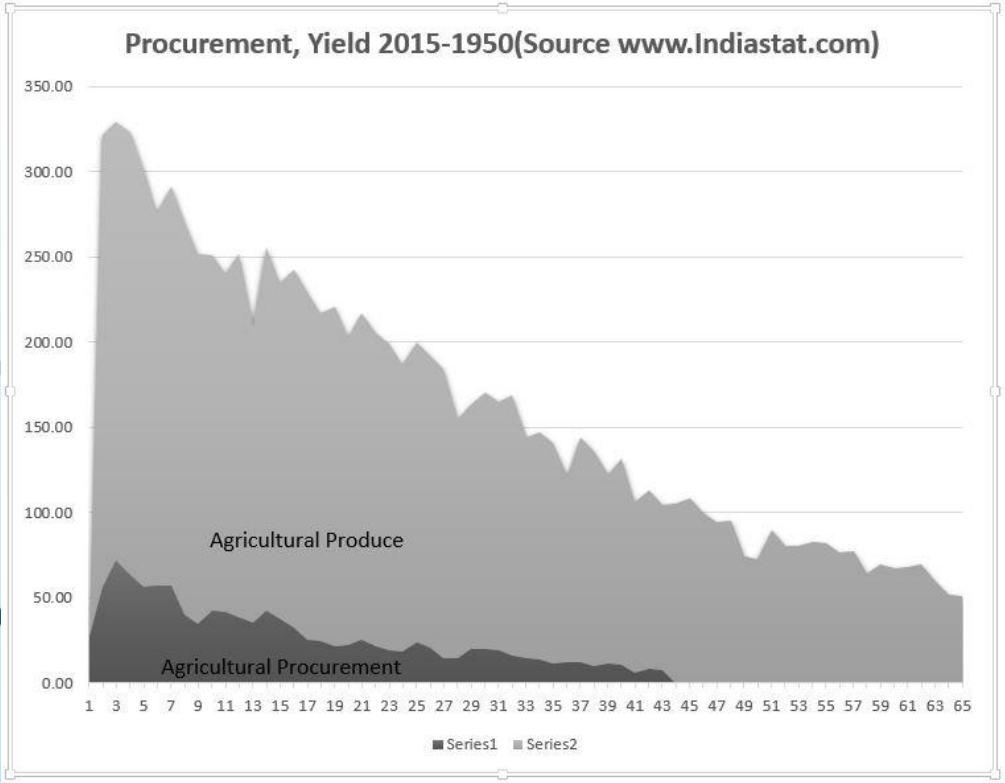
Problems, Issues and Challenges-Supply

- Disproportionate pricing of a crop
- Agro-climatic issues
- Destruction of Inventory due to inclement weather or natural calamities
- Loss of Land due to Urban Sprawl or Industrial encroachment
- Pest , Rodent attacks
- Leakages and Pilferages
- Spoilage
- Middle men

Problems, Issues and Challenges- Supply

- Cost- Increase in the cost of raw materials, labour, production and machinery cost and pricing further down the supply chain.
- Inventory Policies to balance between safety stocks, spoilage and maintain the inflation levels.
- Taxation policies, Fiscal Deficit, Fuel prices and Policies
- Information asymmetry, heteroscedasticities, Incompleteness.

Problems, Issues and Challenges - Supply



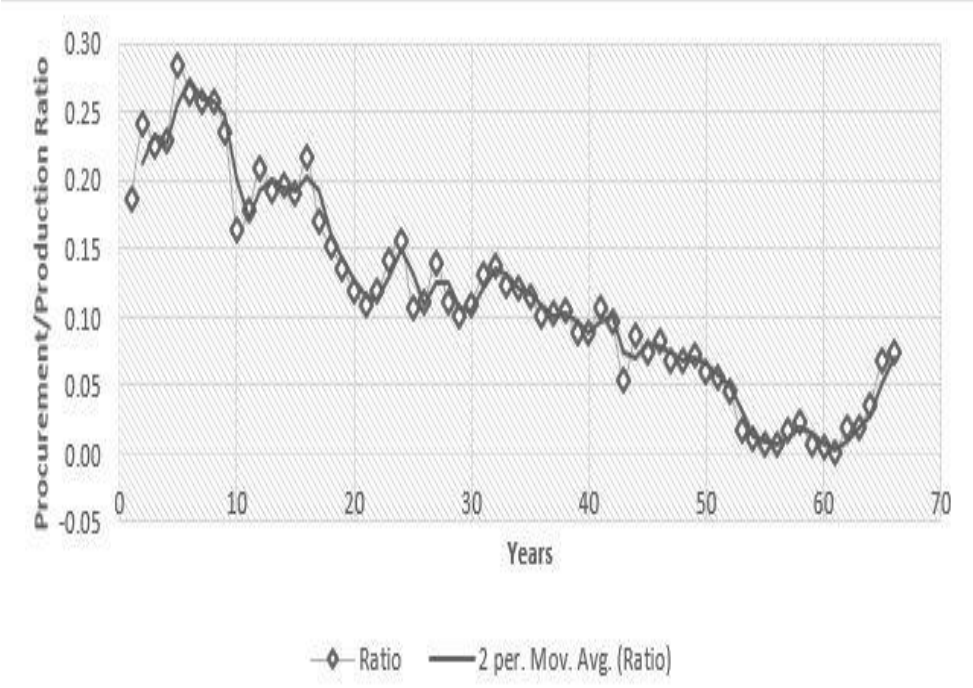


Figure 2. Procurement/Production ratio 1950-2018

Problems, Issues and Challenges -Demand

- Population Dynamics.
- Poverty Level Estimation
- Free riding and Leakages
- Exports and Imports Policies
- Delay in trans-shipment
- Delay in last mile distribution
- Allocation to government officials
- Exclusion of poor due to non-availability of ration cards and Aadhar card
- Sudden increase in demand
- Spoilage due to weather
- Incomplete and Imperfect information.

Data Noises

Centre	Rice	Wheat	Atta (Wheat)	Gram Dal	Tur/ Arhar Dal	Urad Dal	Moong Dal	Masoor Dal	Sugar	Milk @	Ground-nut Oil *	Must-ard Oil *	Vanas-pati *	Soya Oil *	Sun-flower Oil	Palm Oil *	Gur	Tea Loose	Salt Pack (Iodised)	Potato	Onion	Tomato
NORTH ZONE																						
CHANDIGARH	20	13	14	42	65	55	58	60	32	25	90	82	62	66	79	55	NR	200	12	16	12	22
DELHI	22	14	17	39	87	69	79	71	38	21	102	61	51	54	65	NR	NR	148	12	23	28	15
HISAR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
KARNAL	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
PANCHKULA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
GURGAON	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SHIMLA	25	NR	17	35	82	64	73	NR	35	20	83	76	50	NR	NR	NR	NR	150	12	22	26	NR
MANDI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
DHARAMSHALA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SOLAN	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SRINAGAR	18	NR	15	46	55	NR	NR	NR	25	20	NR	72	68	NR	NR	NR	NR	192	10	14	12	NR
JAMMU	25	14	16	33	82	NR	NR	NR	35	22	85	73	53	NR	NR	NR	NR	300	12	21	22	NR
AMRITSAR	17	12	15	31	72	50	69	63	32	26	79	NR	50	68	80	NR	NR	240	12	14	21	11
LUDHIANA	18	12	13	30	78	58	60	60	34	25	99	71	49	60	85	46	NR	180	12	16	11	10
BATHINDA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
LUCKNOW	16	11	13	37	80	58	60	68	34	28	92	70	51	NR	93	NR	NR	215	11	20	25	18
KANPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
VARANASI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
AGRA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
JHANSI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
MEERUT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
ALLAHABAD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
GORAKHPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
DEHRADUN	16	13	16	35	75	55	81	NR	35	22	80	55	49	55	NR	NR	NR	140	12	20	24	14
HALDWANI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
RUDRAPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
HARIDWAR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Source:- *State Civil Supplies Dept.*

NR -> Not Reported @ -> (Rs./Lt.) * -> (Packed)

Note:- 1. Difference in prices of a commodity at different centres is partly attributed to variety differences. In case of Edible oils and Tea difference in prices is due to ordinary/refined or loose/packed type.

Developed by:- National Informatics Centre(NIC)

Continue.....

Centre	Rice	Wheat	Atta (Wheat)	Gram Dal	Tur/ Arhar Dal	Urad Dal	Moong Dal	Masoor Dal	Sugar	Milk @	Ground-nut Oil *	Must-ard Oil *	Vanas-pati *	Soya Oil *	Sun-flower Oil	Palm Oil *	Gur	Tea Loose	Salt Pack (Iodised)	Potato	Onion	Tomato
WEST ZONE																						
RAIPUR	19	19	21	32	71	63	65	58	34	22	76	69	55	54	58	NR	NR	180	10	20	22	NR
DURG	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
AMBIKAPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
BILASPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
JAGDALPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
PANAJI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

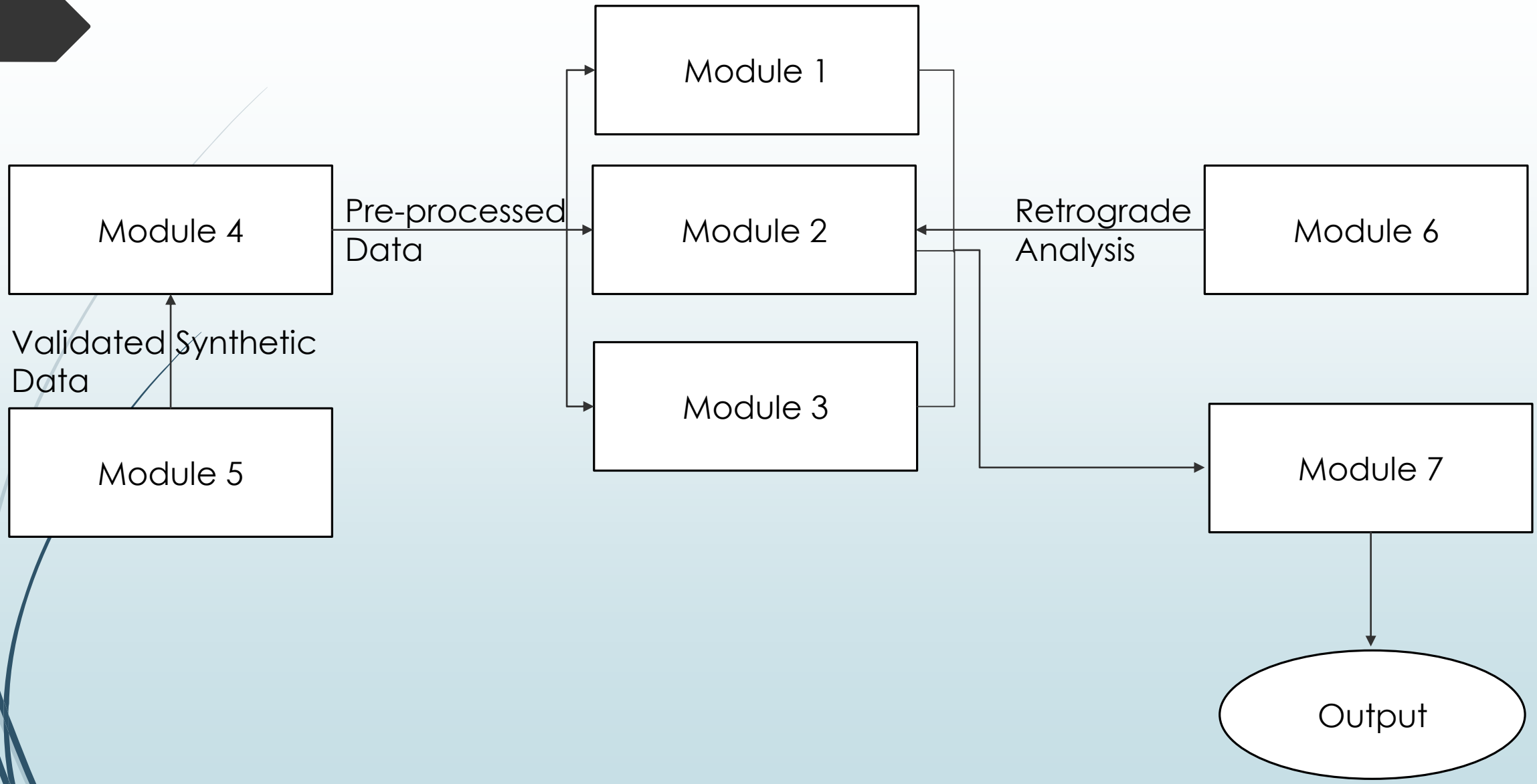
Objectives

- Supply Side Strategizing and Planning to meet the Demand using Artificial Intelligence, tools and technological implements.
- Inventory and Logistical Management at Facility level using technological implements such as smart cards.
- Demand Prediction, Analysis Model, and Algorithms for different geographical locations in India.

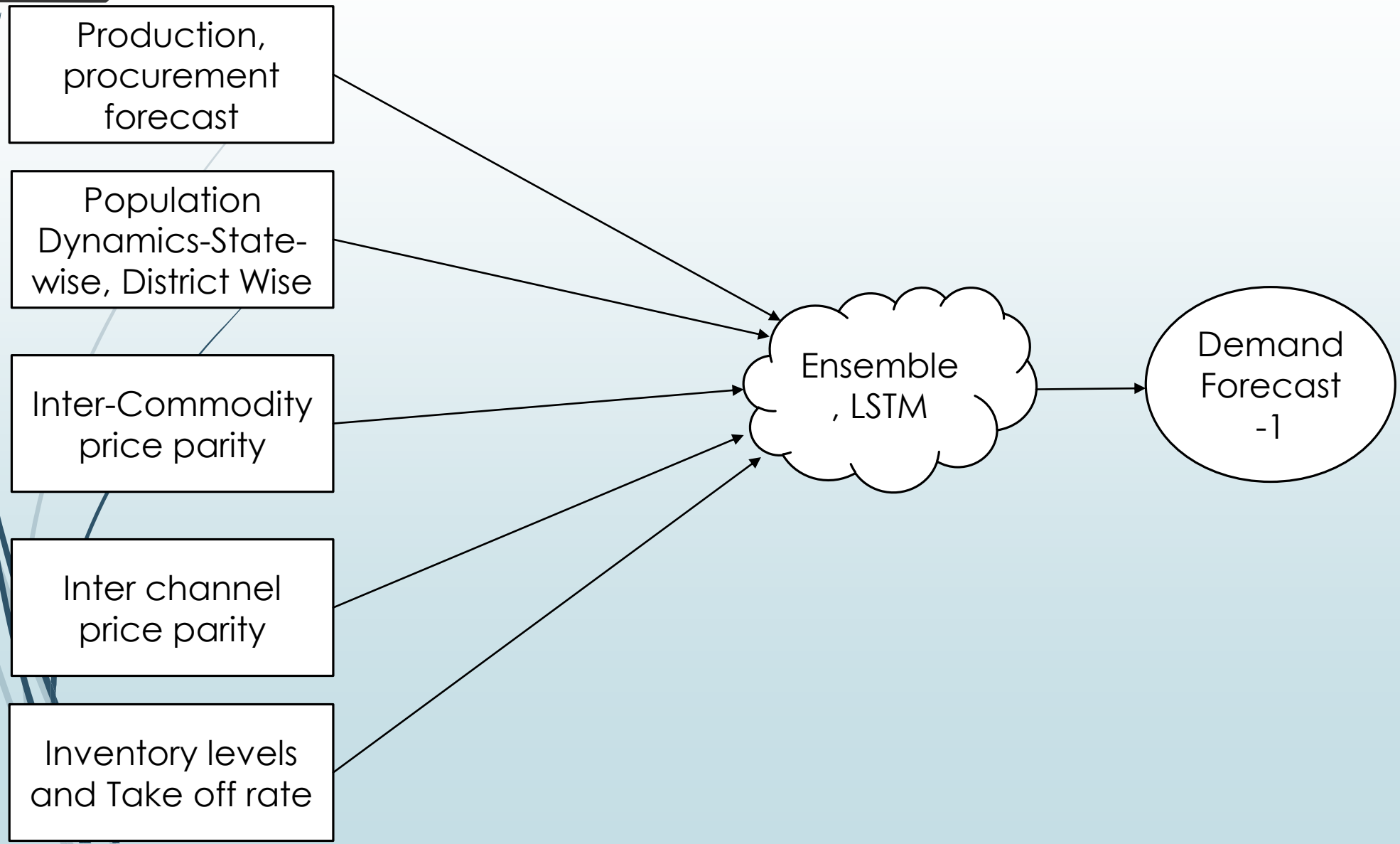
Implementable, Deliverables-Problem Framework, Algorithm and Mechanisms

- Module 1: Numerical data analysis
- Module 2: Textual Data Analysis
- Module 3: GIS and Climate based Data analysis, Image Analysis
- Module 4: Data Cleaning Module
- Module 5: Synthetic Data Generation, test data generation and validation
- Module 6: Retrograde analysis of food grain policies and other policies in reality
- Module 7: Forecasting, Recommendation and Strategic Decision Making Module

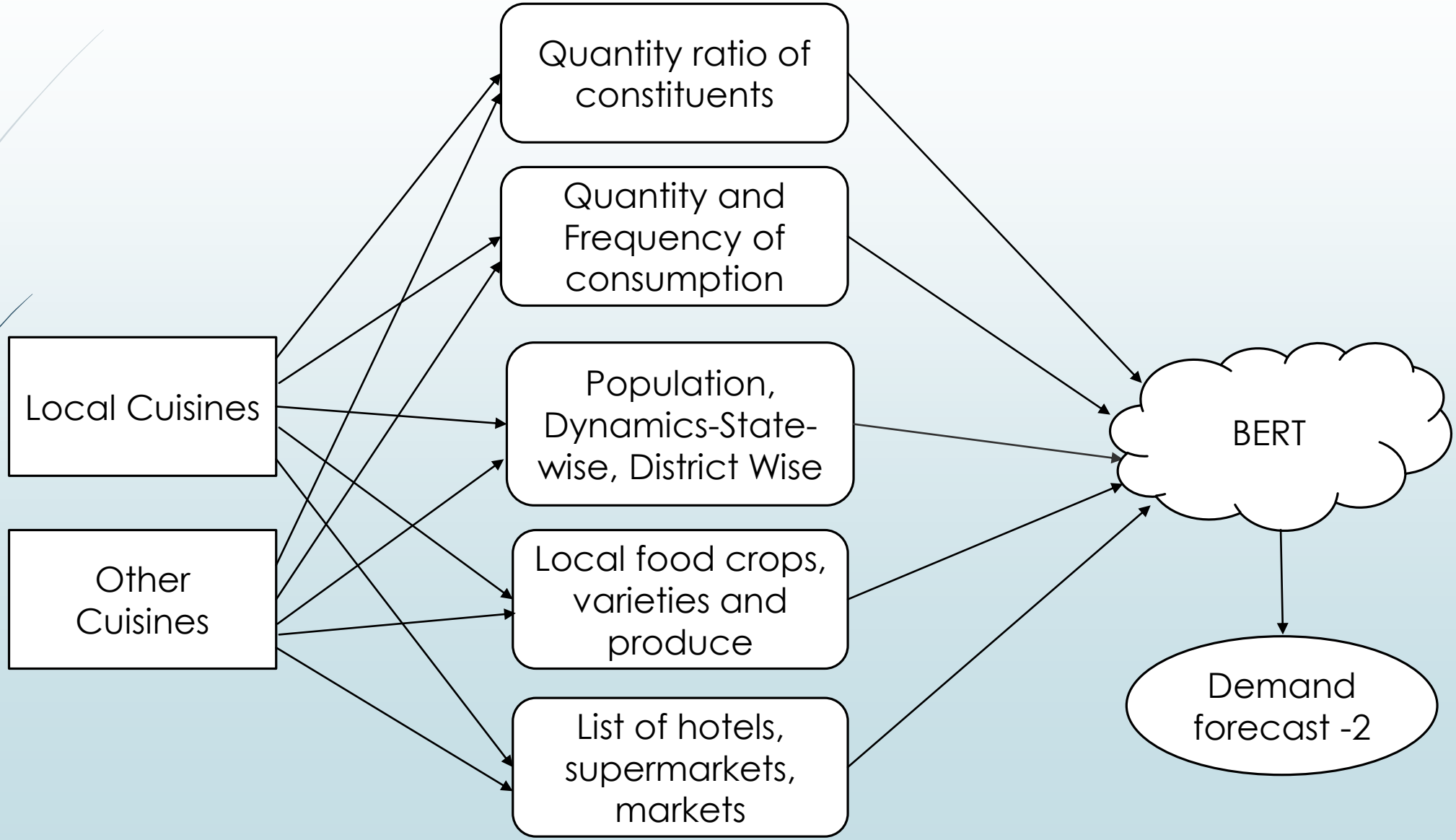
Module Relationship Diagram



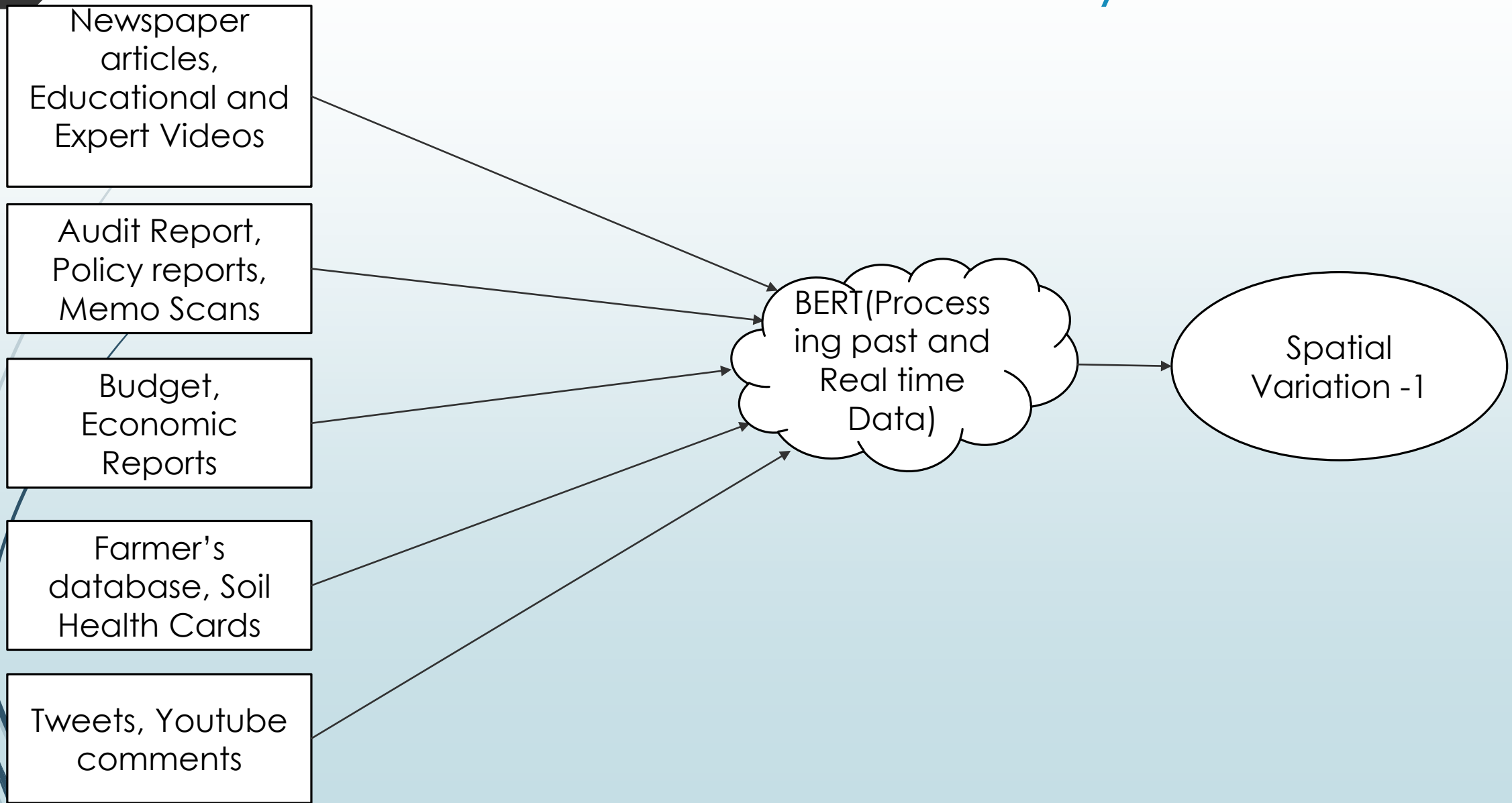
Module 1-Numerical Data Analysis-I Temporal Forecast



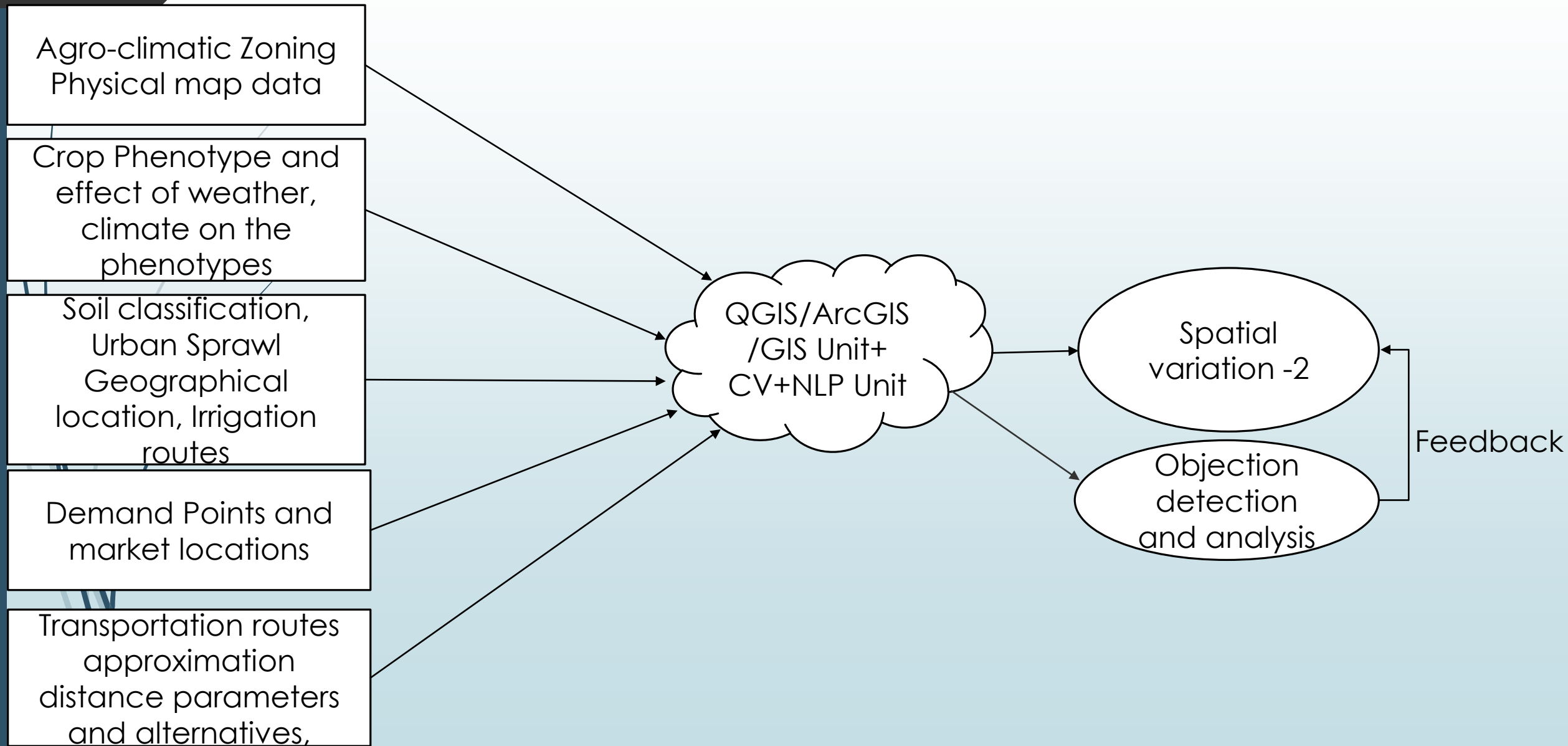
Module 1-Numerical Data Analysis-I-Spatial variation forecast



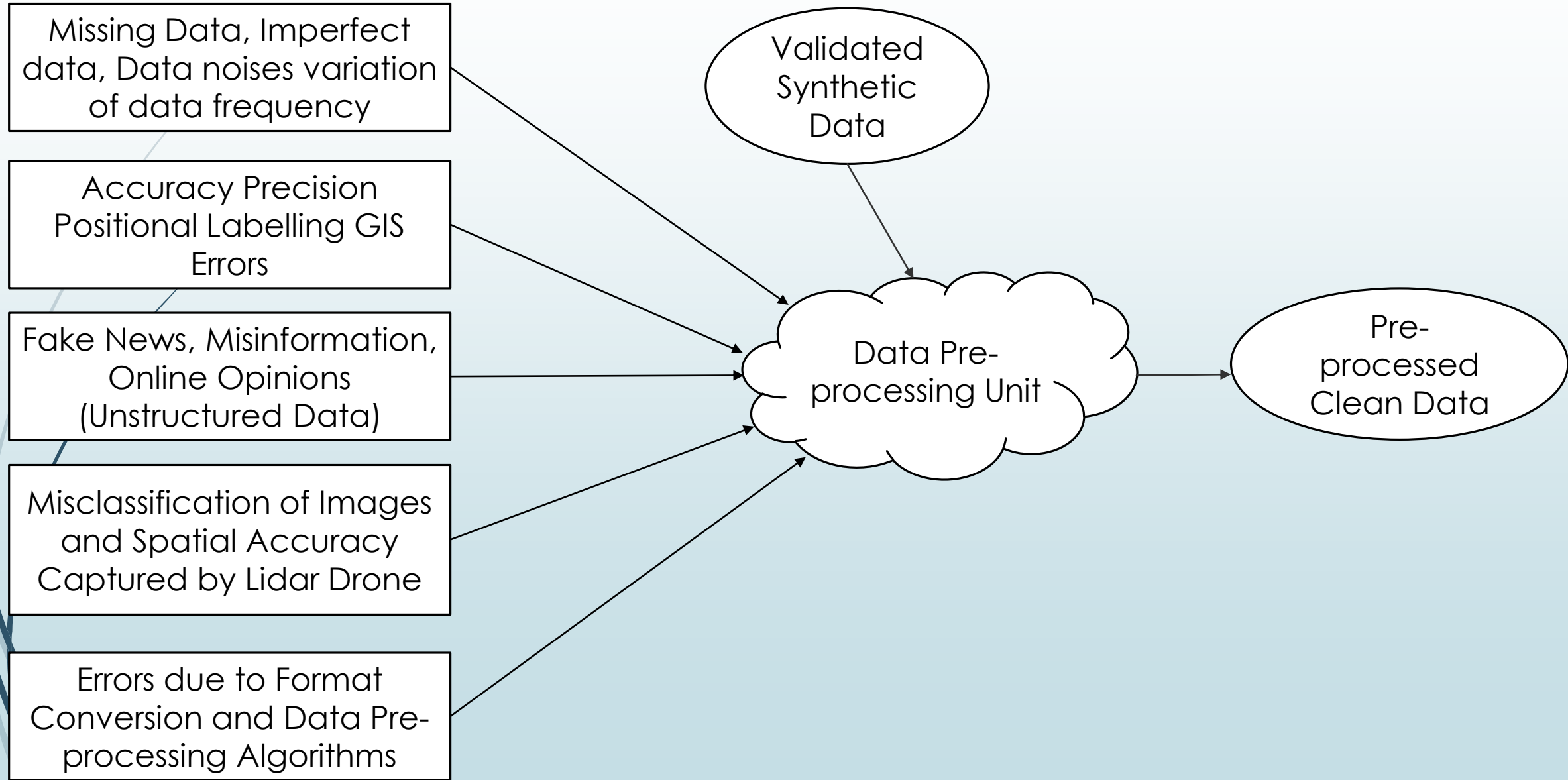
Module-2 Textual Data Analysis



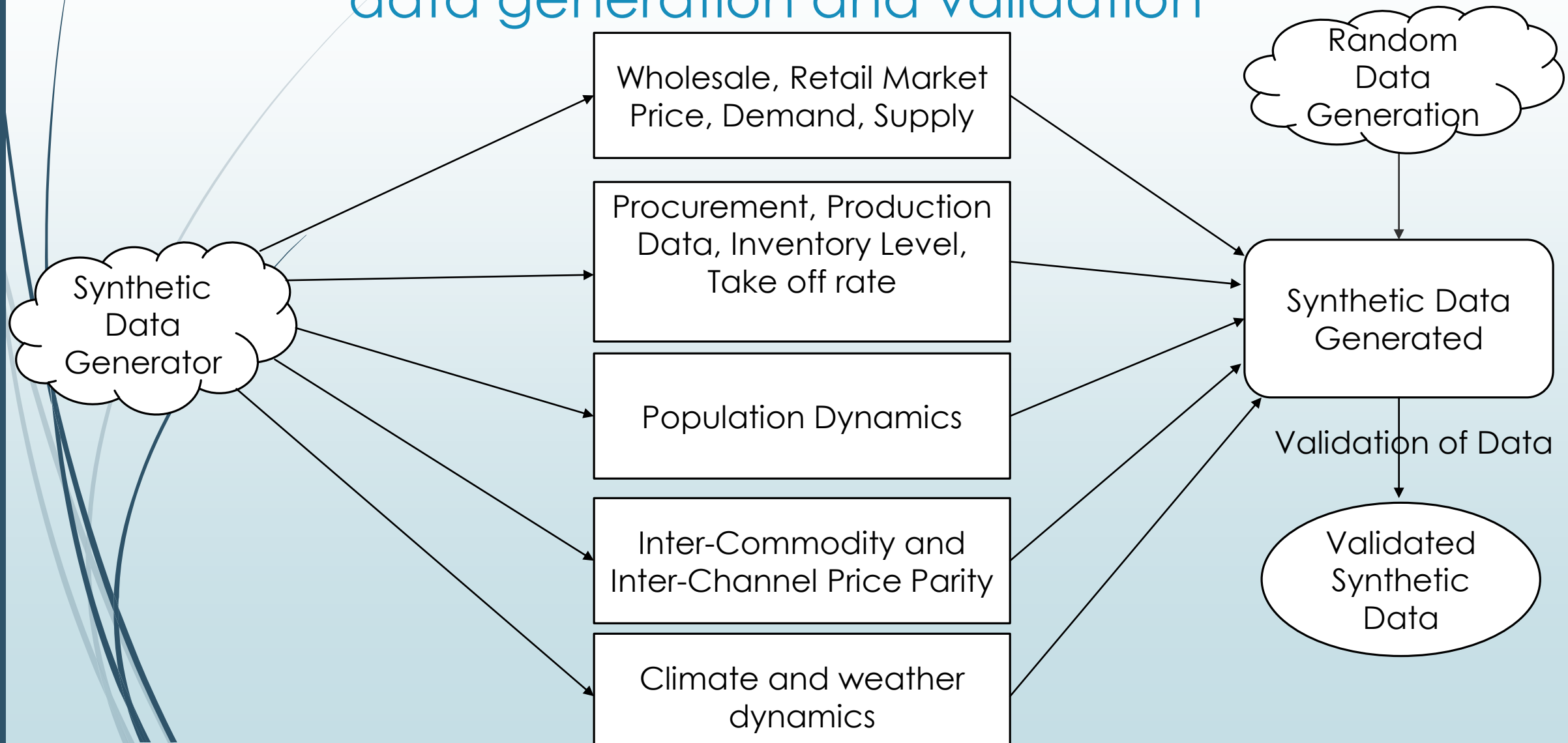
Module 3: GIS and Climate based Data analysis, Image Analysis



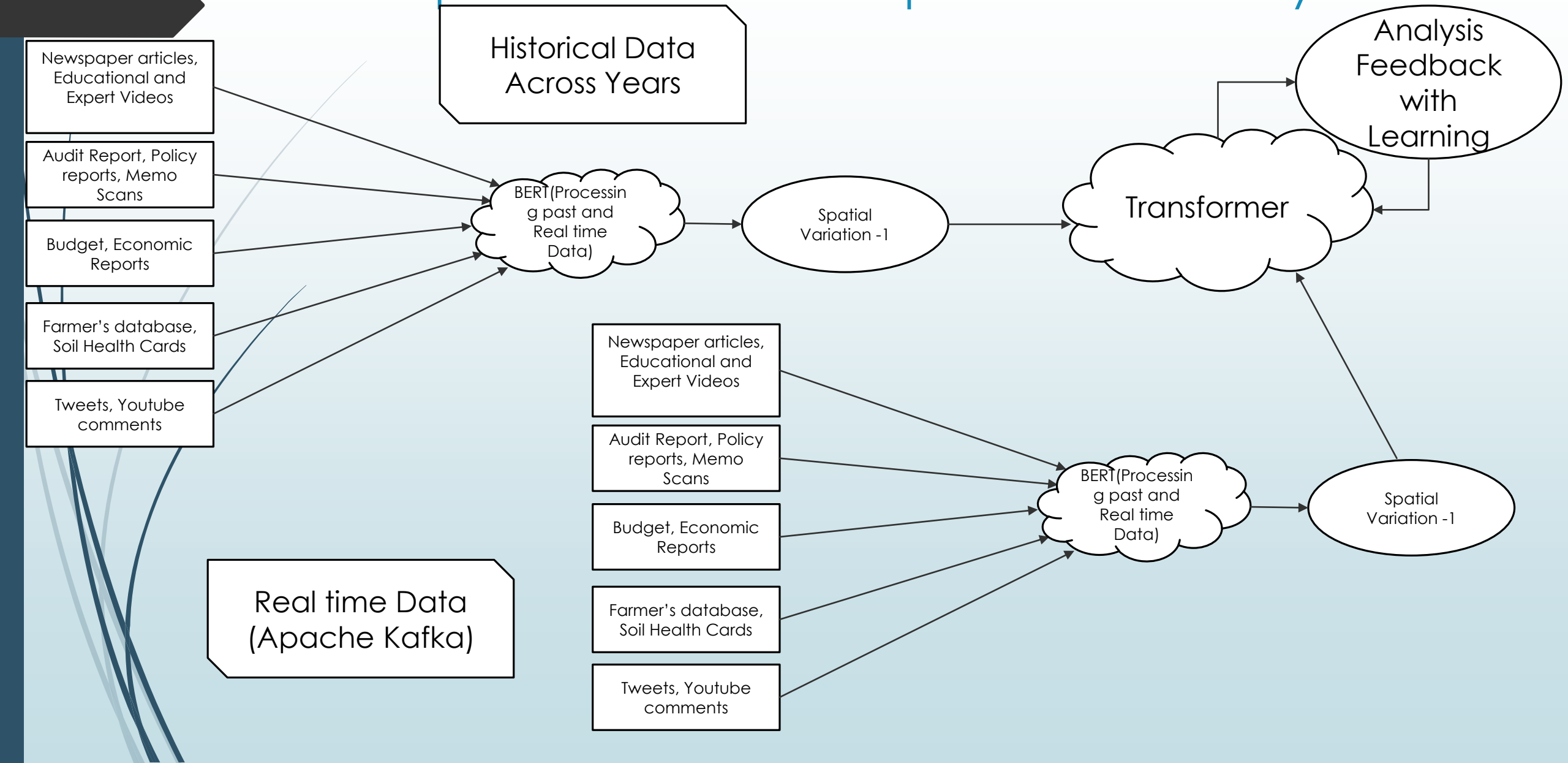
Module 4: Data Cleaning Module



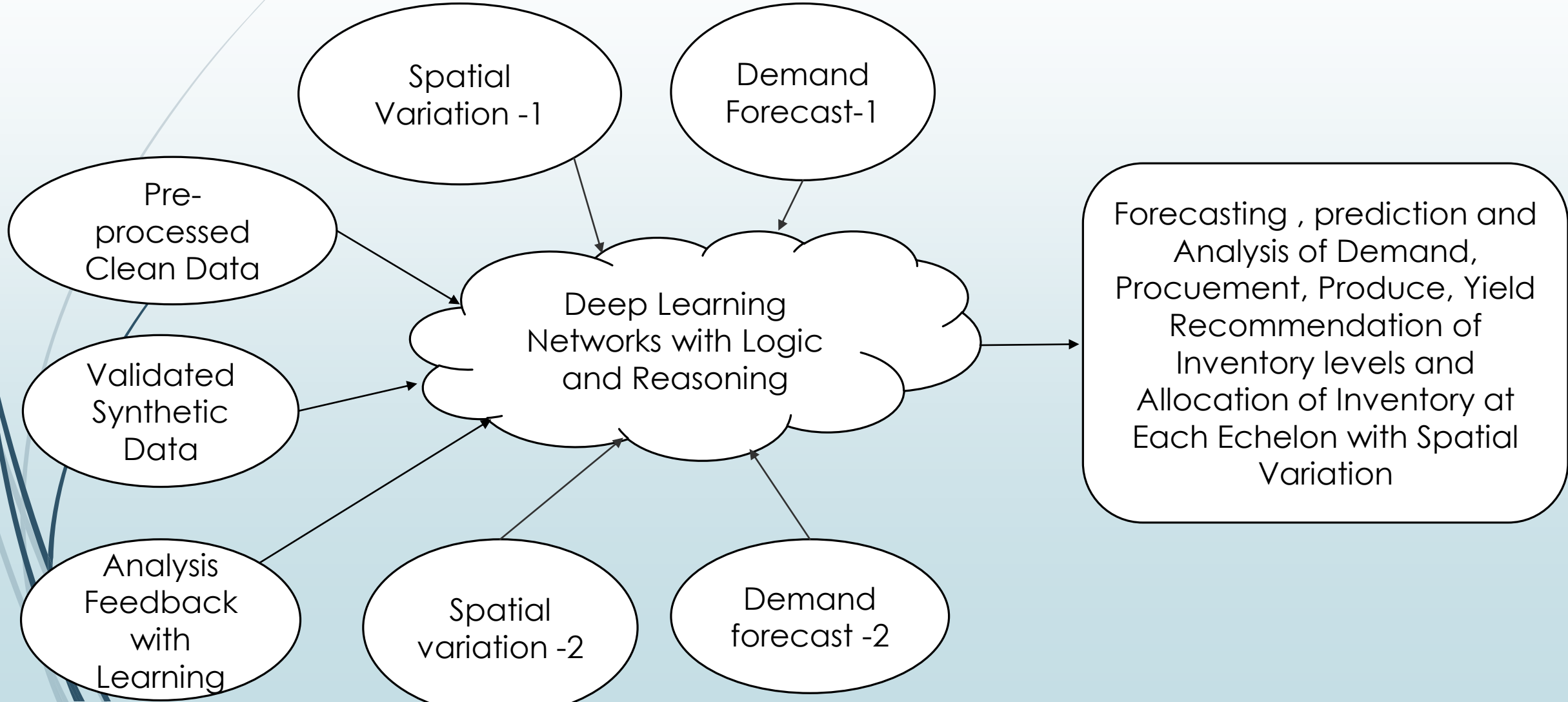
Module 5: Synthetic Data Generation, test data generation and validation



Module 6: Retrograde analysis of food grain policies and other policies in reality



Module 7: Forecasting, Recommendation and Strategic Decision Making Module



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Timeline

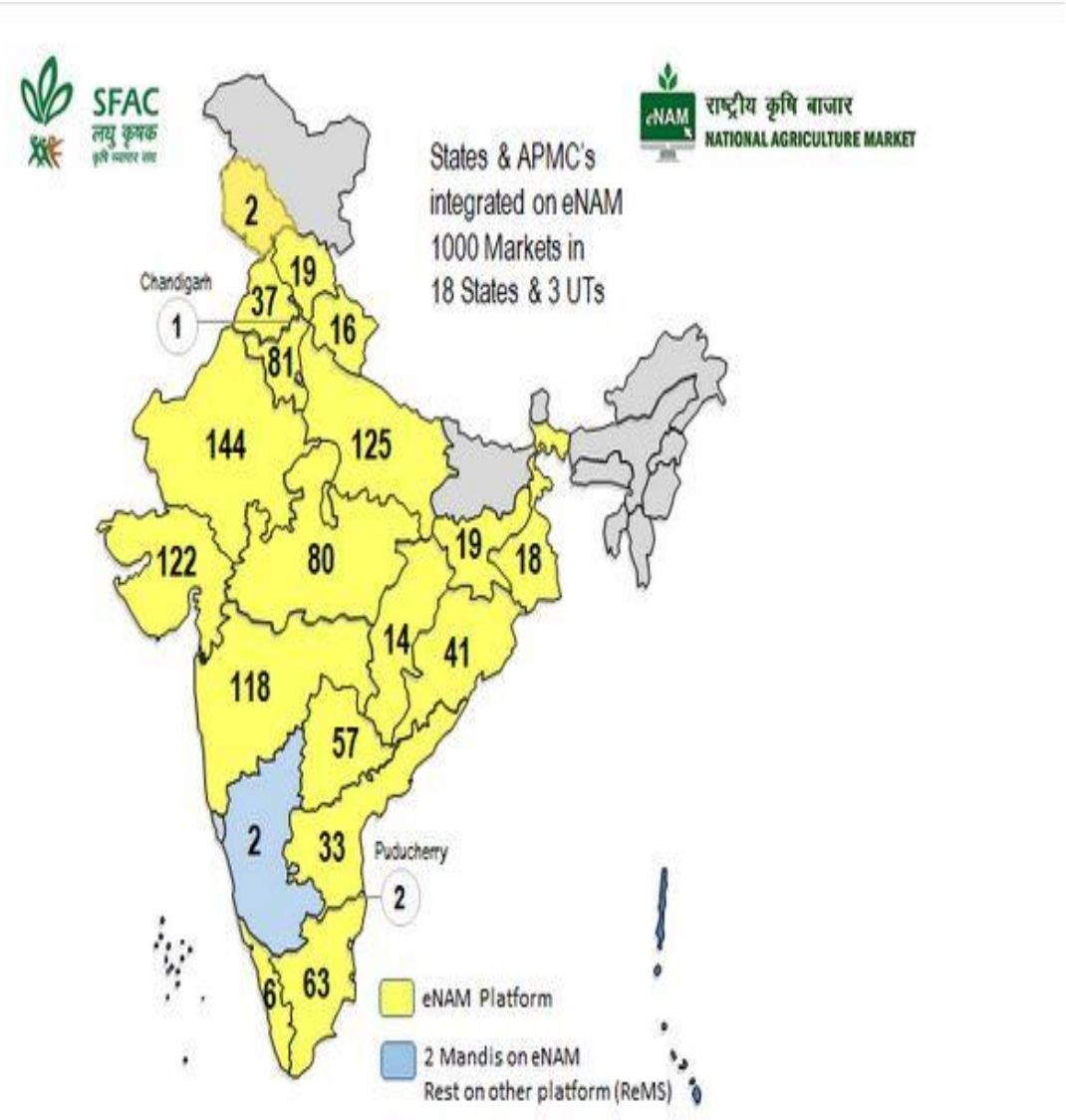
Duration / Activity	Oct 2022-Nov 2022	Nov 2022-Dec 2022	Dec 2022-Jan 2023	Jan 2023 – Feb 2023	Feb 2023-Mar 2023	Mar 2023-Apr 2023	Apr 2023-May 2023	May 2023-June 2023	Jun-July 2023	July-Aug 2023	Aug-Sept 2023
Literature survey											
Module 1											
Module 2											
Module 3											
Module 4											
Module 5											
Module 6											
Module 7											
Combining and Testing											

Budget

S.no	Resource	Amount (Rs)
1.	Members (Human Resource)	6, 00,000
1.	Indiastat District	14,514(for Single District under Regular Plan) with Limited no of tables, Plans could be customized accordingly
1.	LiDAR Drones	8,27,852.50 – 19,04,060.75 ($10,000-23,000) Complex Drones ($50,000-3,00,000) 41,39,262.50-2,48,35,575.00
1.	Landbot (Optional)	
1.	Thermal Sensors (Optional)	1.2 Lakhs
1.	Google TPU (Computational Resource)	Free(for Individual non commercial research GPU), Check Table
1.	AWS (Computational Resource)	Needs Customized Plan
1.	ArcGIS	21,46,900 (ArcGIS pro/Advanced) 11,29,900 (ArcGIS Desktop Standard) 15,800/Year (ArcGIS Student)
1.	QGIS	Free (Open Source)
1.	Python , Java, C++, MongoDB with IDE	Free (Open Source)

TPU v4 Pricing	Price per chip-hour	% discount from on-demand
on-demand / evaluation	$3.22	
1Y CUD (committed use discount) reservation	$2.03	37%
3Y CUD (committed use discount) reservation	$1.45	55%
Preemptible	$0.97	70%

Annexure-I



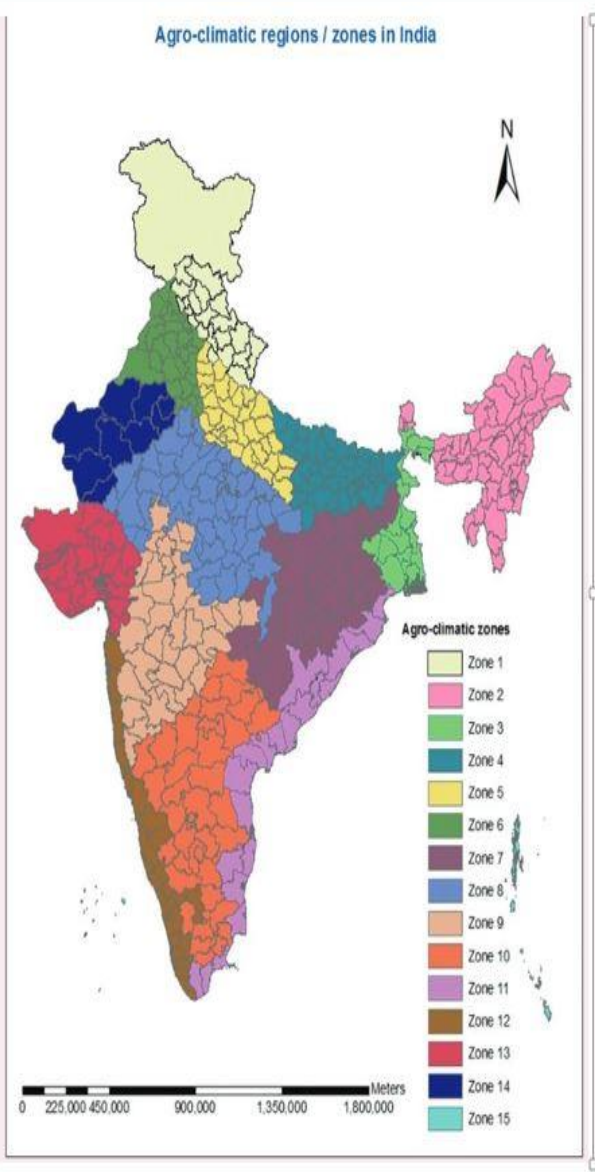


Table 1.2: Agro-climatic regions/zones in India

S.No.	Agro-climatic regions/zones	States represented
I	Western Himalayan region	Himachal Pradesh, Jammu & Kashmir, Uttarakhand
II	Eastern Himalayan region	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, West Bengal
III	Lower Gangetic plain region	West Bengal
IV	Middle Gangetic plain region	Uttar Pradesh, Bihar
V	Upper Gangetic plain region	Uttar Pradesh
VI	Trans Gangetic plain region	Chandigarh, Delhi, Haryana, Punjab, Rajasthan
VII	Eastern plateau and hills region	Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, West Bengal
VIII	Central plateau and hills region	Madhya Pradesh, Rajasthan, Uttar Pradesh
IX	Western plateau and hills region	Madhya Pradesh, Maharashtra
X	Southern plateau and hills region	Andhra Pradesh, Karnataka, Tamil Nadu
XI	East coast plains and hills region	Andhra Pradesh, Odisha, Puducherry, Tamil Nadu
XII	West coast plains and ghat region	Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu
XIII	Gujarat plains and hills region	Gujarat, Dadra & Nagar Haveli, Daman & Diu
XIV	Western dry region	Rajasthan
XV	Island region	Andaman & Nicobar Islands, Lakshadweep

Annexure-I Data Noise

Centre	Rice	Wheat	Atta (Wheat)	Gram Dal	Tur/ Arhar Dal	Urad Dal	Moong Dal	Masoor Dal	Sugar	Milk @	Ground-nut Oil *	Mustard Oil *	Vanaspati *	Soya Oil *	Sunflower Oil	Palm Oil *	Gur	Tea Loose	Salt Pack (Iodised)	Potato	Onion	Tomato
NORTH ZONE																						
CHANDIGARH	20	13	14	42	65	55	58	60	32	25	90	82	62	66	79	55	NR	200	12	16	12	22
DELHI	22	14	17	39	87	69	79	71	38	21	102	61	51	54	65	NR	NR	148	12	23	28	15
HISAR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
KARNAL	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
PANCHKULA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
GURGAON	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SHIMLA	25	NR	17	35	82	64	73	NR	35	20	83	76	50	NR	NR	NR	NR	150	12	22	26	NR
MANDI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
DHARAMSHALA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SOLAN	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SRINAGAR	18	NR	15	46	55	NR	NR	NR	25	20	NR	72	68	NR	NR	NR	NR	192	10	14	12	NR
JAMMU	25	14	16	33	82	NR	NR	NR	35	22	85	73	53	NR	NR	NR	NR	300	12	21	22	NR
AMRITSAR	17	12	15	31	72	50	69	63	32	26	79	NR	50	68	80	NR	NR	240	12	14	21	11
LUDHIANA	18	12	13	30	78	58	60	60	34	25	99	71	49	60	85	46	NR	180	12	16	11	10
BATHINDA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
LUCKNOW	16	11	13	37	80	58	60	68	34	28	92	70	51	NR	93	NR	NR	215	11	20	25	18
KANPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
VARANASI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
AGRA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
JHANSI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
MEERUT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
ALLAHABAD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
GORAKHPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
DEHRADUN	16	13	16	35	75	55	81	NR	35	22	80	55	49	55	NR	NR	NR	140	12	20	24	14
HALDWANI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
RUDRAPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
HARIDWAR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Source:- *State Civil Supplies Dept.* NR -> Not Reported @ -> (Rs./Lt.) * -> (Packed)

Note:- 1. Difference in prices of a commodity at different centres is partly attributed to variety differences. In case of Edible oils and Tea difference in prices is due to ordinary/refined or loose/packed type.

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Centre	Rice	Wheat	Atta (Wheat)	Gram Dal	Tur/ Arhar Dal	Urad Dal	Moong Dal	Masoor Dal	Sugar	Milk @	Ground-nut Oil *	Mustard Oil *	Vanaspati *	Soya Oil *	Sunflower Oil	Palm Oil *	Gur	Tea Loose	Salt Pack (Iodised)	Potato	Onion	Tomato
WEST ZONE																						
RAIPUR	19	19	21	32	71	63	65	58	34	22	76	69	55	54	58	NR	NR	180	10	20	22	NR
DURG	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
AMBIKAPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
BILASPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
JAGDALPUR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
PANAJI	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Lidar Drones

- Drones choice: The payload capacity of both a lidar sensor and RGB camera needs to be taken into consideration.
- About LIDAR Drones:
- Lidar Drone Full Solution Providers
- If you need a full lidar drone solution, then the below providers have packages and expertise to put a full solution together for you.

- OnyxScan Advanced Lidar Systems

Lidar Drones

- About Lidar DraganFly UAS
- Phoenix Lidar Systems
- LidarUSA
- Riegl Laser Measurement Systems
- Xena Sensor Technology

Lidar Drones

- Lidar – Light Detection and Ranging or Lidar is a remote sensing technology where the environment is scanned with a pulsed laser beam and the reflection time of the signal from the object back to the detector is measured.The Time-of-Flight (ToF) reflection time measurement can be used over distances from one meter up to several kilometers. To increase the range of lidar systems, very short laser pulses in the invisible Near Infrared range are used. These enable a far higher laser power compared to continuous wave lasers, while still complying with eye safety requirements.During the scanning process, the lidar system will gather individual distance points within an aggregate of points, from which 3D images of the environment can be computed. The laser scanners deflect the laser beam using deflecting mirrors, which enable them to achieve very wide fields of vision (FoV).Most of the latest UAV lidar systems can rotate around their own axis and offer 360 degree visibility. Modern devices achieve very high data rates with over one million distance points per second.

Lidar Drones

- How Lidar Sensors Works In Brief

1. Emission of a laser pulse
2. Record of the back scattered signal
3. Distance measurement (time of flight x speed of light)
4. Retrieving plane position and altitude
5. Computation of precise echo position

Lidar Drones

- Lidar UAV Uses In Brief

1. Agriculture and forestry
2. Archaeology and cultural heritage documentation
3. Corridor mapping: power line, railway track, and pipeline inspection
4. Topography in open-cast mining
5. Construction site monitoring

Lidar Drones

1. Building and structural inspections
2. Surveying of urban environments
3. Resource management
4. Collision avoidance
5. Shoreline and storm surge modeling
6. Hydrodynamic modeling
7. Digital Elevation Models

Lidar Drones

S.no	Lidar Drones
1	DJI M600 Pro lidar quadcopter
2	Draganflyer Commander
3	Riegl RiCopter Lidar UAV
4	Harris H4 Hybrid HE UAV
5	VulcanUAV Harrier Industrial
6	VelosUAV helicopter
7	Robota Eclipse fixed wing drone
8	DJI Matrice 200 Series quadcopter
9	OnyxStar Xena drone lidar
10	OnyxStar Fox-C8 HD quadcopter
11	GeoDrone X4L lidar quadcopter
12	Tron F9 VTOL fixed wing lidar
13	Boreal long range fixed wing drone
14	Vapor 55 UAV helicopter
15	DJI Matrice 600
16	DJI Matrice 600 Pro