Understanding the Relationships Between Logistics Performance and International Trade

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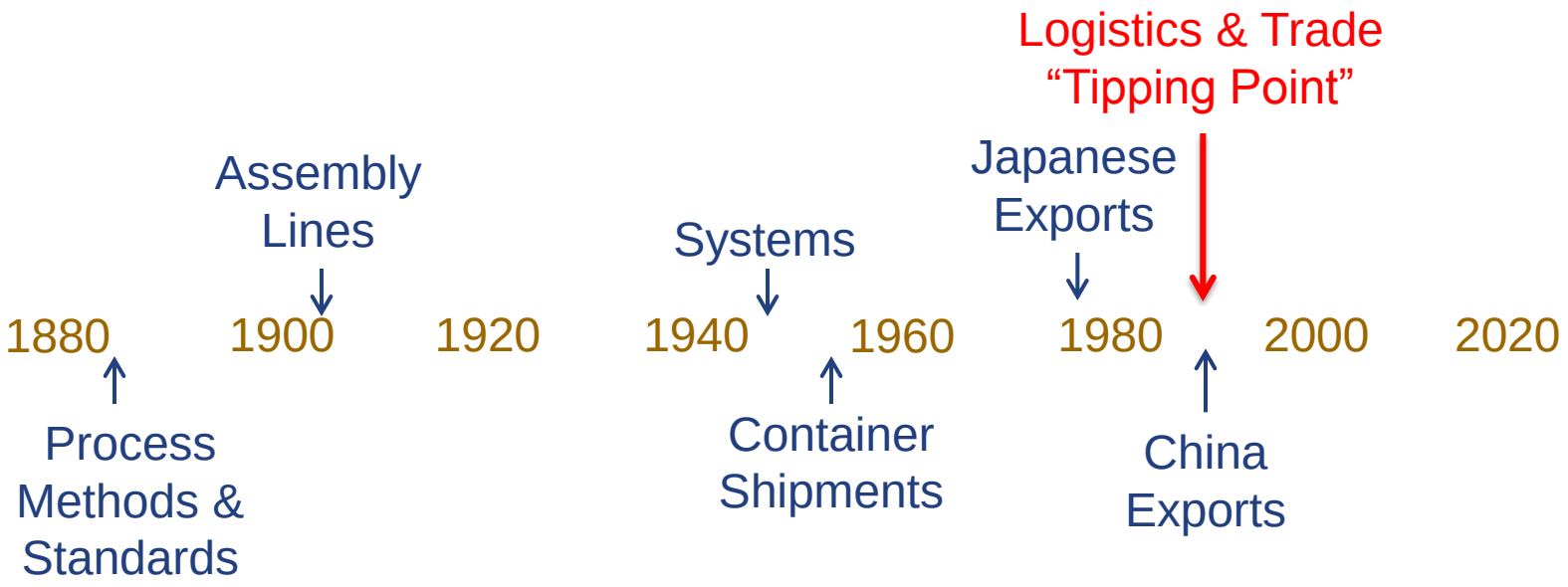
Georgia Tech Supply Chain & Logistics Institute

- Education
- Research
- Industry Collaboration
- Global Outreach

- A unit of the School of Industrial & Systems Engineering
- Ranked #1 Industrial Engineering Program for 20 consecutive years
- World's largest supply chain & logistics research and education unit

Georgia Tech Supply Chain & Logistics Research and Innovation Centers

Evolution of Logistics & Trade



Supply Chains

"Manufacturing" Focus → "Manufacturing & Logistics" Focus

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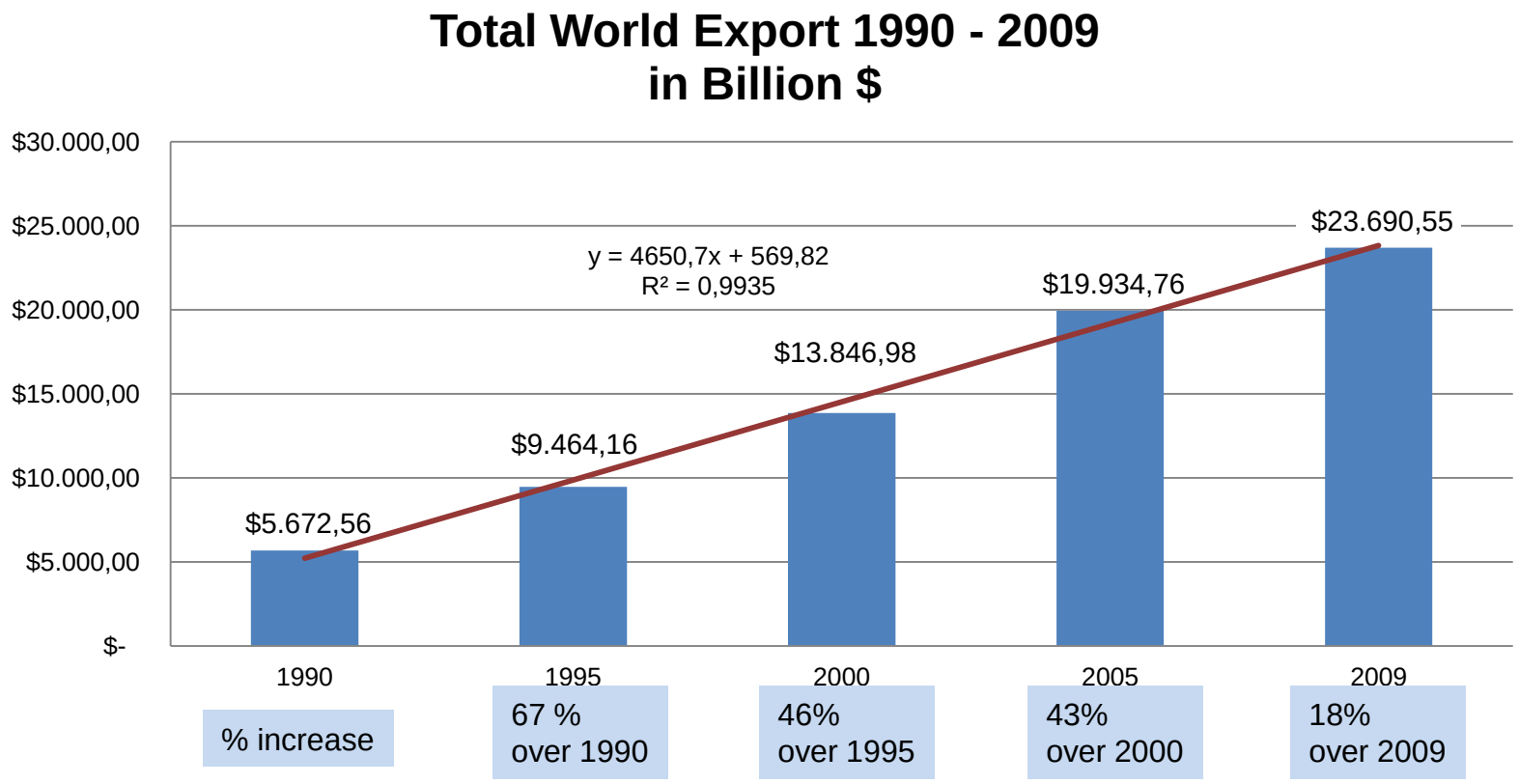
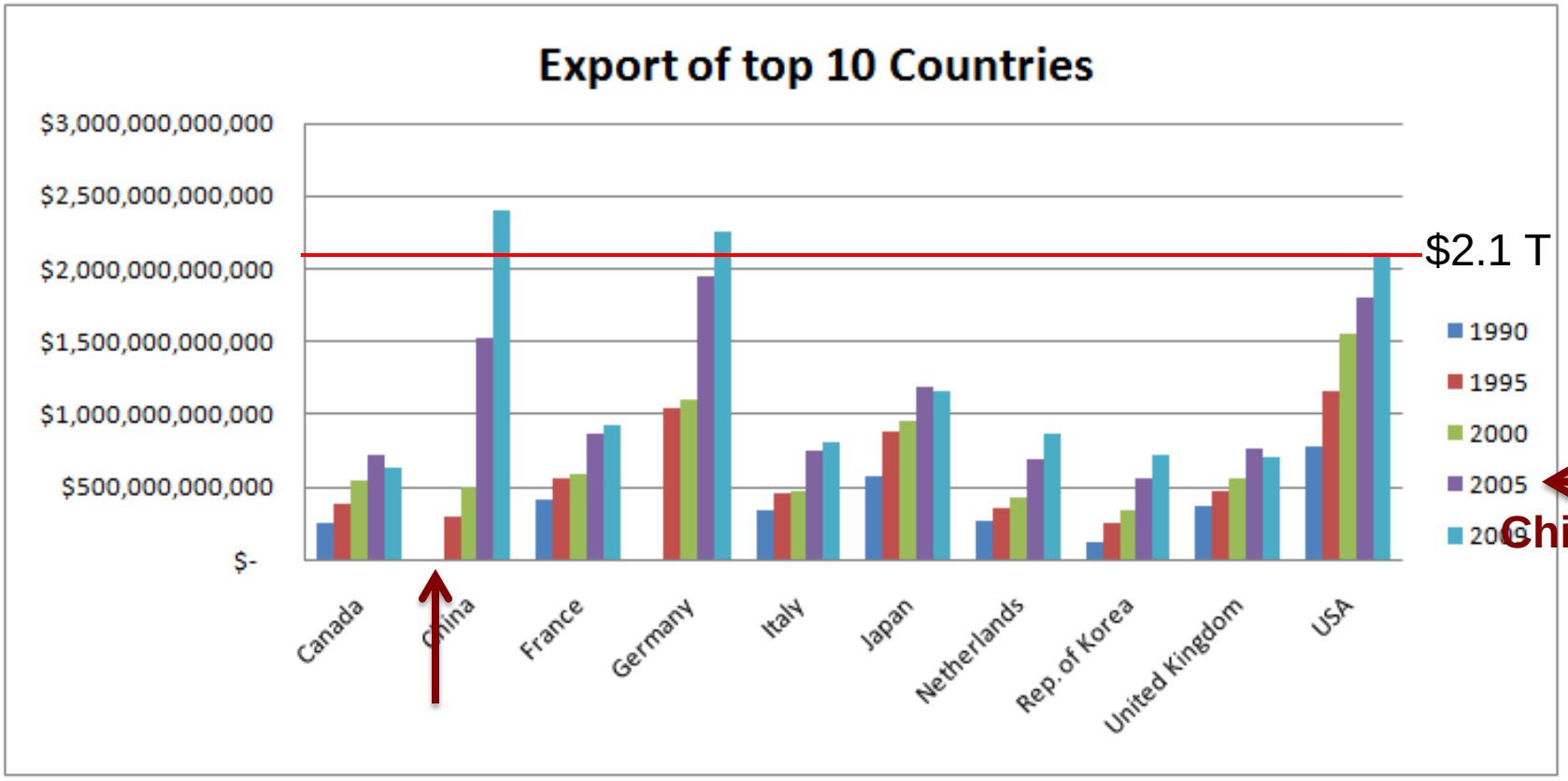
Expansion of Trade – A Supply Chain Revolution



Exporting Countries



- China exports today about the same as everyone else combined in 1990
- Top ten have more than half of total exports

World's Largest Container Ports (million TEUs)

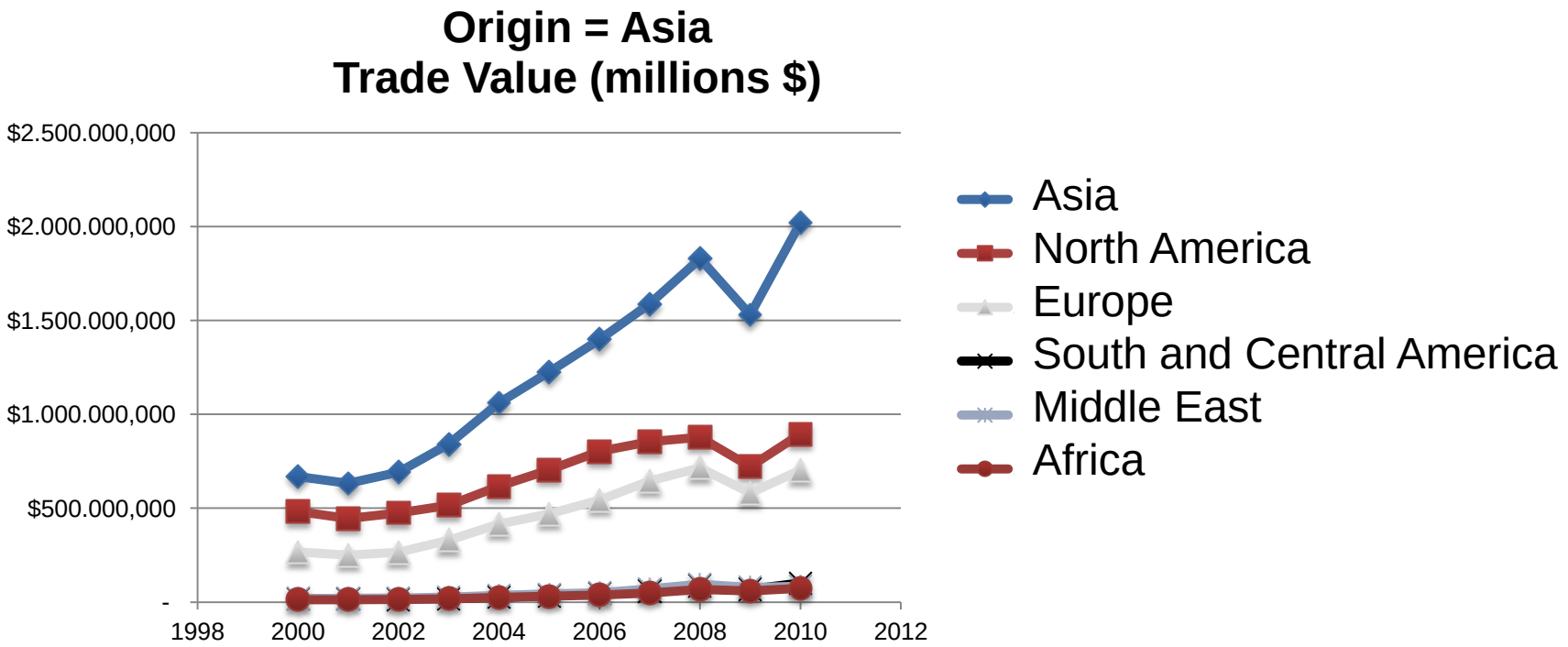
1989		2009	
Hong Kong	4.5	Singapore	25.8
Singapore	4.4	Shanghai *(China)*	25.0
Rotterdam *(Netherlands)*	3.9	Hong Kong	20.9
Kaohsiung *(Taiwan)*	3.4	Shenzhen *(China)*	18.2
Kobe *(Japan)*	2.5	Busan *(South Korea)*	11.9
Busan *(South Korea)*	2.2	Guangzhou *(China)*	11.2
Los Angeles *(United States)*	2.1	Dubai *(United Arab Emirates)*	11.1
New York/New Jersey *(United States)*	2.0	Ningbo *(China)*	10.5
Keelung *(Taiwan)*	1.8	Qingdao *(China)*	10.2
Hamburg *(Germany)*	1.7	Rotterdam *(Netherlands)*	9.7
Long Beach *(United States)*	1.5	Tianjin *(China)*	8.7
Yokohama *(Japan)*	1.5	Kaohsiung *(Taiwan)*	8.5
Antwerp *(Belgium)*	1.5	Antwerp *(Belgium)*	7.3
Tokyo *(Japan)*	1.4	Port Klang *(Malaysia)*	7.3
Felixstowe *(Britain)*	1.4	Hamburg *(Germany)*	7.0

- **China has made huge investments in logistics infrastructure**
- **Very "export" focused**

Logistics and Trade Mega Trends

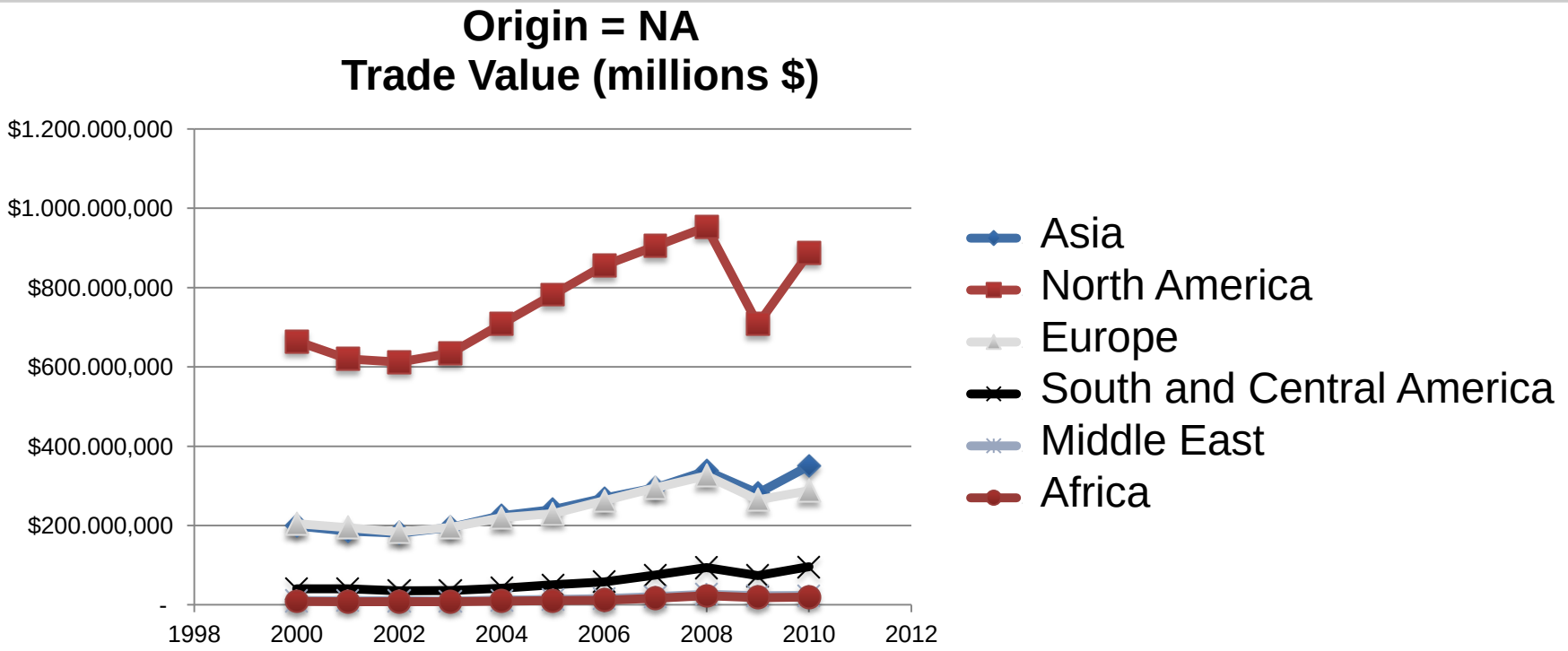
- Globalization of manufacturing
  - Geographically diverse supply chain networks
  - Intraregional trade increasing faster than interregional trade
- Increasing attention on logistics
  - Focus on lean means less “slack” in supply chains
  - Focus on total landed cost (manufacturing, transportation and inventory)
  - More shipper control of shipment decisions
  - More carrier focus on service (e.g., Maersk Daily)
- Computing advances
  - Increased capability for supply chain visibility
  - Dramatic increase in data
  - Increased availability of decision technology
- Increasingly complex supply chains
  - Dramatic increase in difficulty
  - Increasing need for process standardization and supply chain integration
  - Necessity for modeling and analytics to deal with complexity
  - Lack of logistics knowledge and analytical capability is a major barrier to trade growth

Asia Regional Trade



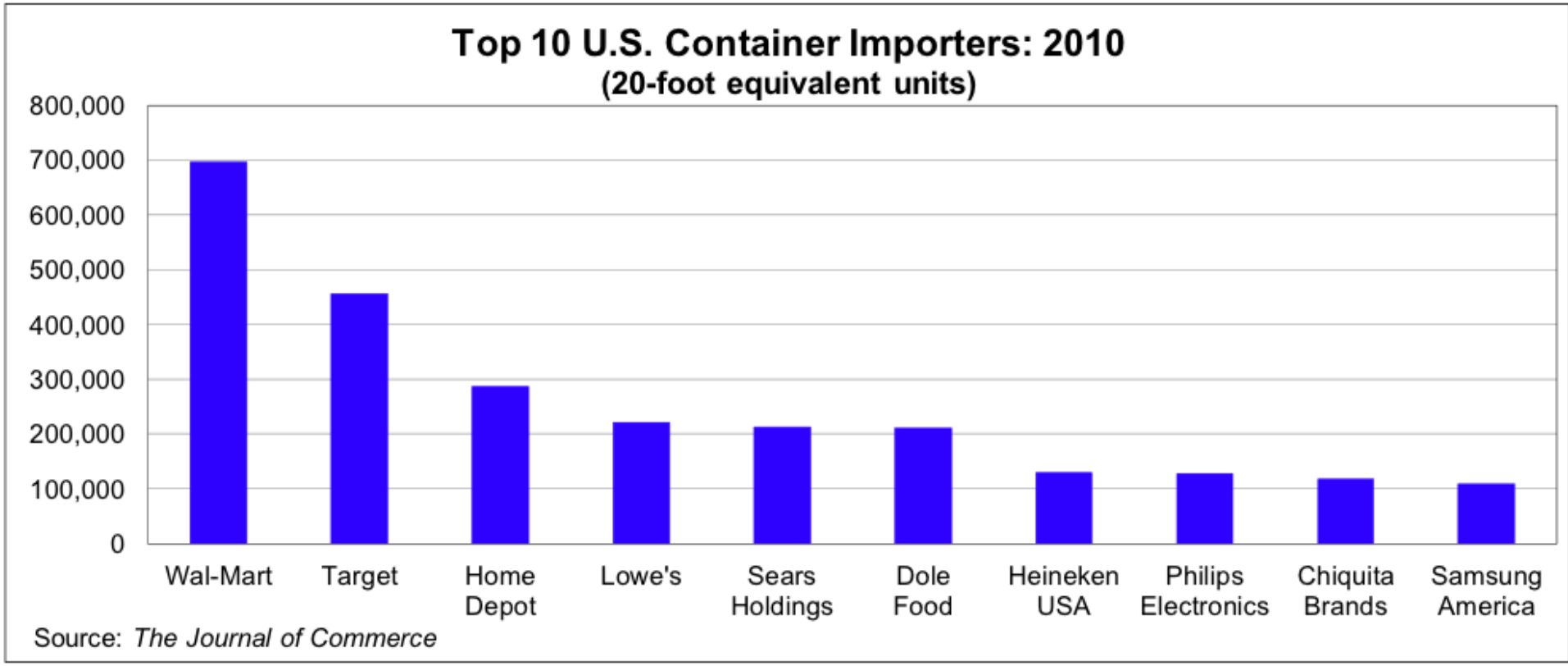
- Asia to Asia is growing at a much faster rate the Asia to any other region.
- Asia to Asia is bigger than Asia to all other regions combined.
- Asia to NA and Asia to Europe are growing at approximately the same rates.
- Asia to Asia in 2010 recovered to approximate trend before 2009 downturn.

North America Regional Trade



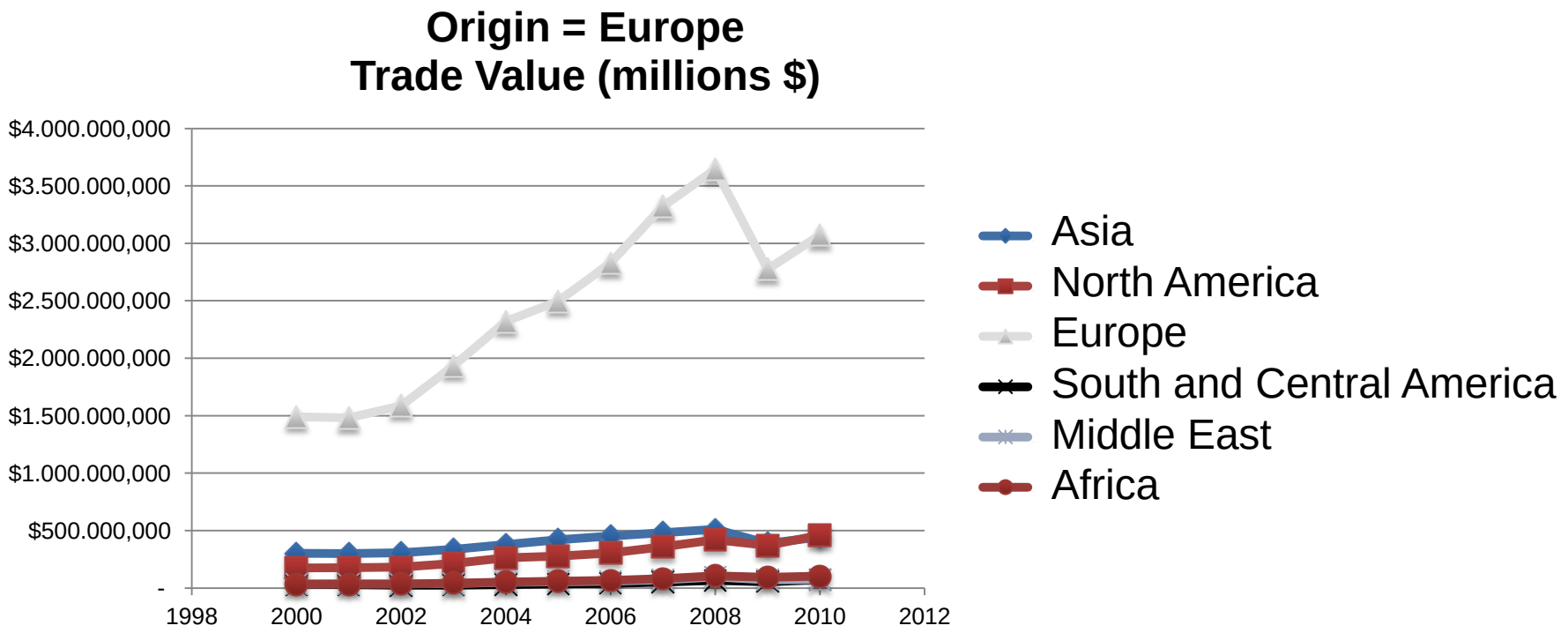
- NA to NA is growing at a much faster rate than NA to any other region.
- NA to NA is bigger than NA to all other regions combined.
- NA to NA is about half as big as Asia to Asia.
- NA to NA in 2010 only recovered to 2007 level.

US Imports



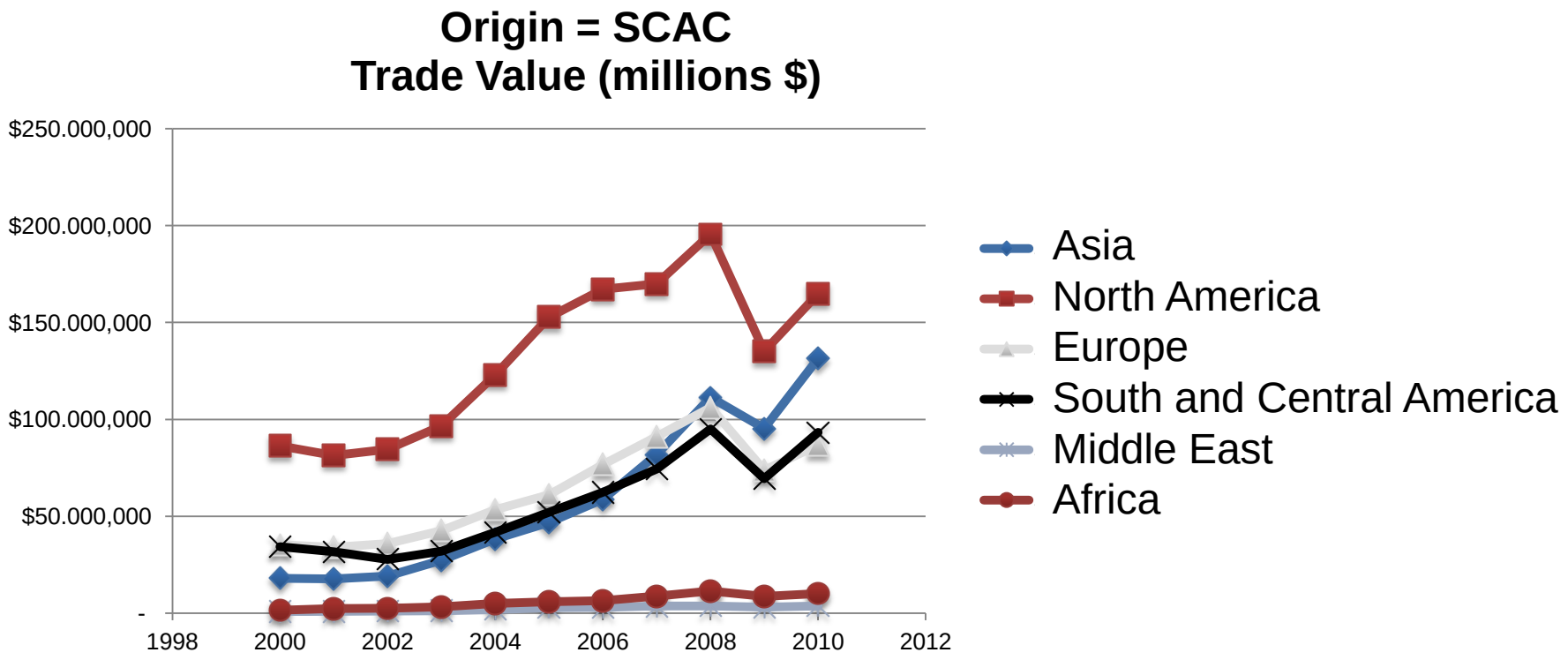
- Dominated by big retailers

Europe Regional Trade



- Europe to Europe is growing at a much faster rate than Europe to any other region.
- Europe to Europe is bigger than Europe to all other regions combined.
- Europe to Europe is almost twice as big as Asia to Asia.
- Europe to Europe is four times as big as NA to NA.
- Europe to Europe in 2010 has not recovered to 2007 level.

South and Central Regional Trade



- Prior to 2009 SCAC to SCAC was growing at approximately the same rate as SCAC to NA, Europe and Asia.
- SCAC to Asia recovered to approximately the same trend as before 2009 while SCAC to NA recovered to about 2006 and 2007 levels.

Why is SCAC intraregional trade less than interregional trade?

Latin America and US Container Ports (million TEUs)

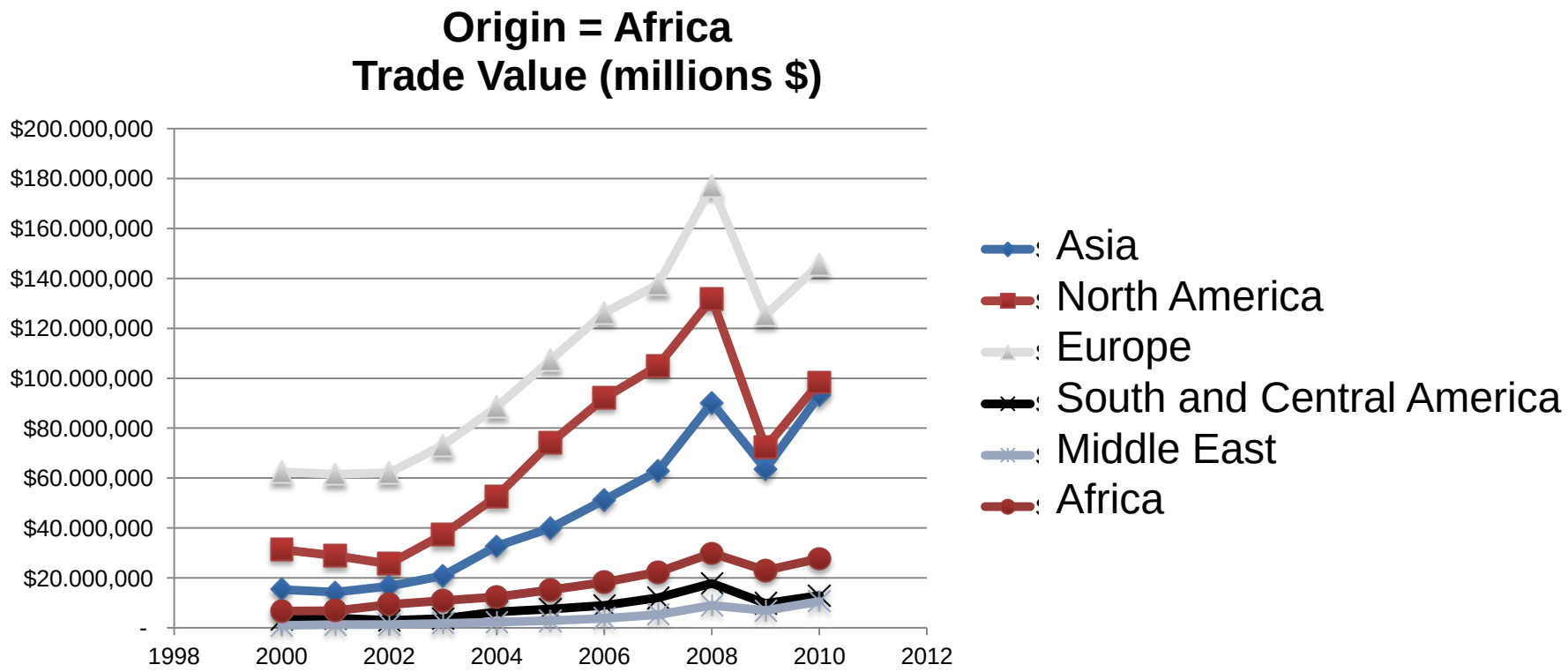
Latin America 2009

- #54 Balboa 2.01
- #62 Kingston 1.69
- #70 Buenos Aires 1.41
- #71 Manzanillo 1.41
- #85 Cartagena 1.14
- #87 Manzanillo Mexico 1.11
- #88 Callao Peru 1.09

USA 2009

- #16 Los Angeles 6.75
- #18 Long Beach 5.07
- #21 New York/New Jersey 4.56
- #42 Savannah 2.36
- #53 Oakland 2.05
- #60 Houston 1.80
- #61 Hampton Roads 1.75
- #63 San Juan 1.67
- #64 Seattle 1.58
- #67 Tacoma 1.55
- #82 Charleston 1.18
- #103 Miami .81

Africa Regional Trade



- Africa to Africa trade is small and not growing as fast as Africa to Europe, NA and Asia.
- Prior to 2009 Africa to Europe and Africa to NA were growing at about the same rates.

Relationships Between Logistics Performance and International Trade

- **Production**
  - Cost
  - Quality

Logistics

- **Demand**
  - Price
  - Quality

- **Logistics Performance Factors**
  - Intermediary cost
  - Transport cost
  - Inventory cost
  - Storage cost
  - Quality loss
  - Dependability
  - Time

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Different Logistics Perspectives

- Infrastructure/service providers
  - Examples: Ports, Railroads
  - Decision influences: capacity, revenue growth, costs and service
- Carriers
  - Examples: Container lines, trucking companies, airlines
  - Decision influences: competition, revenue, utilization/balance, costs, inertia and ignorance
- Shippers
  - Examples: Retailers, manufacturers
  - Decision influences: transportation cost, inventory on books, speed, reliability, risk, inertia and ignorance
- Government
  - Examples: Customs
  - Decision influences: revenue, regulations and budgets

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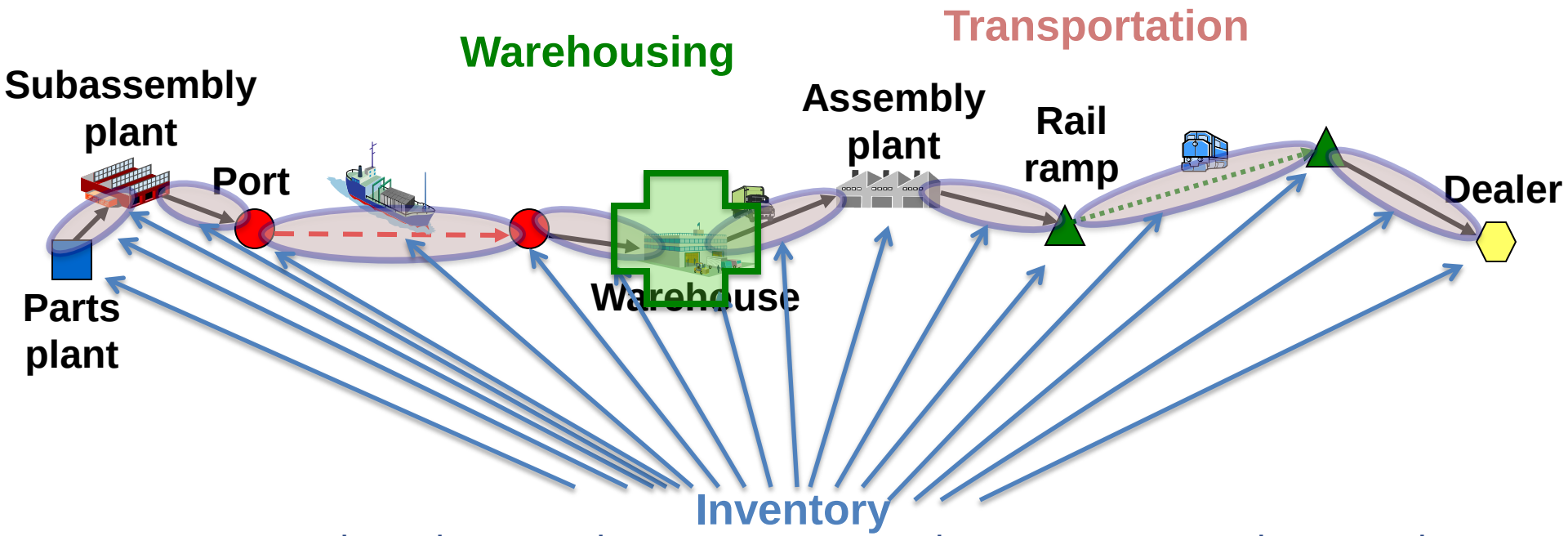
How has "globalization" changed logistics?



- Transportation – increased
- Inventory – increase and moved
- Warehousing – limited change

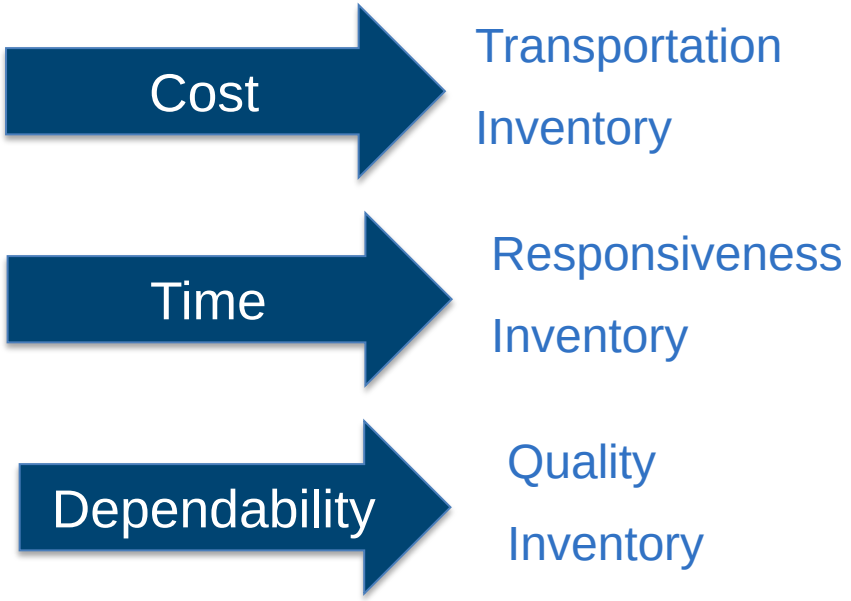
- Time to customer – increased
- Variability – increased
- Complexity – increased
- Technology – increased

Logistics performance increasingly more critical to competiveness!

Supply Chain and Logistics Performance

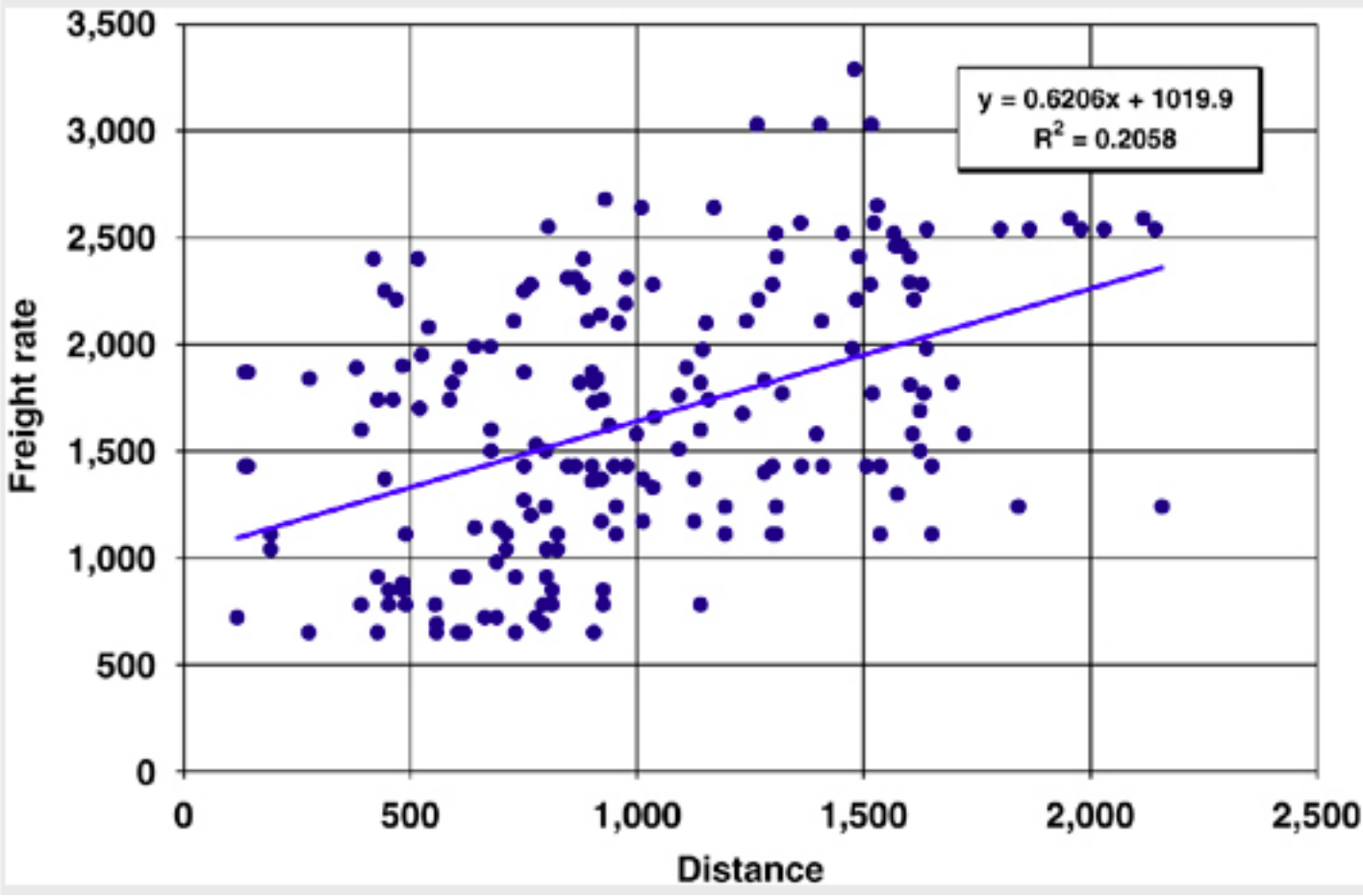
- Individual enterprise “logistics” performance
  - Usually the focus of each enterprise

- **Supply chain “network” performance**
  - Major concern of the shippers
  - Key to export competiveness



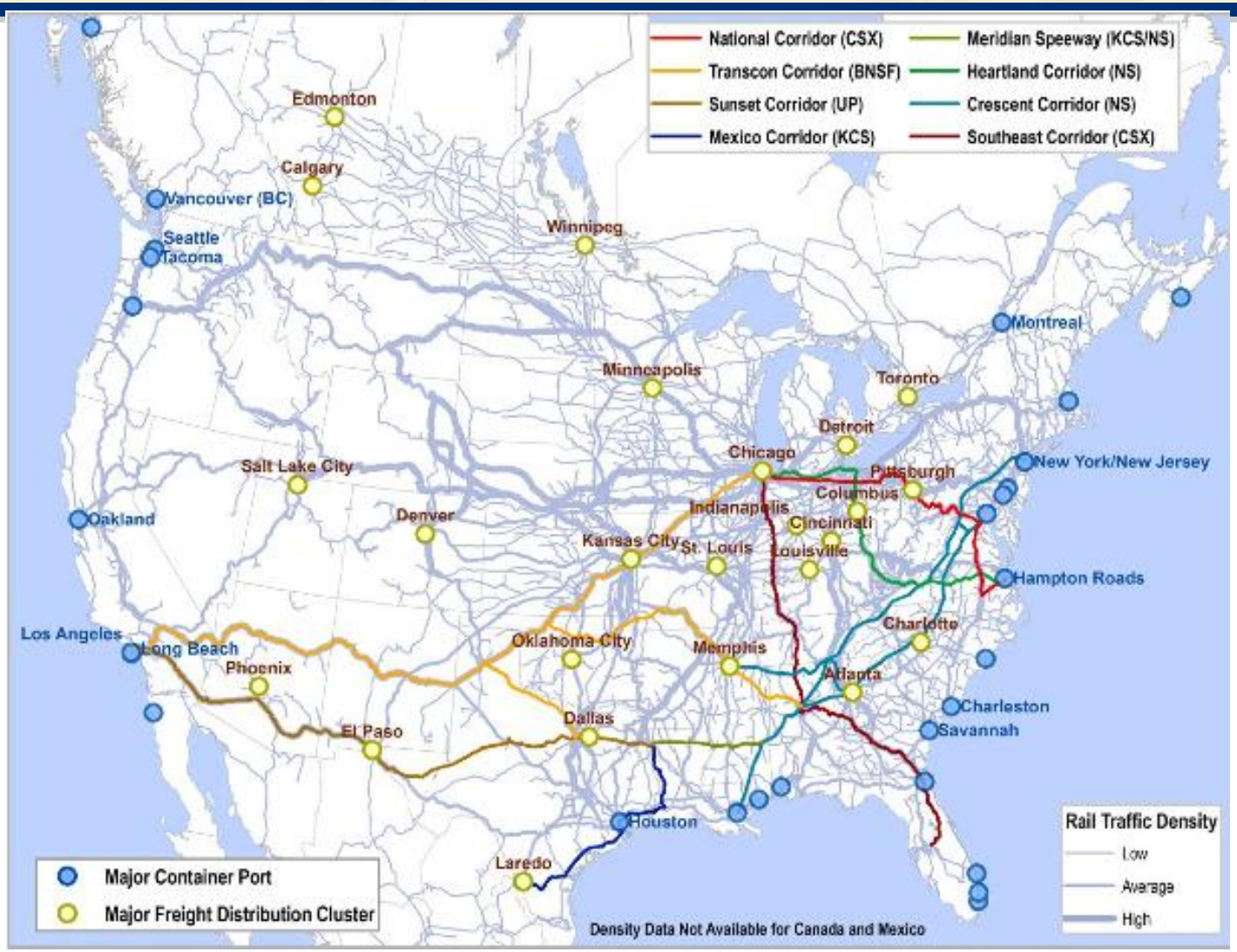
Cost – Freight Rates

- Distance
- Time
- Flow balance
- Competition



Ref: "Liner Shipping Connectivity and Port Infrastructure as Determinants of Freight Rates in the Caribbean," Gordon Wilmsmeier and Jan Hoffmann

Impact of Global Trade on Transportation

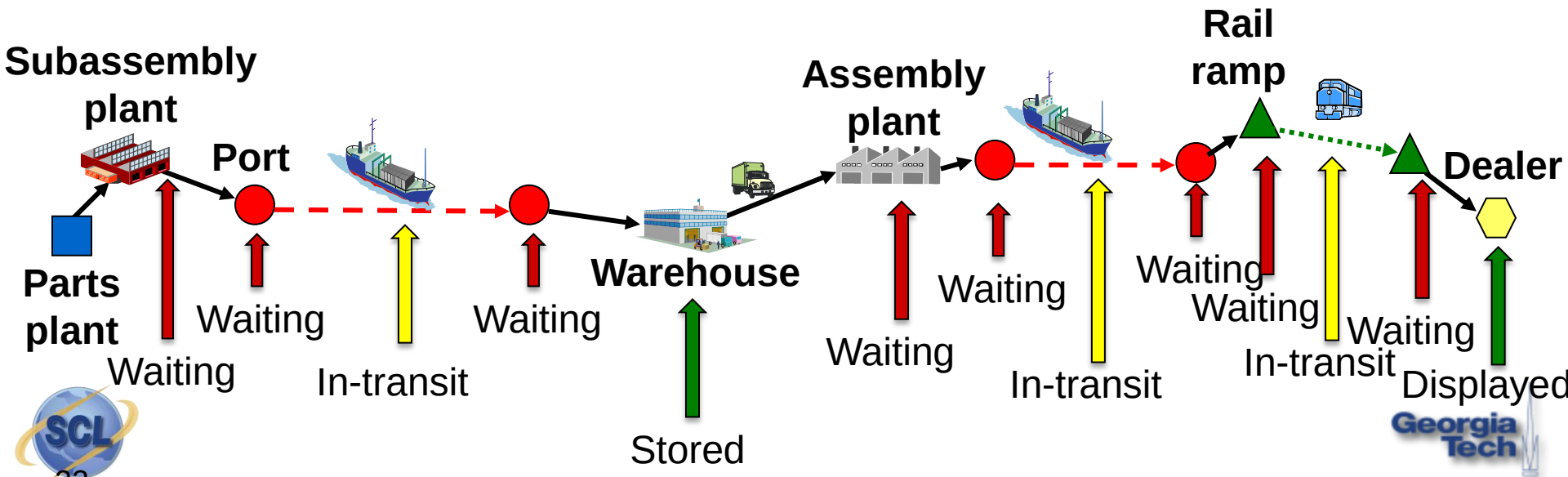


Major American Rail Corridors Improved since 2000

Impact of Globalization on Inventory

- Where is the inventory?
- Why is it there?
- How much is where?

- Inventory in every element of the supply chain
- “Waiting” inventory is a particular problem
- Less inventory in warehouses
- Not good visibility of aggregate inventory



How is inventory measured?

- Days of inventory
  - Amount of inventory divided by average demand per day
    - 200 cars at dealer
    - Average 5 cars sold per day
    - 200/5 = 40 days of inventory
- Inventory turns
  - 365 days divided by average days of inventory
    - Average days of inventory = 40
    - Inventory turns = 365/40 = 9.125 turns/year
- Inventory cost
  - Generally expressed as a percent of inventory value (5% to 50%)
  - A $36,500 car at 10% = ($36,500*10%)/365 = $10/day
- Increasingly inventory will drive transportation decisions!

Inventory and Stock Out Costs

- Components of inventory cost
  - Capital (% of cost)
  - Insurance (% of cost)
  - Obsolesce (sometimes % of cost)
  - Storage (not % of cost)
  - Handling (not % of cost)
- Components of stock out cost
  - Lost sales (may include companion products)
  - Lost customers (may influence other customers)
- Notes
  - In-transit inventory cost should not include storage or handling costs
  - Stock out cost are very dependent on the situation
  - Many retailers plan on rarely running out of stock

Daily Inventory Cost

Products	Retail Value per 40 Foot Container		Inventory Cost per Day Low Value Product		Inventory Cost per Day High Value Product	
	Low	High	Rate = 10%	Rate = 40%	Rate = 10%	Rate = 40%
Clothing (low value)	$225,000	$520,000	$61.64	$246.58	$142.47	$569.86
Clothing (mid range)	$500,000	$3,600,000	$136.99	$547.95	$986.30	$3,945.21
Sport shoes	$350,000	$2,520,000	$95.89	$383.56	$690.41	$2,761.64
Bicycles	$240,000	$480,000	$65.75	$263.01	$131.51	$526.03
Toys (low quality)	$60,000	$720,000	$16.44	$65.75	$197.26	$789.04
Consumer electronics (small)	$170,000	$430,000	$46.58	$186.30	$117.81	$471.23
Consumer electronics (large)	$70,000	$140,000	$19.18	$76.71	$38.36	$153.42
Appliances (small)	$45,000	$100,000	$12.33	$49.32	$27.40	$109.59
Appliances (large)	$30,000	$65,000	$8.22	$32.88	$17.81	$71.23
Furniture (assembled)	$20,000	$150,000	$5.48	$21.92	$41.10	$164.38
Furniture (flat packed)	$70,000	$360,000	$19.18	$76.71	$98.63	$394.52
Automobile parts	$50,000	$375,000	$13.70	$54.79	$102.74	$410.96

Source OCED (2005) DSTI/DOP/MTC(2005)5REV1

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Balance Sheet

PANAMA MOTORS CORP		
10-K		
2/28/11		
Balance Sheet		
	December 31,	
	2009	2010
ASSETS		
Current Assets		
Cash and cash equivalents	$24,549	$23,774
Marketable securities	2,139	138
Total cash and marketable securities	26,688	23,912
Accounts and notes receivable, net	9,659	8,216
Inventories	14,939	13,921

Stock prices are often hurt by increasing inventory on balance sheets
Often inventory is manipulated at end of reporting periods

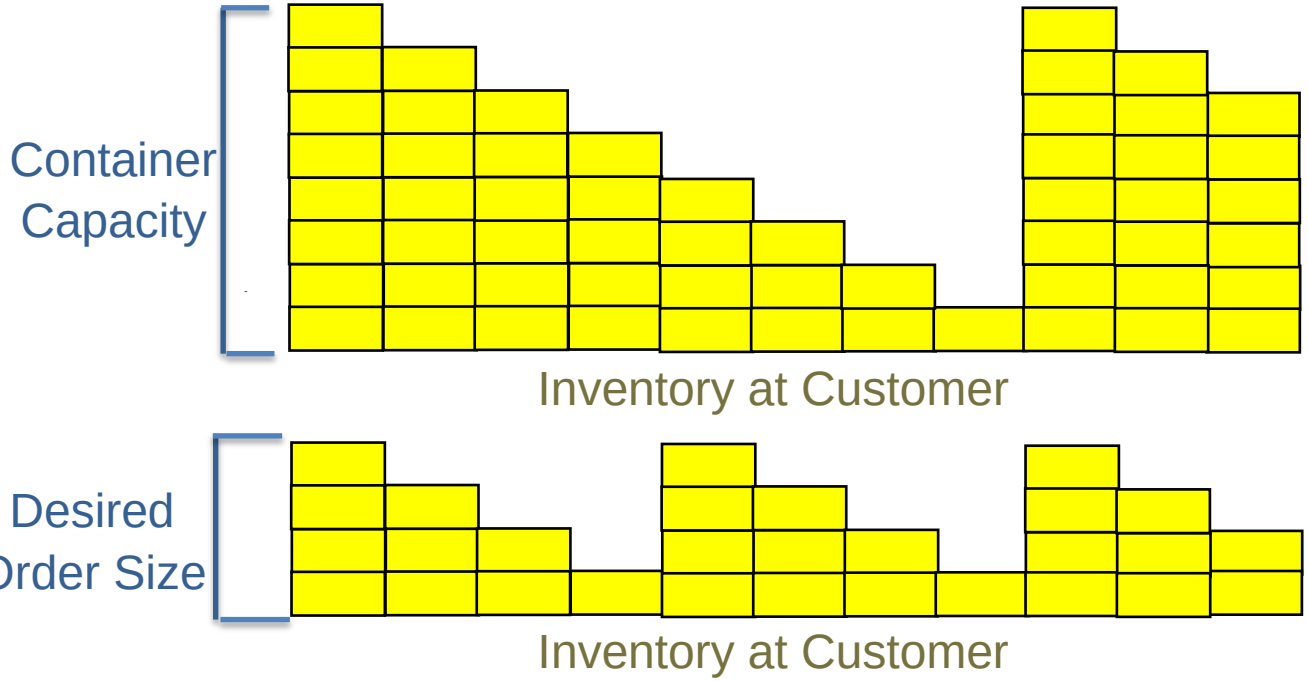
Panama Motors Inventory Performance

- Days of Inventory = (Inventory/(Annual cost of goods sold))*365
- Inventory turns = (Annual cost of goods sold)/Inventory

	2009	2010
Inventories	14,939	13,921
Automotive cost of sales	166,259	163,742
Days of inventory	33	31
Inventory turns	11.1	11.8

- Note: these are “point” measures
- When would these measures look best?

Cost - “Full Container” Shipments



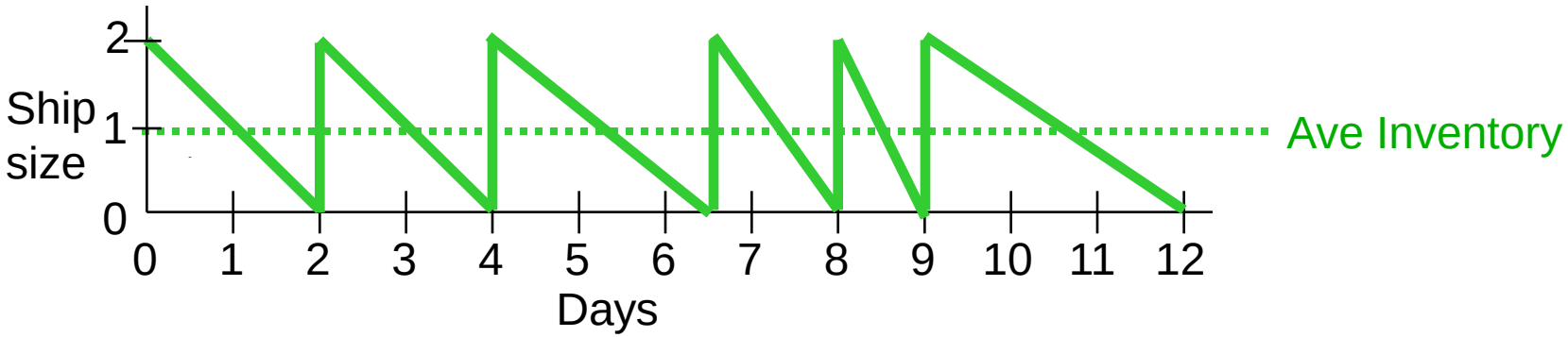
Increased inventory

Increased transportation cost and time

- Full containers not a problem for large volume exporters
- Decreases competiveness for start up exporters
- Particularly important for refrigerated products

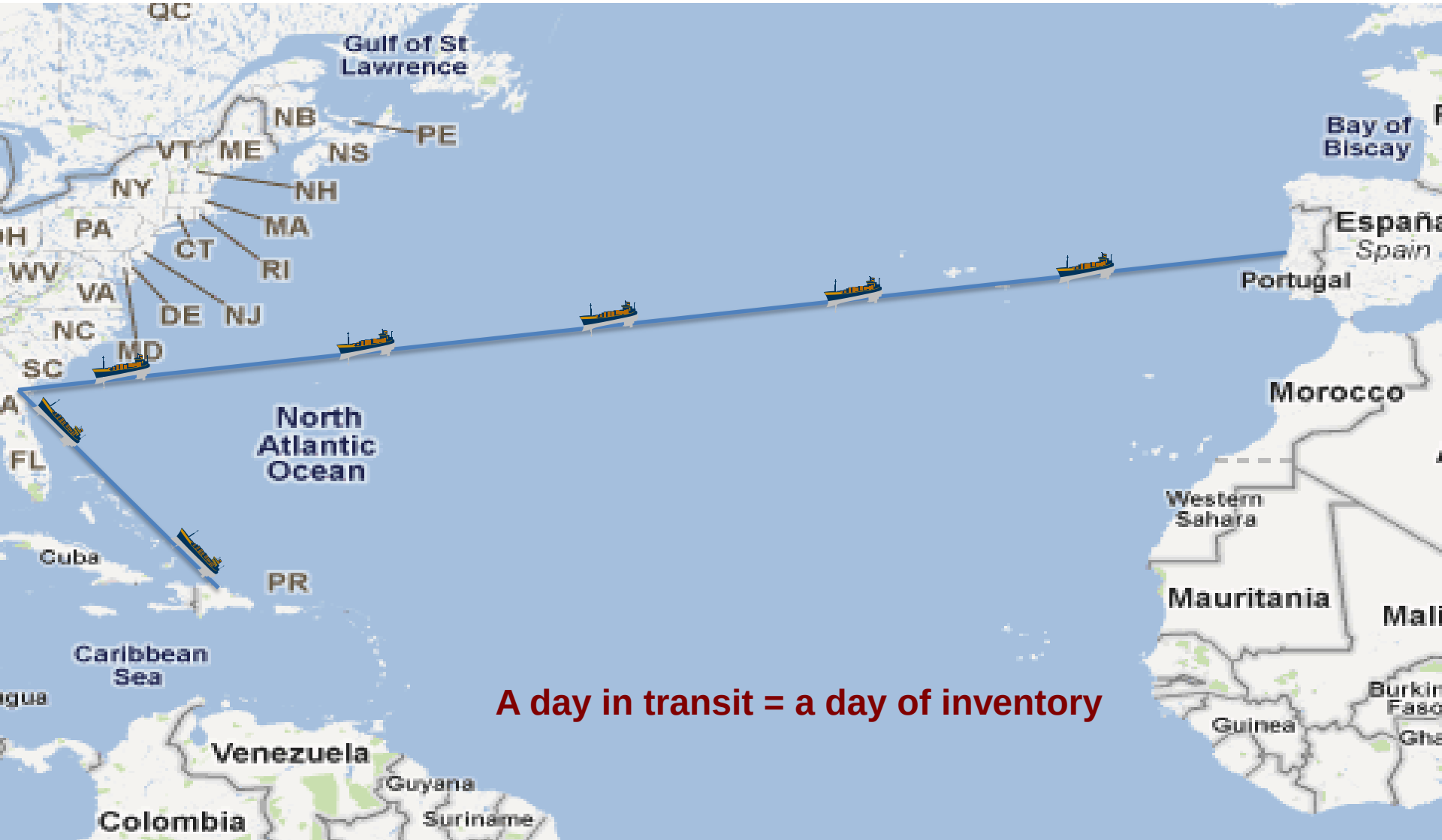
“Cycle” Inventory

- Example
  - Purchase from single supplier
  - Sell an average of one container of product per day
  - Order cycle = 2 days
  - Average cycle inventory = 1 day of inventory



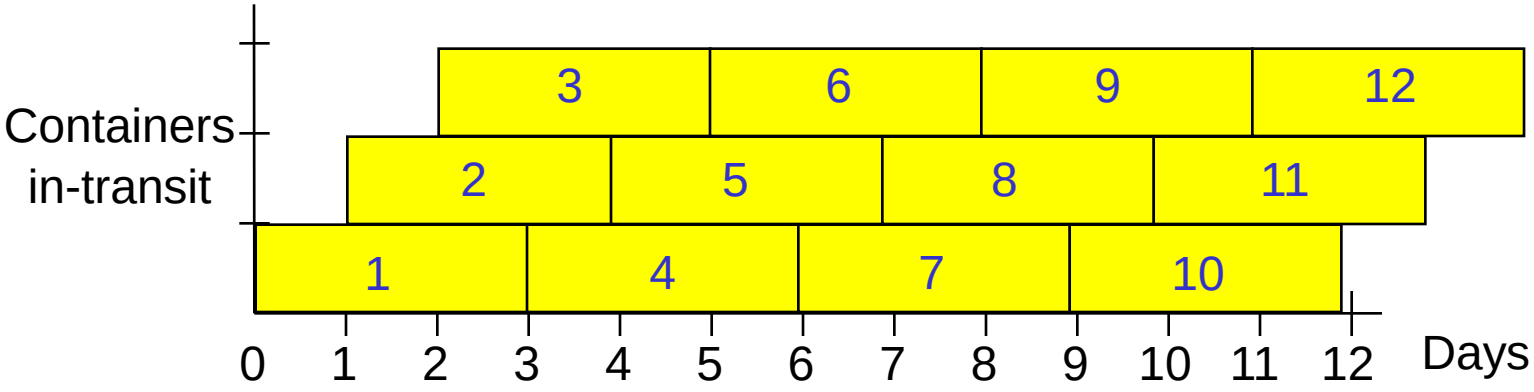
- Cycle inventory = ½ average production/shipment size
- Note that cycle inventory quantity is not dependent on demand

Time – In-transit Inventory



“In-transit” Inventory

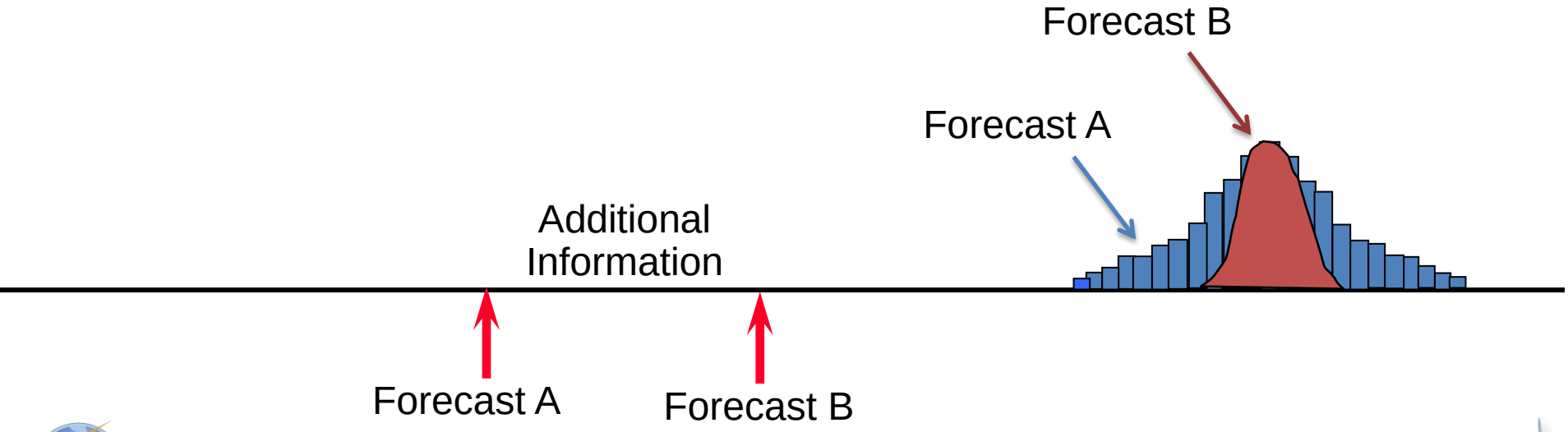
- Example
  - Purchase from a single supplier
  - Sell an average of one container of product per day
  - Average transit time = 3 days
  - Average in-transit inventory = 3 days of inventory



- In-transit inventory = (ave purchase rate)*(ave transit time)

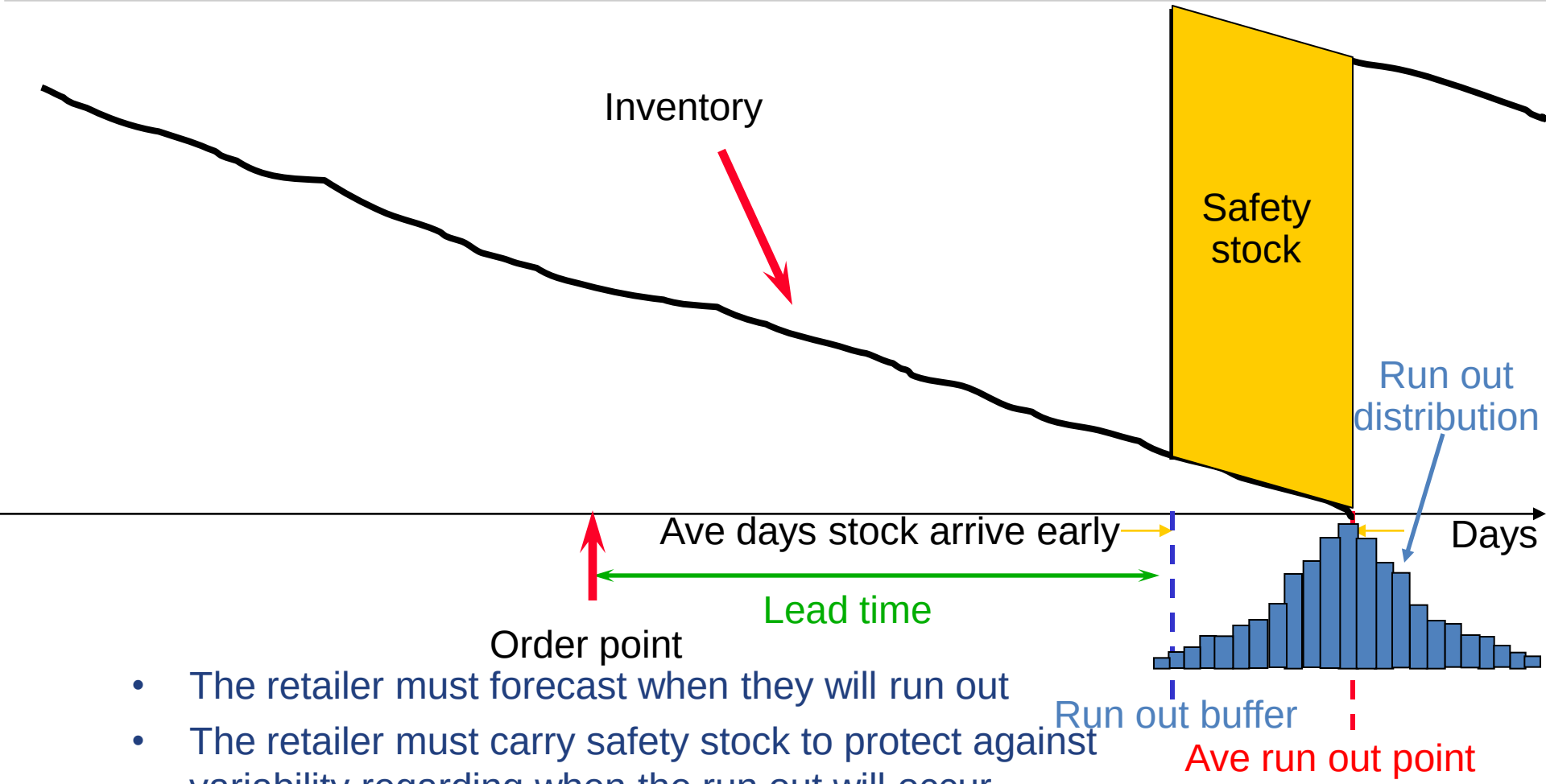
Impact of Transit Time on Forecasts

- Forecast errors increase with time to the event
  - Forecast B has more information regarding inventory levels
  - Forecast B has more current information regarding demand trends
  - Forecast B should be better and have less safety stock
  - Less transit time means less safety stock
  - Difficult to say exactly how much less (test with simulation)



Safety Stock (demand)

Uncertain demand but known lead time



- The retailer must forecast when they will run out
- The retailer must carry safety stock to protect against variability regarding when the run out will occur
- Longer lead time causes more safety stock

Time – Direct Versus Multi-stop Route

- Direct ship lanes
  - Minimize transit time
  - May not utilize ship capacity
- Multi-stop routes
  - Longer distance
  - Stops take time
  - Stops increase potential delays
  - May increase utilization

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Impact of Multi Stop Routes

Port	Arrives	Departs	Transit
Rotterdam, Netherlands	THU	FRI	--
Bremerhaven, Germany	SAT	SUN	2
Hamburg, Germany	MON	TUE	4
Antwerp, Belgium	WED	THU	6
Felixstowe, United Kingdom	FRI	SAT	8
Suez Canal, Egypt	SUN	MON	17
Singapore, Singapore	SAT	MON	30
Busan, Korea, South	SAT	SUN	37
Hakata, Japan	MON	MON	39
Dalian, China	WED	WED	41
Xingang, China	THU	FRI	42
Qingdao, China	SAT	SUN	44

- Impact on shipper?
- Impact on shipping line?

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Maersk Daily Service

- Same cut-off time every day, seven days a week.
- Same fixed and promised transportation time.
- If delayed by 1-3 days, Maersk Line will pay back USD 100 per container.
  If delayed by four days or more, Maersk Line will pay back USD 300 per container.

- Four ports in Asia: Ningbo, Shanghai, Yantian and Tanjung Pelepas
- Three ports in North Europe: Felixstowe, Bremerhaven and Rotterdam

- How does this delay impact shipper inventory?
- For no run-out case, safety inventory is reduced by about 7 days

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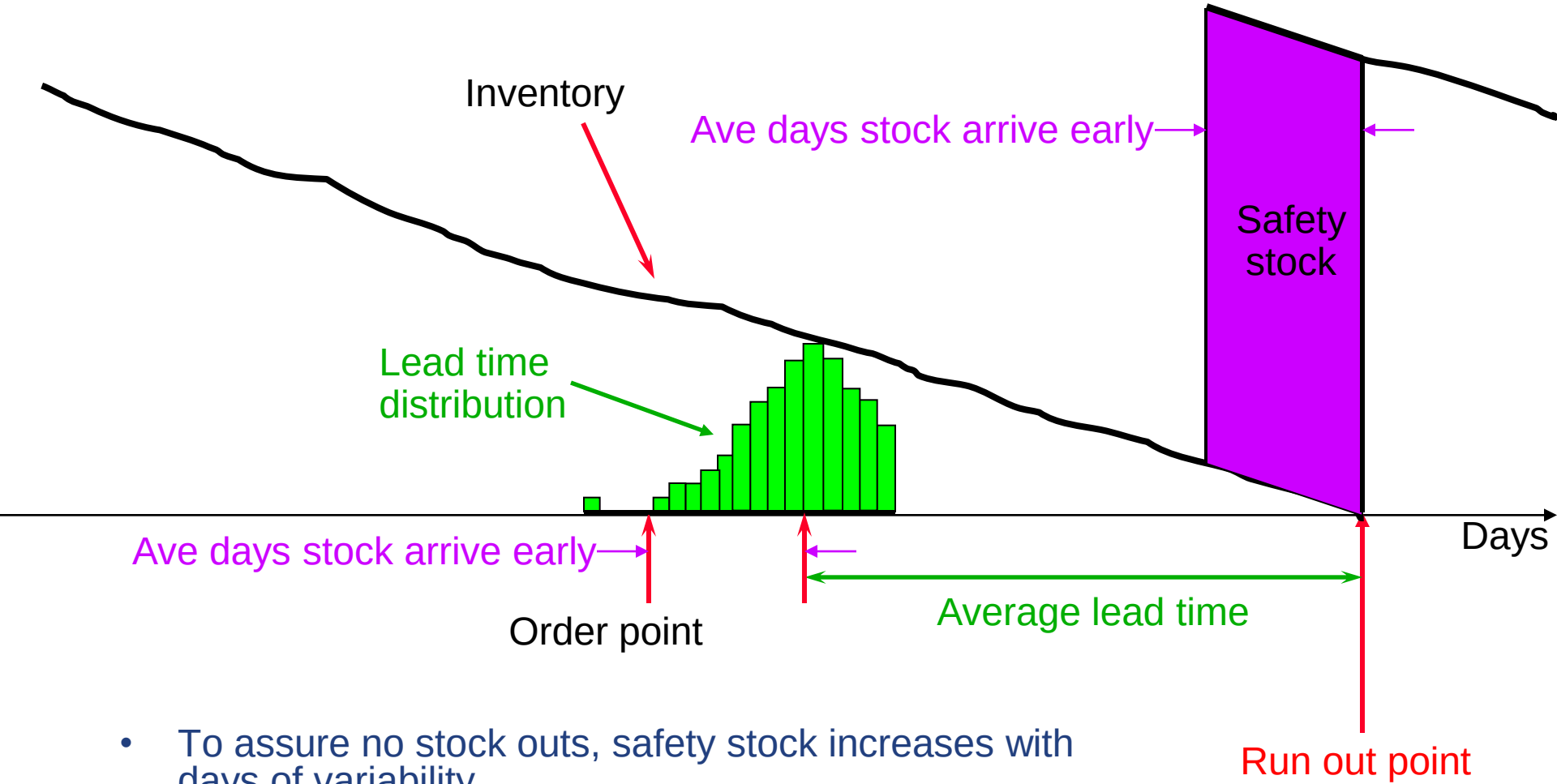
Safety Stock (lead time)

Known demand but uncertain lead time



- To assure no stock outs, safety stock increases with days of variability

Logistics and Trade Observations

- Globalization of manufacturing
  - Dramatic increase in transportation
- Computing advances
  - Dramatic increase in data
- Increasingly complex supply chains
  - Dramatic increase in difficulty
- Trade competiveness
  - Dramatic increase in need for public sector logistics knowledge

Questions?

Comments?

Georgia Tech Supply Chain & Logistics Institute

Panama's Logistics Vision

- Improve logistics performance
  - Integrate Panama's logistics network
  - Generate new logistics services
  - Expand Panama's logistics education
- Grow as a transportation hub for the Americas
  - Transshipment hub
  - Distribution hub
- Become a primary regional Trade Hub for Latin America
- Become a logistics and trade thought leader
  - Georgia Tech Panama Logistics Research & Innovation Center

World Bank Logistics Performance Index 2010

#1 Germany

#2 Singapore

#3 Sweden

#4 Netherlands

#15 United States

#51 Panama

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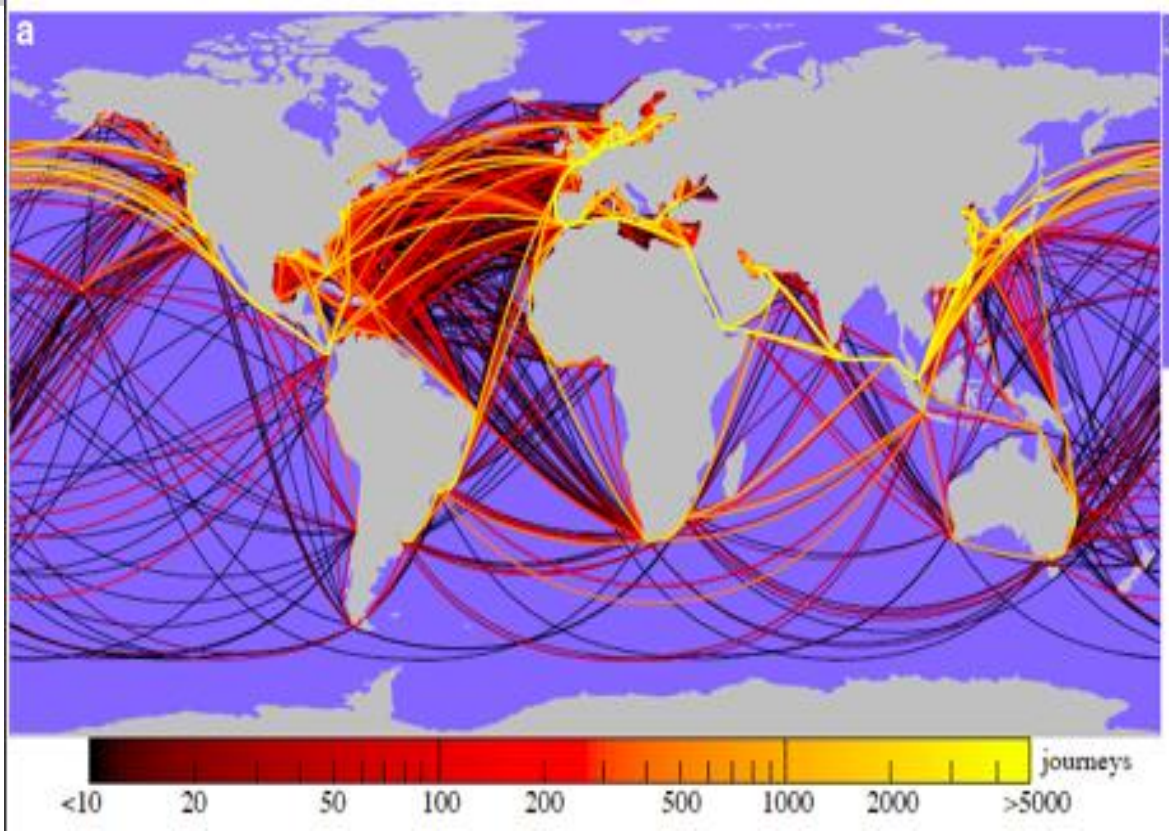
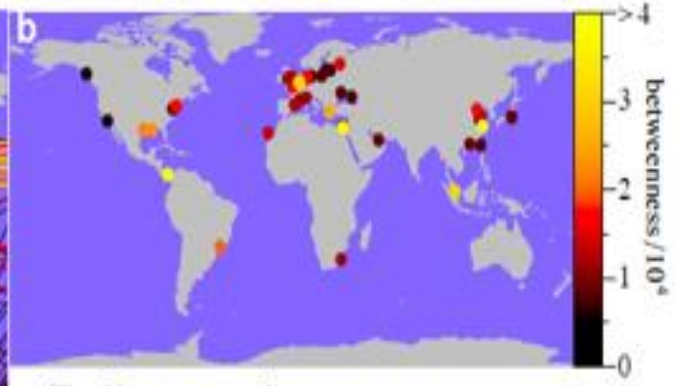
Most Connected Location in the World





The 20 most central ports

1 Panama Canal	11 Santos
2 Suez Canal	12 Tianjin
3 Shanghai	13 New York & New Jersey
4 Singapore	14 Europoort
5 Antwerp	15 Hamburg
6 Piraeus	16 Le Havre
7 Terneuzen	17 St Petersburg
8 Plaquemines	18 Bremerhaven
9 Houston	19 Las Palmas
10 Ijmuiden	20 Barcelona

What must Panama do to improve logistics performance?
How can Panama become the trade hub of the Americas?

Source: Pablo Kaluza et al., "The complex network of global cargo ship movements," 1001.2172 (January 13, 2010), http://arxiv.org/abs/1001.2172.

Panama's Logistics Business Categories

- Canal transit
- Transshipment
- Re-export
- Export
- Import
- In-country logistics
- In-country employment
- Tourism

Panama's Logistics Platform

Customs

Panama Canal

Seaports

Colon Free Zone

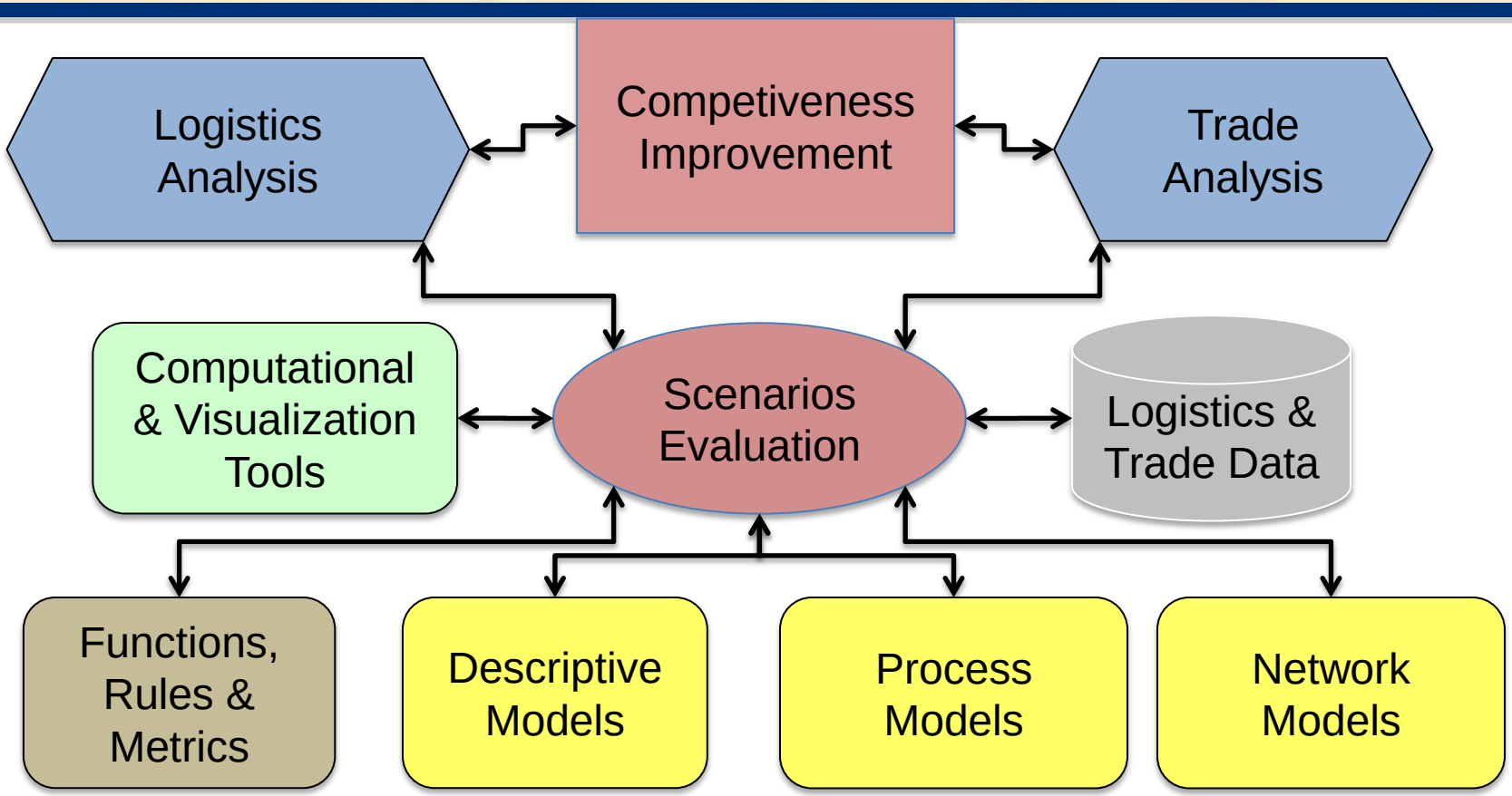
Panama Pacifico

Airports

Road Network

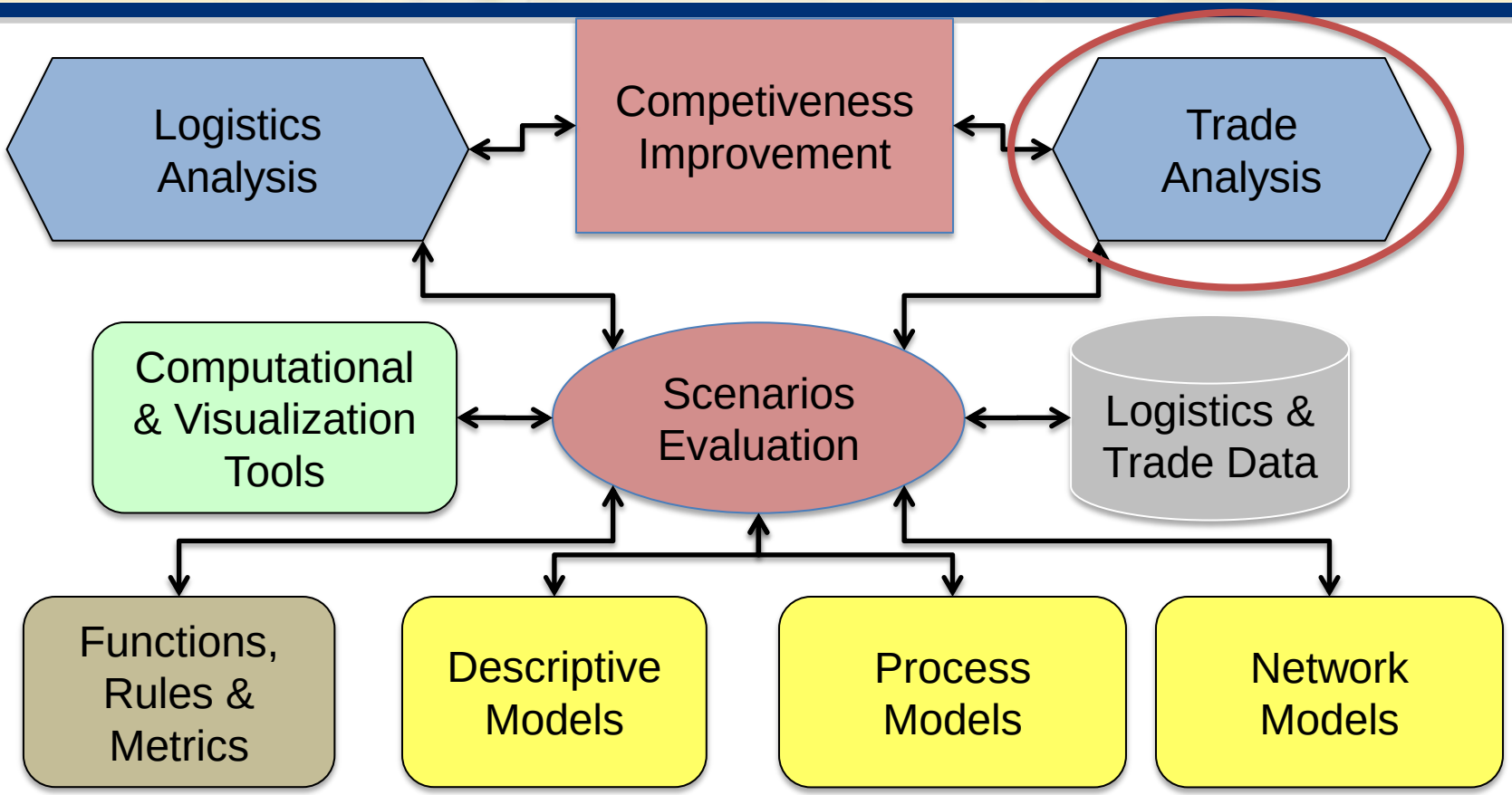
Railroad

Framework for Analytics



Composite Modeling

Composite Modeling



Trade Analysis

- Goals
  - Document structure, cost and capacity of current trade routes
  - Determine modes and volumes for each product family on each trade route
  - Determine how trade routes have changed over time
  - Quantify the attraction/value for each trade route
  - Quantitatively compare trade routes
  - Forecast growth of trade routes
- Questions you can answer
  - Country to country imports and exports by year and commodity (US$ and weights)
  - Country to US port imports and exports by year and commodity (US$ and weights)
  - Changes in trade over time
- Questions you you would like to answer
  - Global port to port trade routes
  - Containers on each trade route
  - Changes in trade routes over time
  - “Causal” relationships

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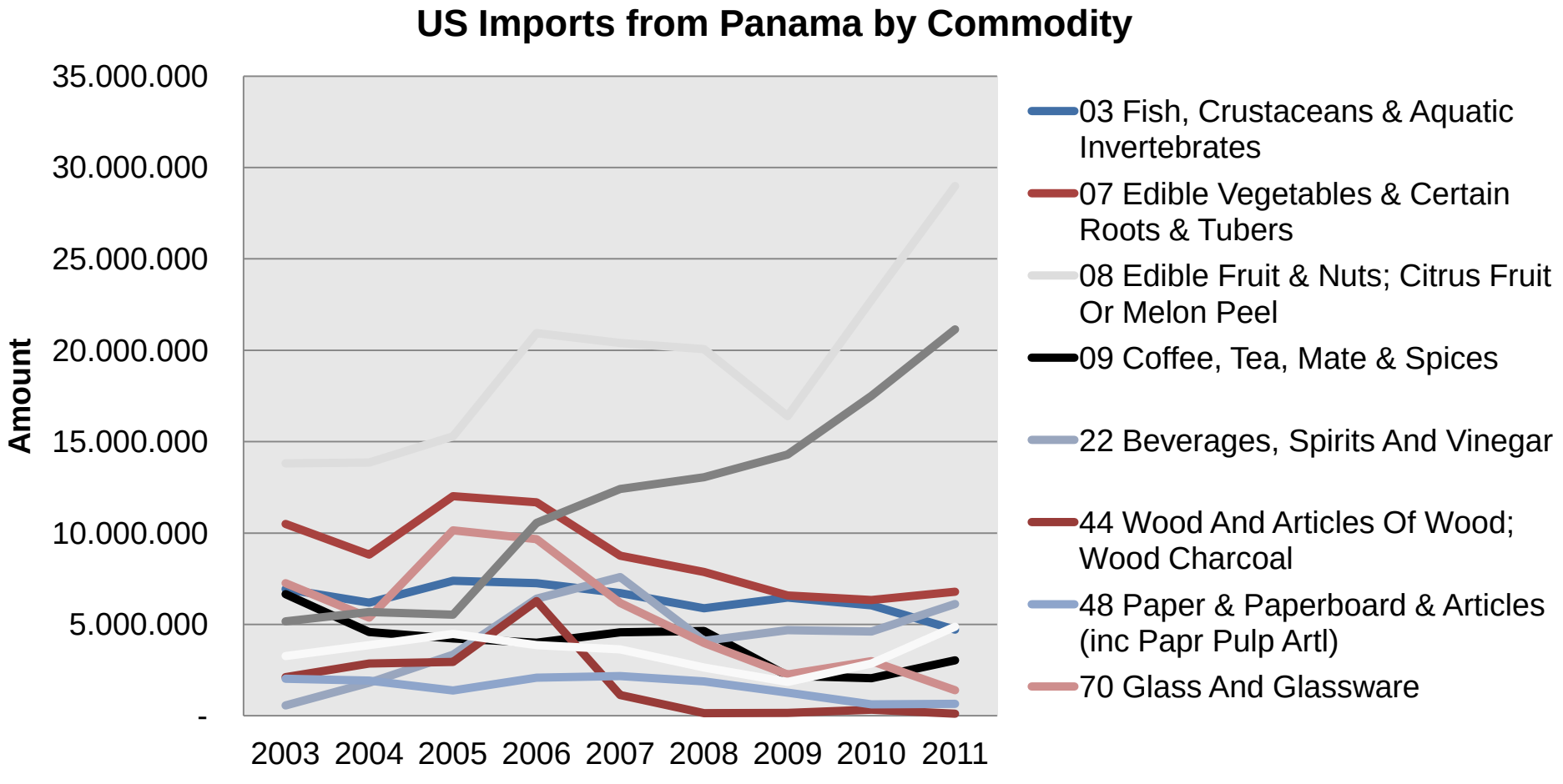
US and Panama Free Trade Agreement



How can Panama take advantage of the free trade agreement?

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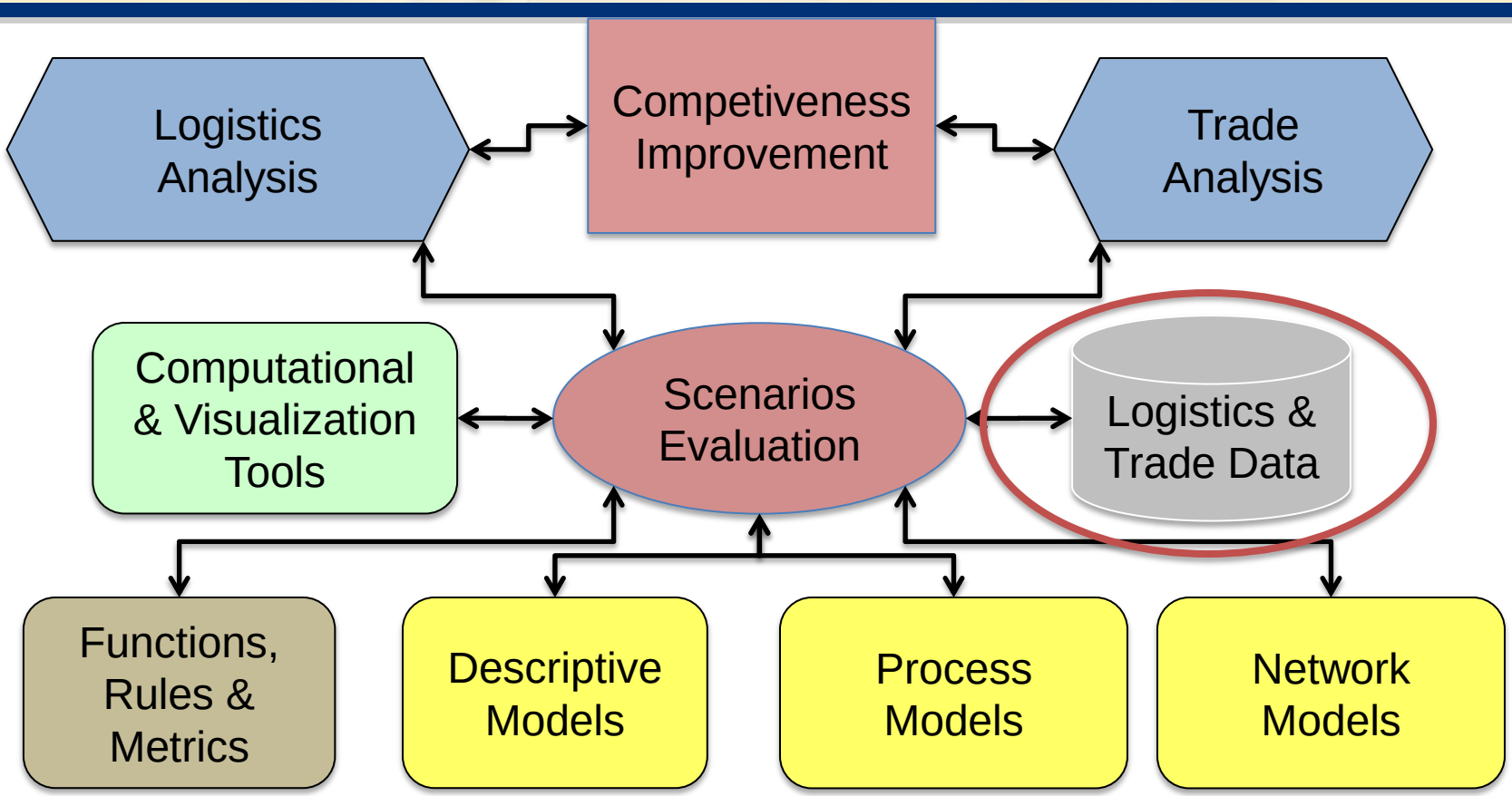
Composite Modeling



Logistics and Trade Data

- Publically available
  - e.g., UN Comtrade database
- Commercially available
  - e.g., road travel distances
- Requires collection
  - e.g., road travel times
- Major effort is required to make data usable

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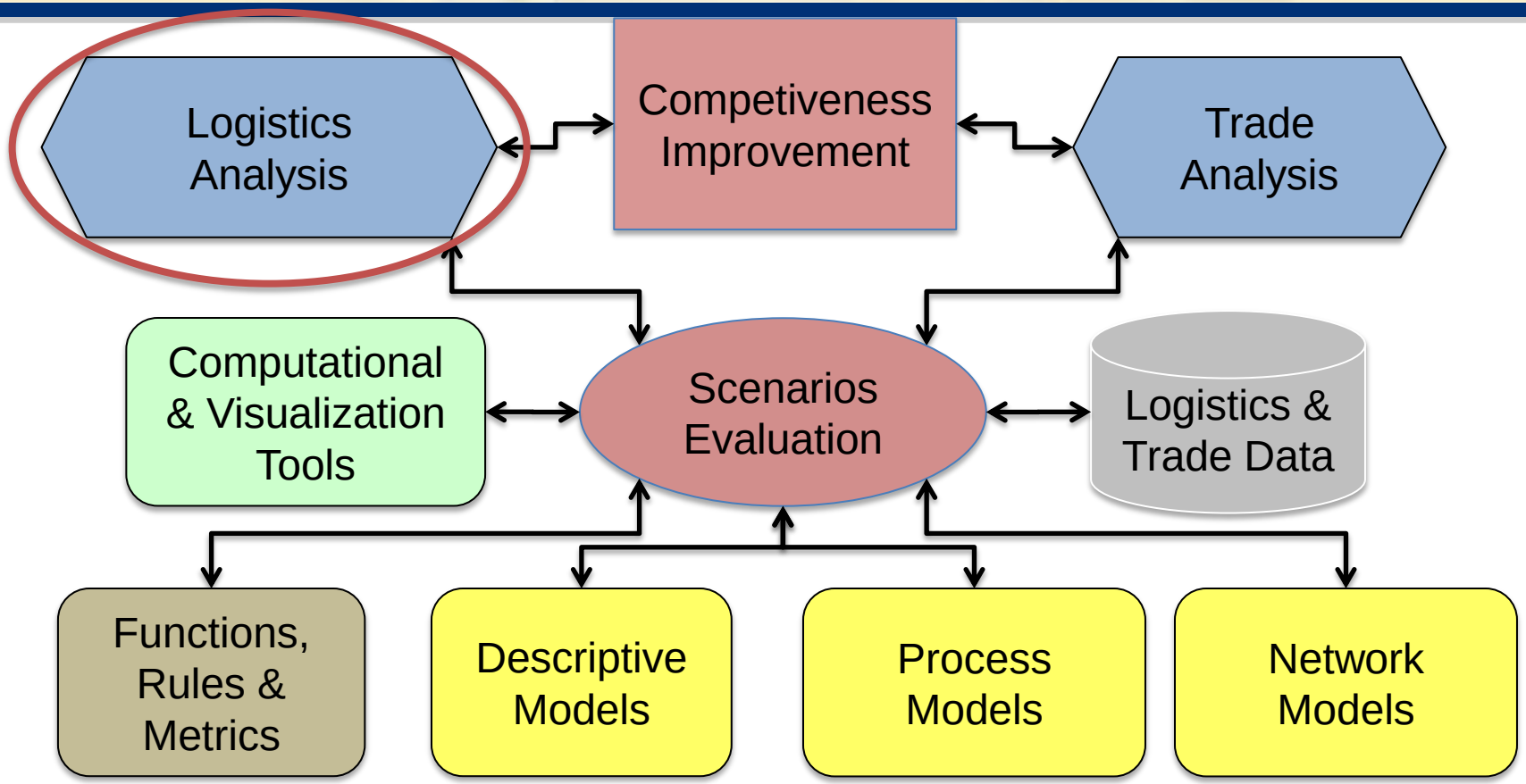
Composite Modeling



Logistics Analysis

- Goals
  - Identify changes in logistics systems requirements and how they are being addressed by stakeholders
  - Document baseline structure and characteristics of existing logistics systems
  - Assess capability and performance of existing logistics systems
  - Enable integration of existing logistics systems
  - Optimize infrastructure/services provider performance
  - Optimize carrier performance
  - Optimize shipper performance
  - Determine where infrastructure and services require improvement
  - Determine the need/opportunity for new technology

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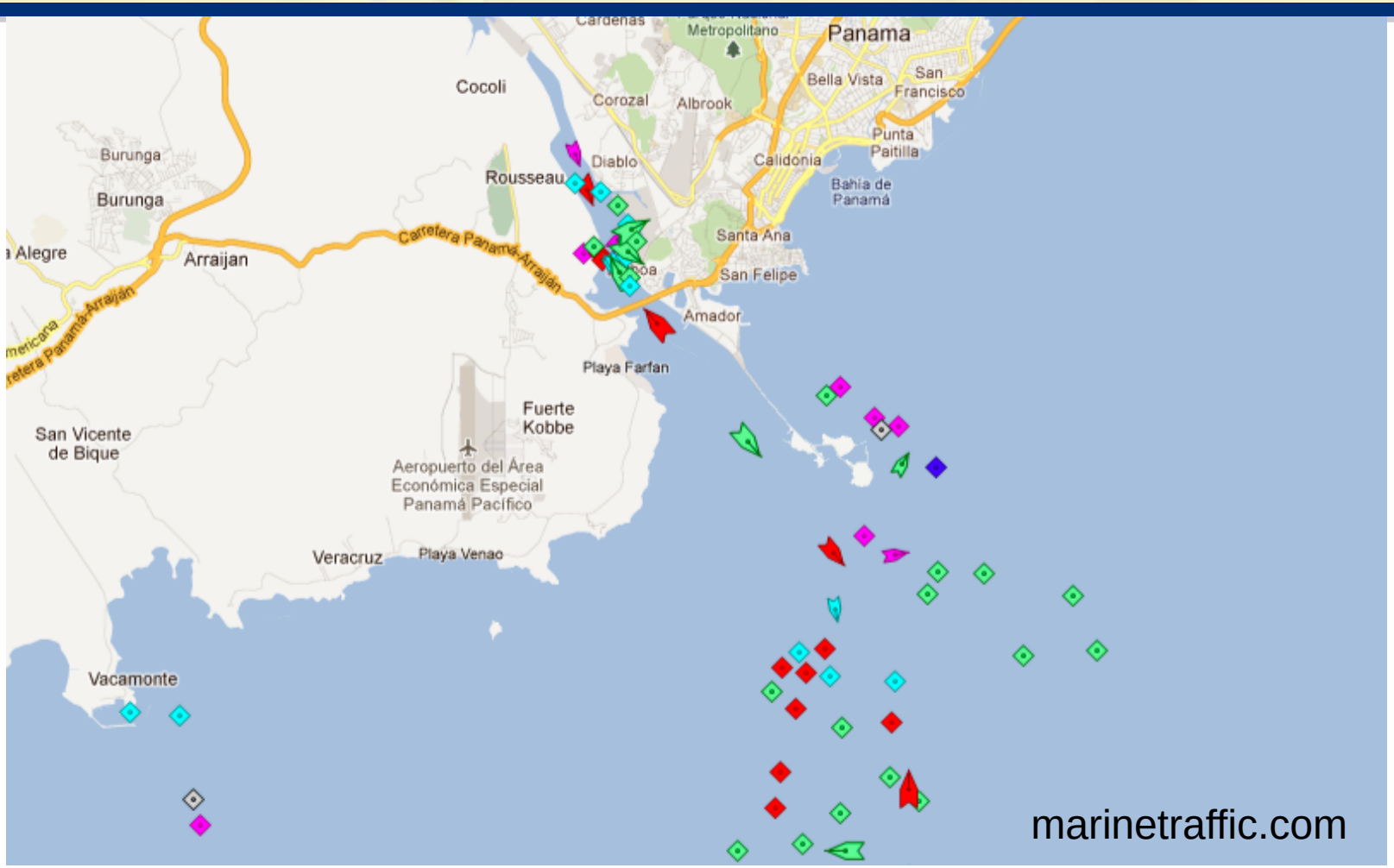
Potential for Post-Panamax Conjestion



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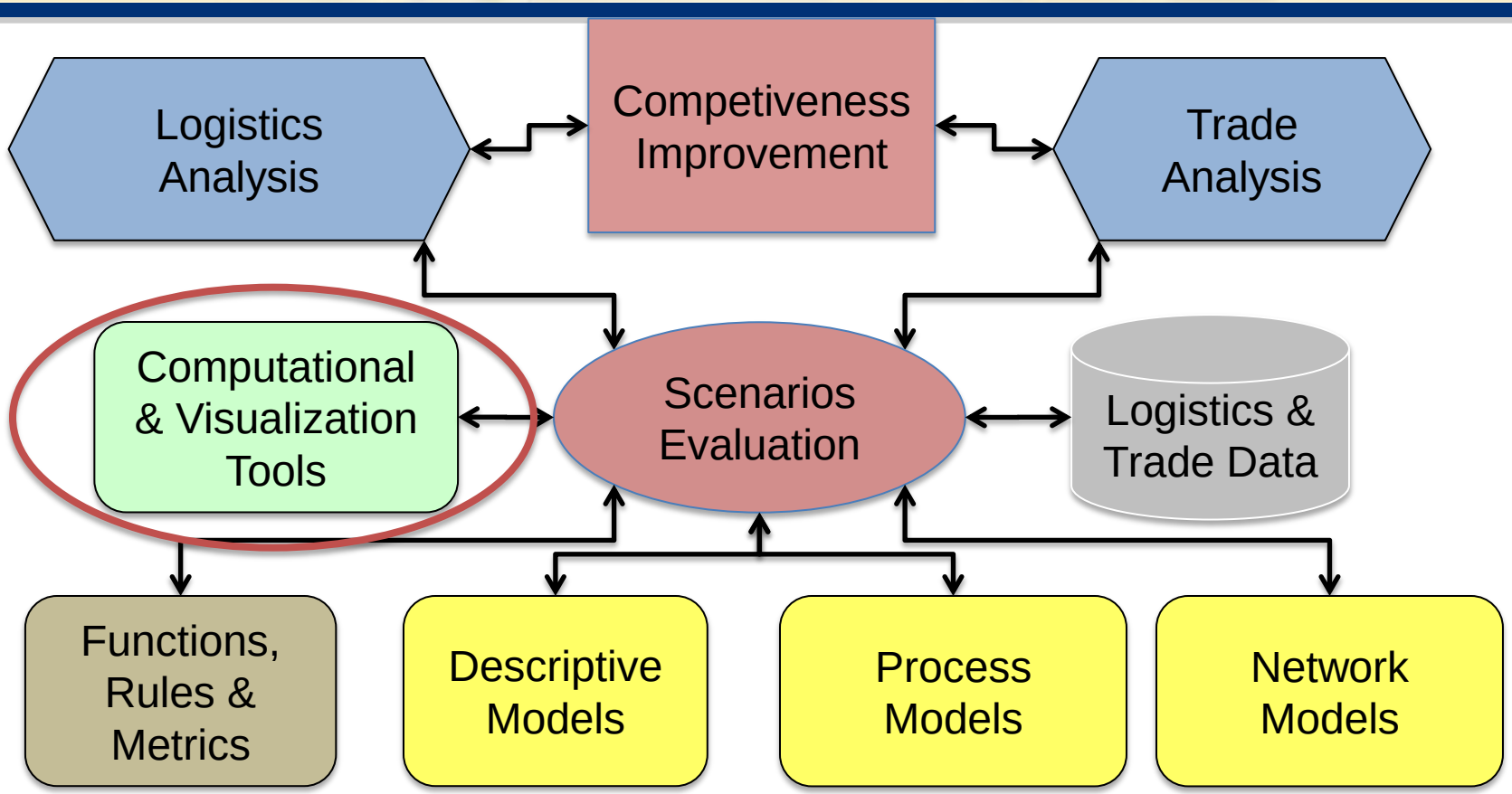
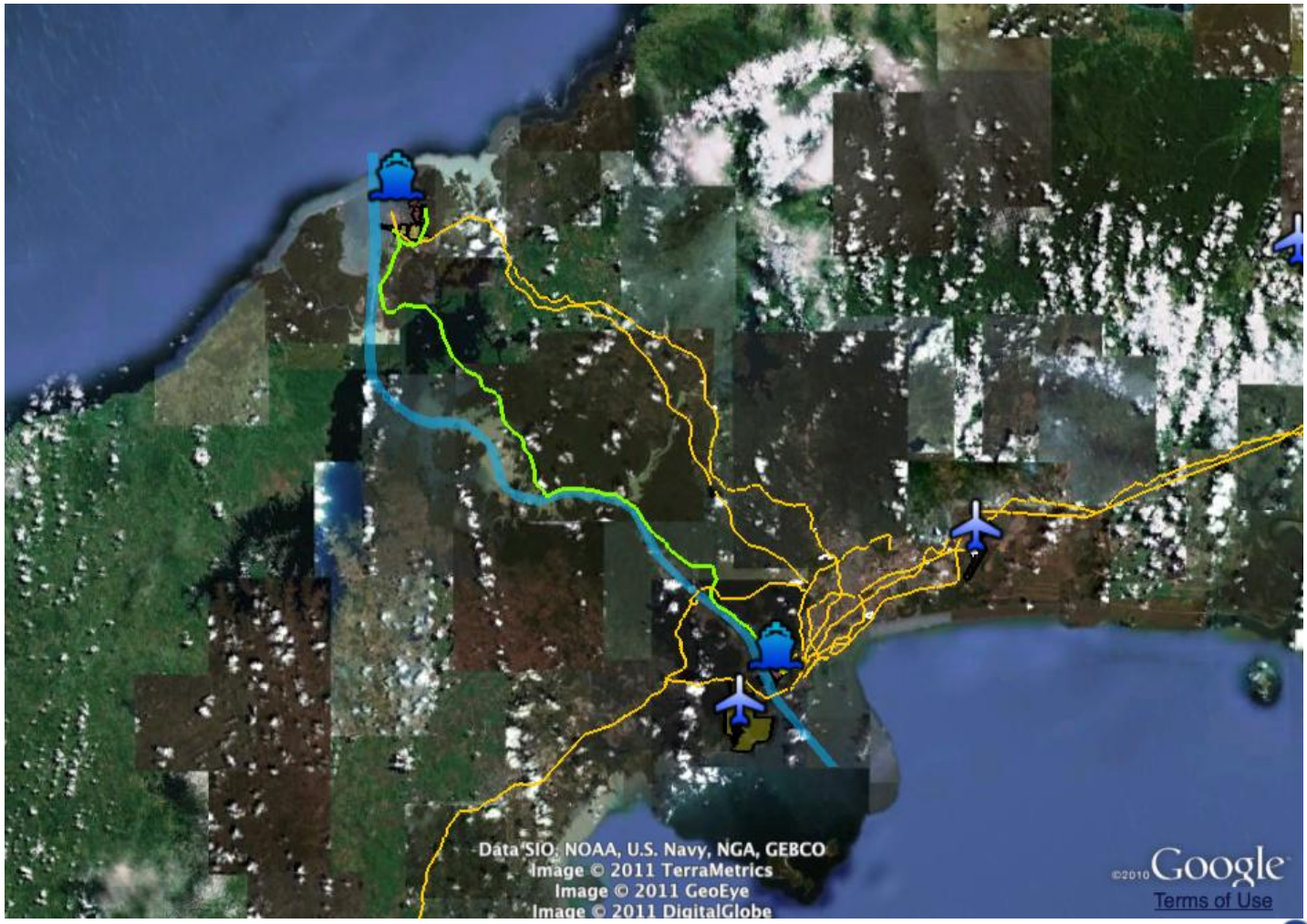
Composite Modeling



Computational and Visualization Tools

- Provide visualization
  - Business graphics
  - Maps
  - Geographic Information Systems (GIS)
- Perform computations
  - Spreadsheets
  - Business analytics
  - Simulation
  - Optimization
  - Custom functions

Visualization Tools



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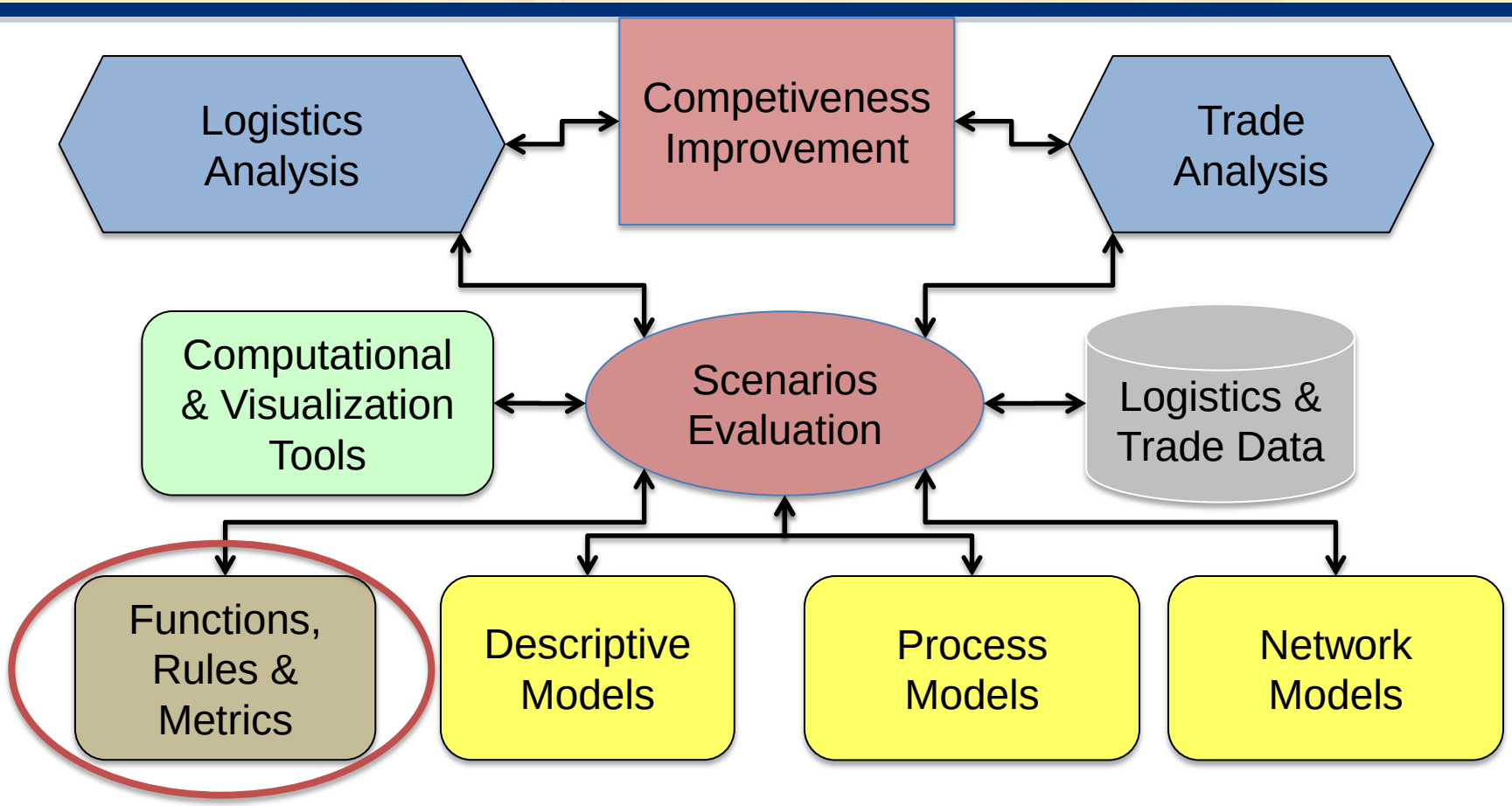
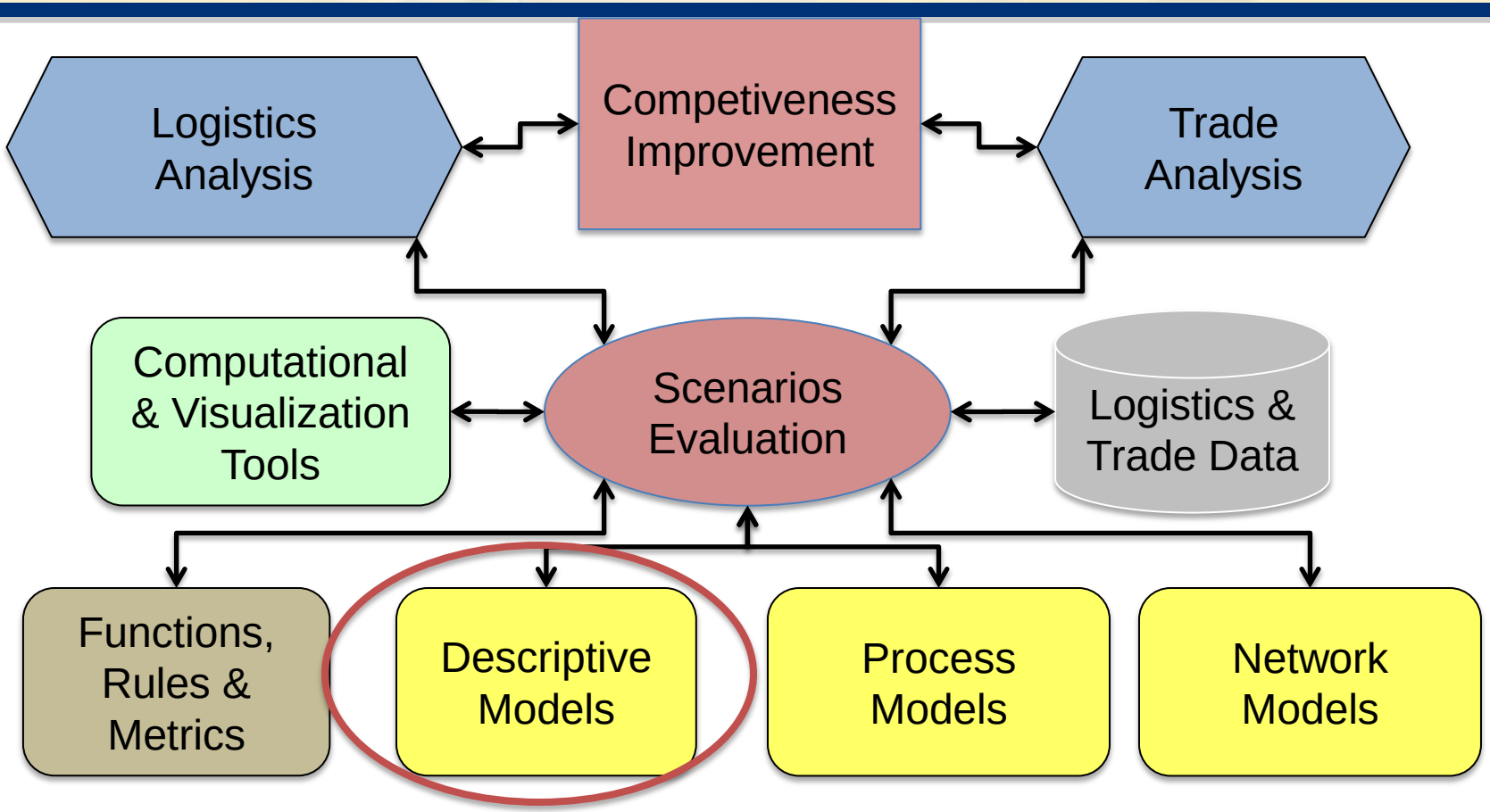
Composite Modeling



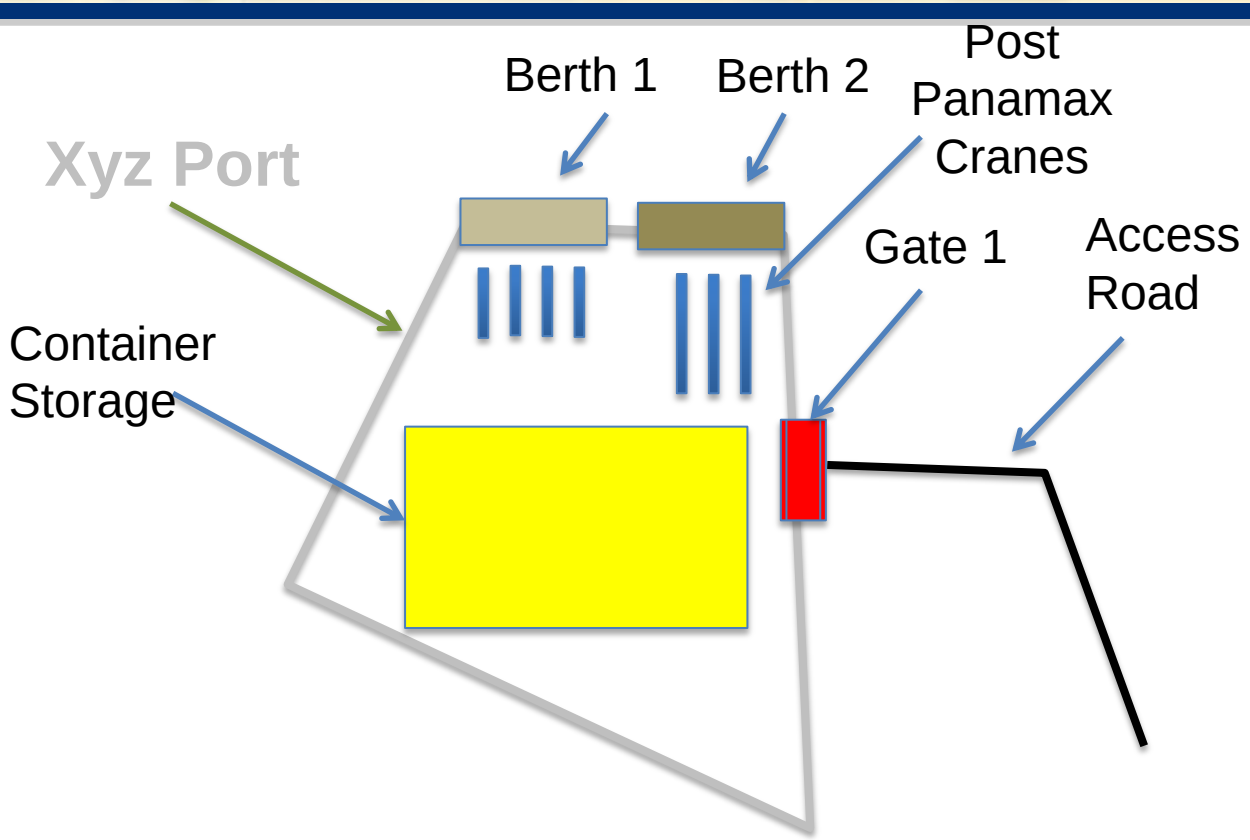
Functions, Rules & Metrics

- Provide “functional” relationships to describe operations
- Provide metrics to estimate logistics performance
- Provide evaluation modules to include in computational methods

Composite Modeling



Descriptive Model



- Facilitate geographic insights with regard to capabilities
- Allow “list” comparisons among similar logistics entities
- Provide input for computational methods

Example Descriptive Model - Seaports

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Example Descriptive Model - Seaports

Seaports	Manzanillo International Terminal	Balboa
Services		
Containers	true	true
General cargo	false	true
Ro-Ro	true	true
Bulk (dry)	false	true
Bulk (liquid)	false	true
Special projects	true	true
Specifications		
Total area (hectare)	160	182
Berths		
Draft alongside	10 - 14	8.1 - 17
Total berths	6	7
Container berths	5	5
Container berths lengths (m)	310,310,310,310,400	

Panama Canal

- 13,000 ships transit the canal annually or average of 35 ships each day
- Canal water time (CWT) averages 21.1 hours (FY 2010) compared to the 23.06 hours in FY 2009
- Average CWT with reservation is 13.3 hours
- Average CWT without reservation is 24.7 hours

Source: ACP

Panama Canal Expansion

- Completion 2014
- Less waiting
- Bigger ships

Ports of Panama

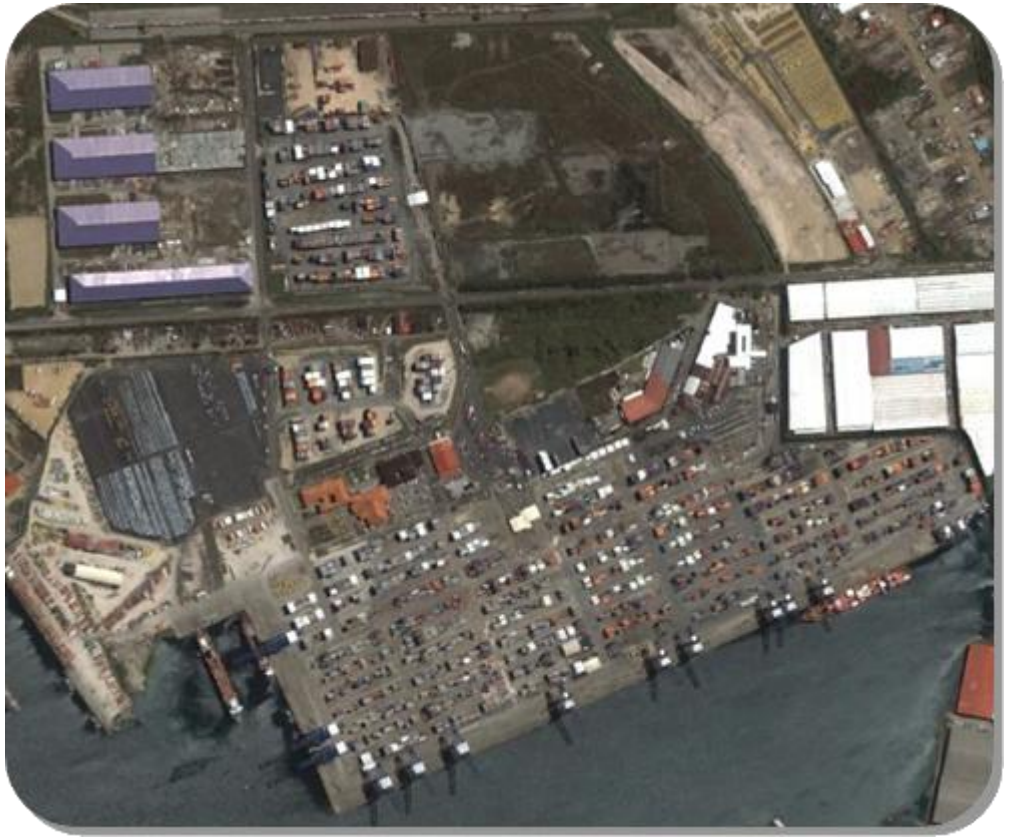
- Port Infrastructure
  - Four Container Port Terminals administered by three of most important terminal operators worldwide
  - Fifth container terminal under construction at in the Pacific side of Panama – to be operated by Ports Singapore Authority (PSA)
  - Terminals in the Atlantic and in the Pacific function as transshipment points for of merchandise, moving over 5.5 million TEU's annually

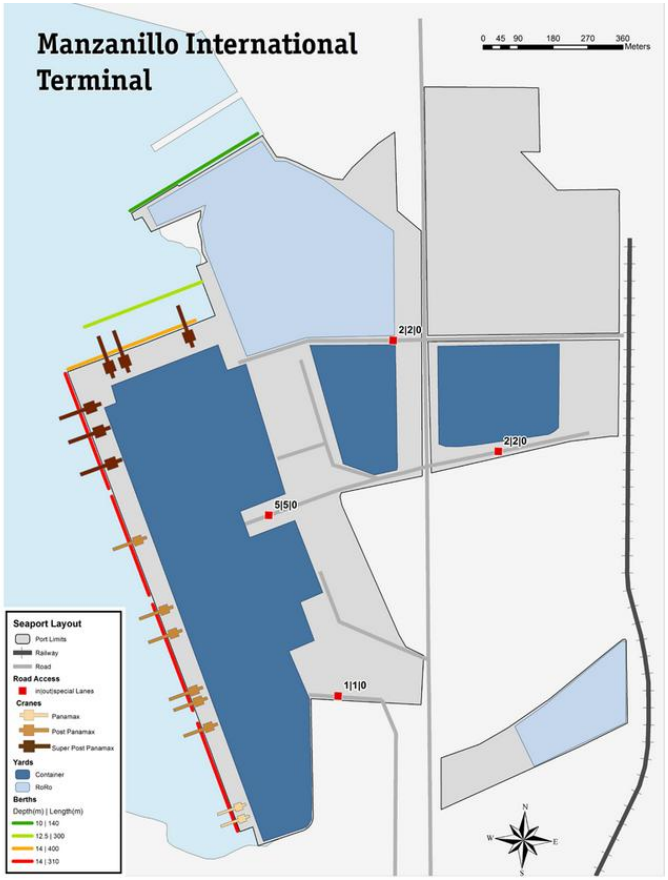
Source: Panama Ministry of Commerce and Industries – *Investment Opportunities in Panama*

Manzanillo International Terminal

- Located outside of the Atlantic entrance of the Panama Canal
- Adjacent to the Colon Free Trade Zone
- Port services to:
  - Shipping lines transiting the Panama Canal
  - Serving South America and the Caribbean

Manzanillo International Terminal





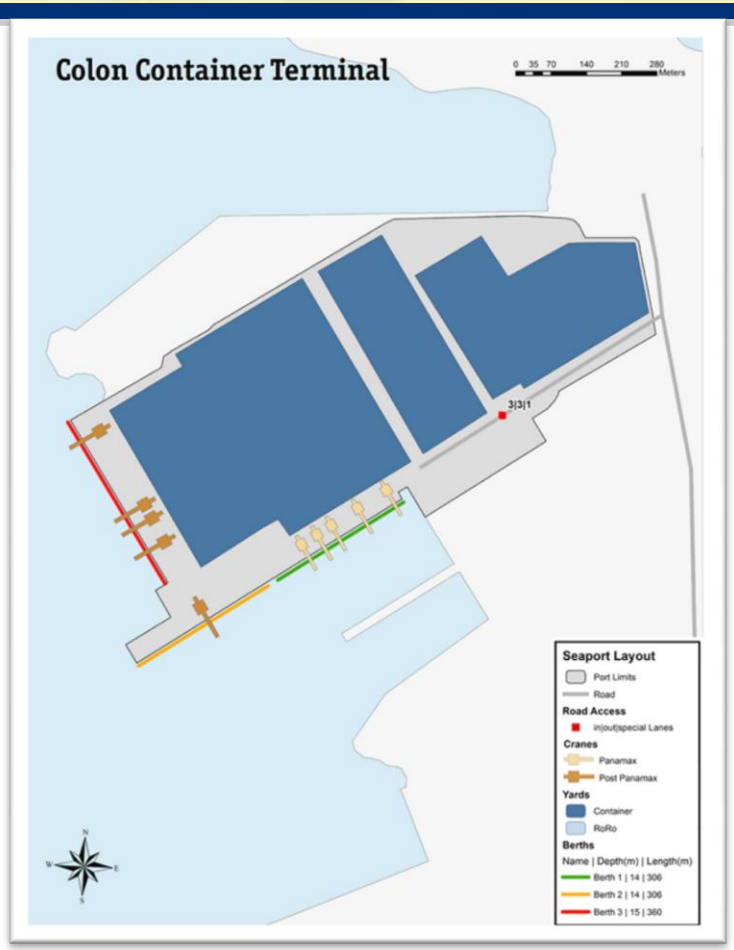
Manzanillo Value-Added Area

MIT Logistics Park

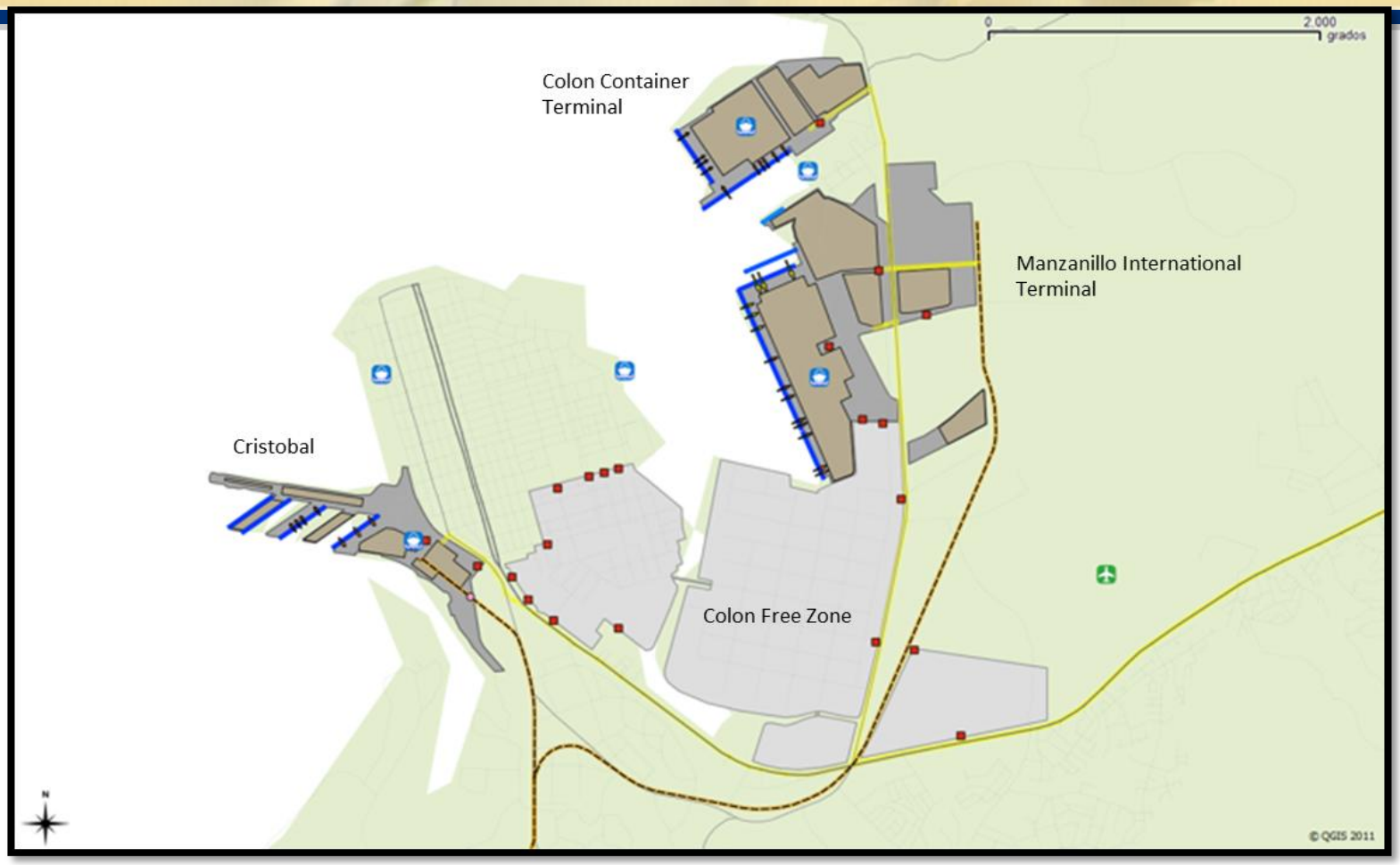
- Adds value to cargo with new division MIT Logistics

  They've opened warehouses to add new options such as labeling, repackaging, assembly, among others.

Colon Container Terminal



Atlantic - Colon



Colon Free Trade Zone

- Established on 1948
- Biggest free zone in the Western Hemisphere
- 1680 acres
- $19 Billion commercial activity (import and exports)

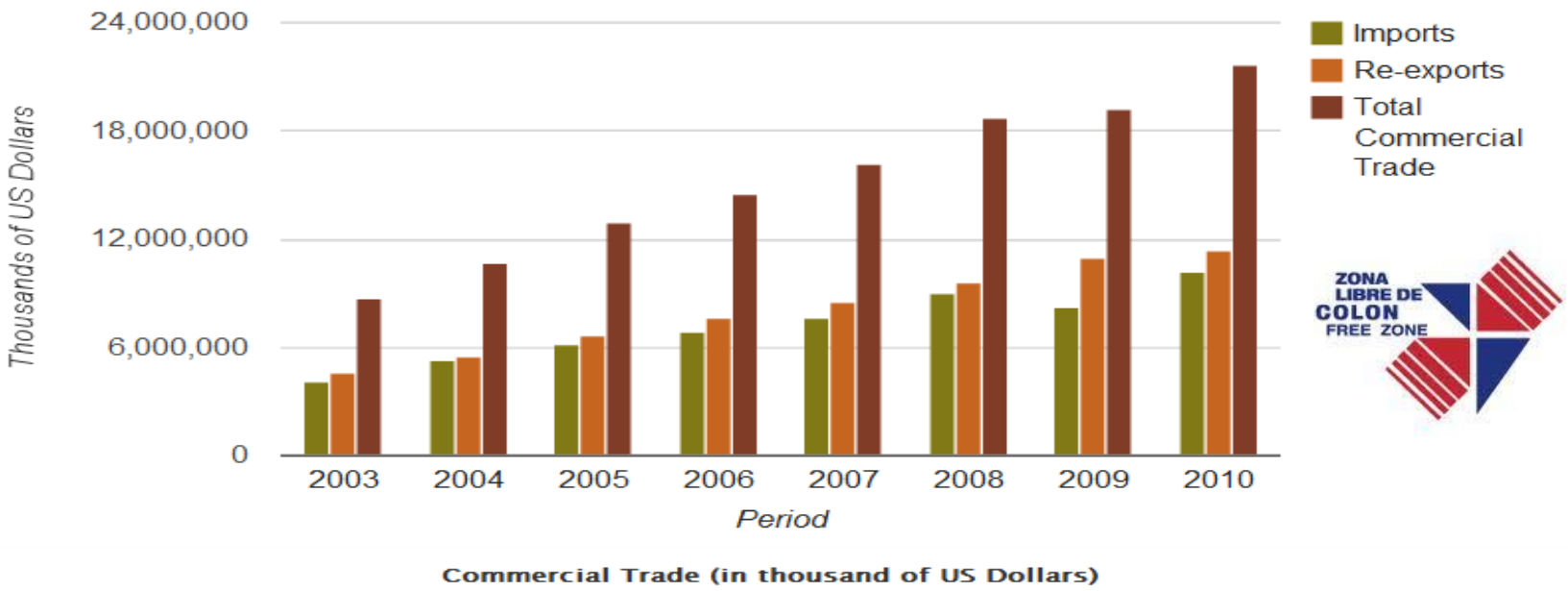
Source: Panama Ministry of Commerce and Industries – *Investment Opportunities in Panama*

Colon Free Trade Zone

- No sales tax, no production tax.
- Tax exemption on income derived from abroad.
- No tax or duty on imports to or re-exports from the Free Zone to foreign countries.
- Income tax for the companies established in the Colon Free Zone is the same one that applies at the national level.
- There is no tax on any of the shipments sent to or from the Free Zone to any place in the world.

Source: http://colonfreezone.com/free-zone-information/

Colon Free Trade Zone



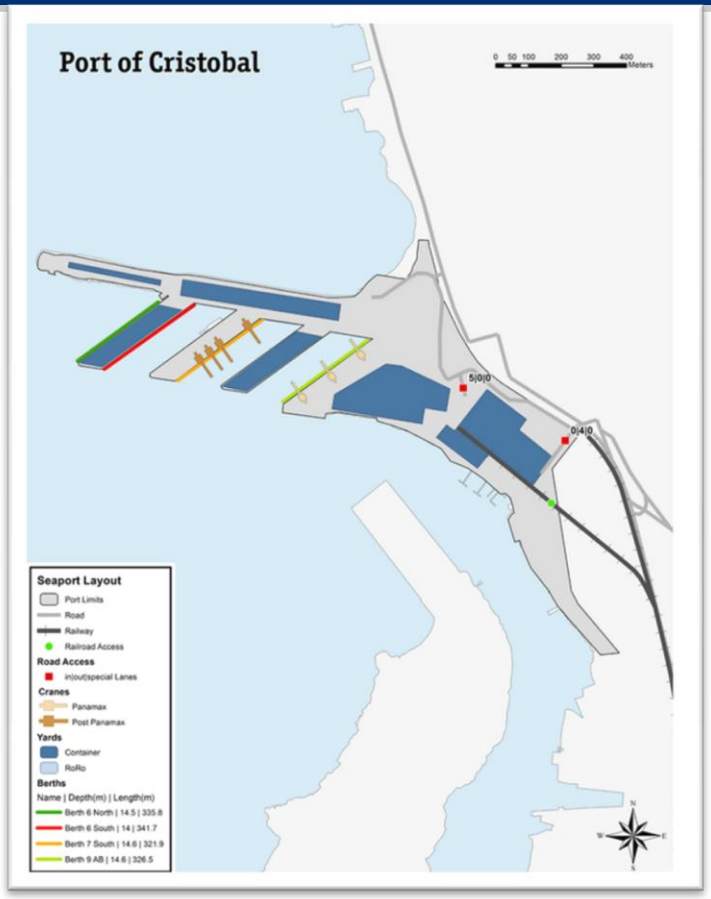
Commercial Trade (in thousand of US Dollars)

Total Commercial Activity (2010)	USD 21,624,215,000
Imports	USD 10,228,285,000
Exports	USD 11,395,930,000
Total Commercial Activity (Jan to Apr 2011)	USD 8,039,412,000
Imports	USD 3,902,815,000
Exports	USD 4,136,597,000

Balboa & Cristobal (Panama Ports Company)

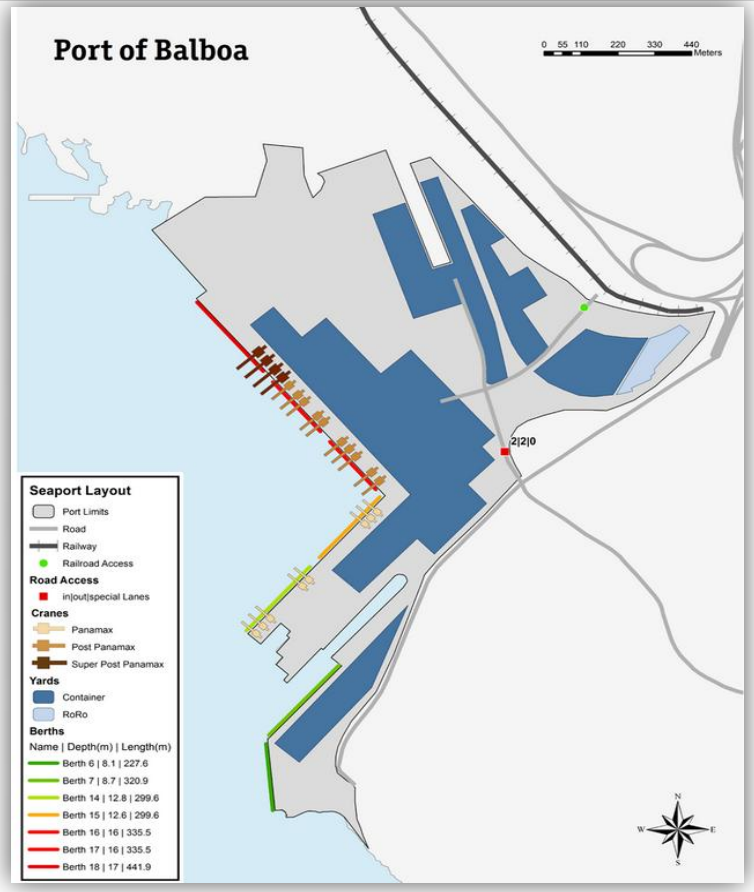
- Panama Ports Company (PPC) is in charge of managing container terminals on each side of the Panama Canal.
  - Port of Cristobal in the Atlantic Ocean
  - Port of Balboa in the Pacific
- Member of the Hutchinson Group
- Provides links and strategic access in the Transatlantic and Transpacific routes.

Cristobal

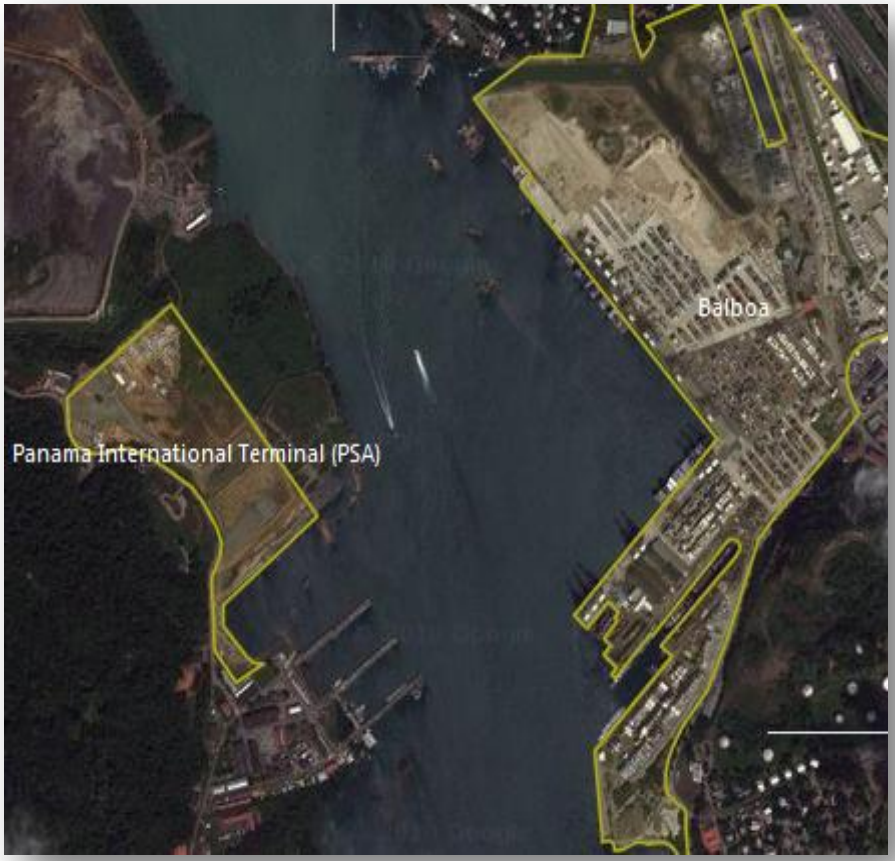

Port of Cristobal
0 50 100 200 300 400 Meters
5|0|0
0|4|0
Seaport Layout
Port Limits
Road
Railway
Railroad Access
Road Access
in/out/special Lanes
Cranes
Panamax
Post Panamax
Yards
Container
RoRo
Berths
Name | Depth(m) | Length(m)
Berth 6 North | 14.5 | 335.8
Berth 6 South | 14 | 341.7
Berth 7 South | 14.6 | 321.9
Berth 9 AB | 14.6 | 326.5

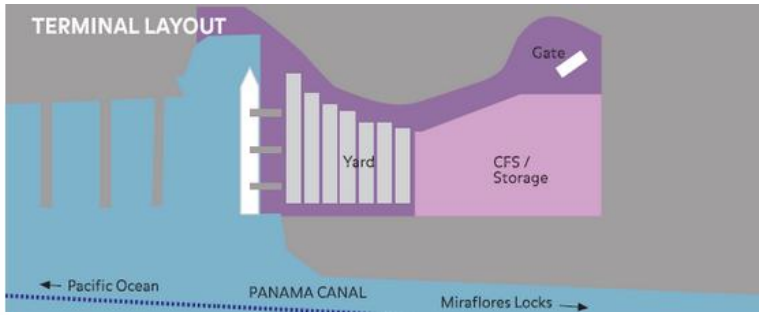
Balboa


Balboa
italGlobe, GeoEye - Términos de uso


Port of Balboa
0 55 110 220 330 440
Meters
2|2|0
Seaport Layout
Port Limits
Road
Railway
Railroad Access
Road Access
in|out|special Lanes
Cranes
Panamax
Post Panamax
Super Post Panamax
Yards
Container
RoRo
Berths
Name | Depth(m) | Length(m)
Berth 6 | 8.1 | 227.6
Berth 7 | 8.7 | 320.9
Berth 14 | 12.8 | 299.6
Berth 15 | 12.6 | 299.6
Berth 16 | 16 | 335.5
Berth 17 | 16 | 335.5
Berth 18 | 17 | 441.9
N
W
E
S

PSA Panama





Specifications	
Total area (hectare)	22
Berths	
Draft alongside	14.5
Total berths	1
Container berths lengths	330 m
Equipment	
Quay Cranes (Post Panamax) (up to 17 cnts)	3
Rubber Tyred Gantry Cranes (6 tiers + 1)	6
Gates	
Inbound lanes	1
Outbound lanes	1

Percentage of Business Distribution

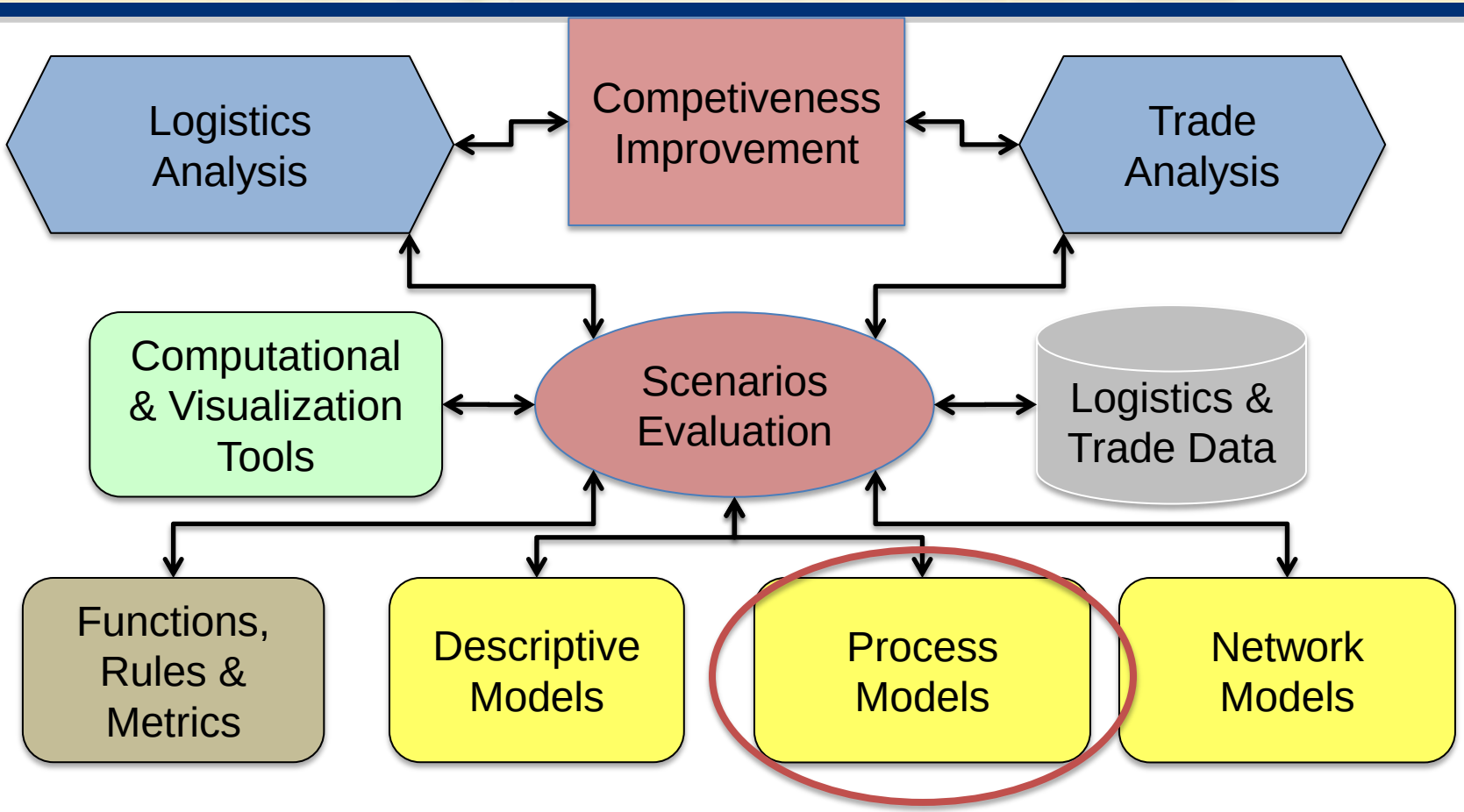
	MIT	CCT	Cristobal	Balboa
Transhipment (%)	80%	85%	83.60%	92.80%
CFZ (%)	15%	10%	0%	0%
National (%)	5%	5%	16.40%	7.20%

Special Economic Zones

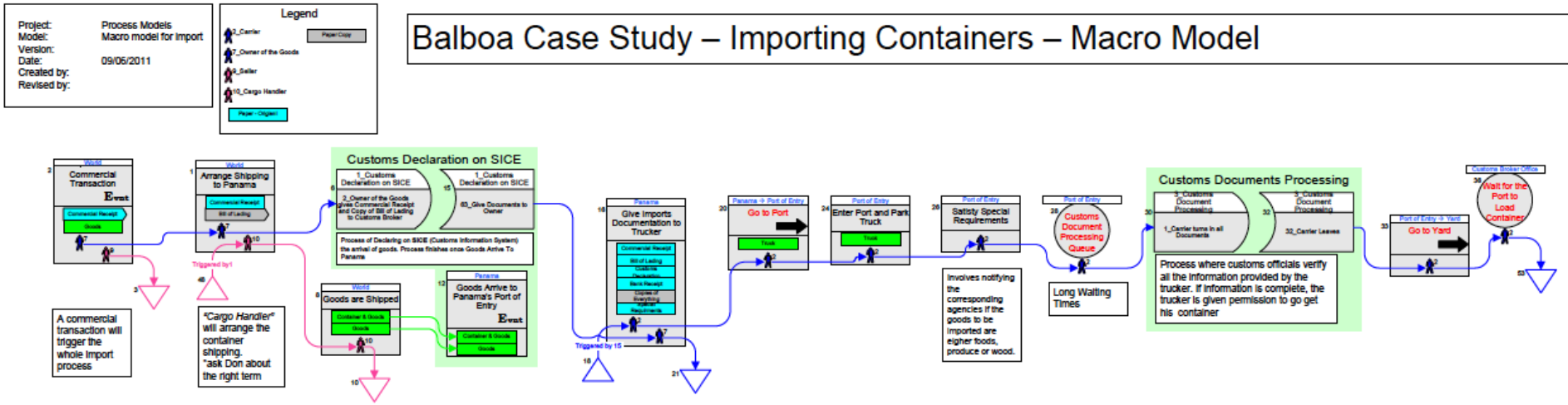
Comparison

Description	Colon Free Zone	Panama Pacifico Area		City of Knowledge	
		All activities	Specific Activities	Affiliated Users	Affiliated with TIP (4)
1 - Fiscal Regime (38 Items)					
Exempt from Income Tax	✔		✔		✔
Exempt from Dividends Tax / Complementary Tax			✔		
Dividends Tax (discounted at 5%)	✔	✔			
Complementary Tax (descounted at 2%)	✔	✔			
Annual Tax (1% of company capital)	✔	✔			
Exempt from tax on remittanes or withholding			✔	✔	✔
Exempt from import taxes, tariffs or any fees	✔	✔ (1)	✔ (1) (2)	✔ (5)	✔ (5)
Exempt from export taxes	✔	✔	✔		✔
Exempt from reexport taxes	✔	✔	✔		
Exempt from invoicing, selling and production taxes	✔				
Exempt from ITBMS		✔ (1)	✔ (1)	✔	✔
Exempt from tax, tariff, fees or any charges to the movement of hydrocarbons		✔	✔		
Free from commercial or industrial license		✔	✔		✔
Exempt from Registration Tax		✔	✔		✔
Exempt from Stamp Duty		✔	✔		✔
Exempt from Property Taxes		✔	✔		✔
Exempt from tax on property transfer		✔	✔		✔
Exempt from taxes on reexport incomes	✔				
Exempt from taxes on incomes earned from foreign sources	✔				
Exempt from Divident Tax to shareholders residents abroad	✔				

Composite Modeling

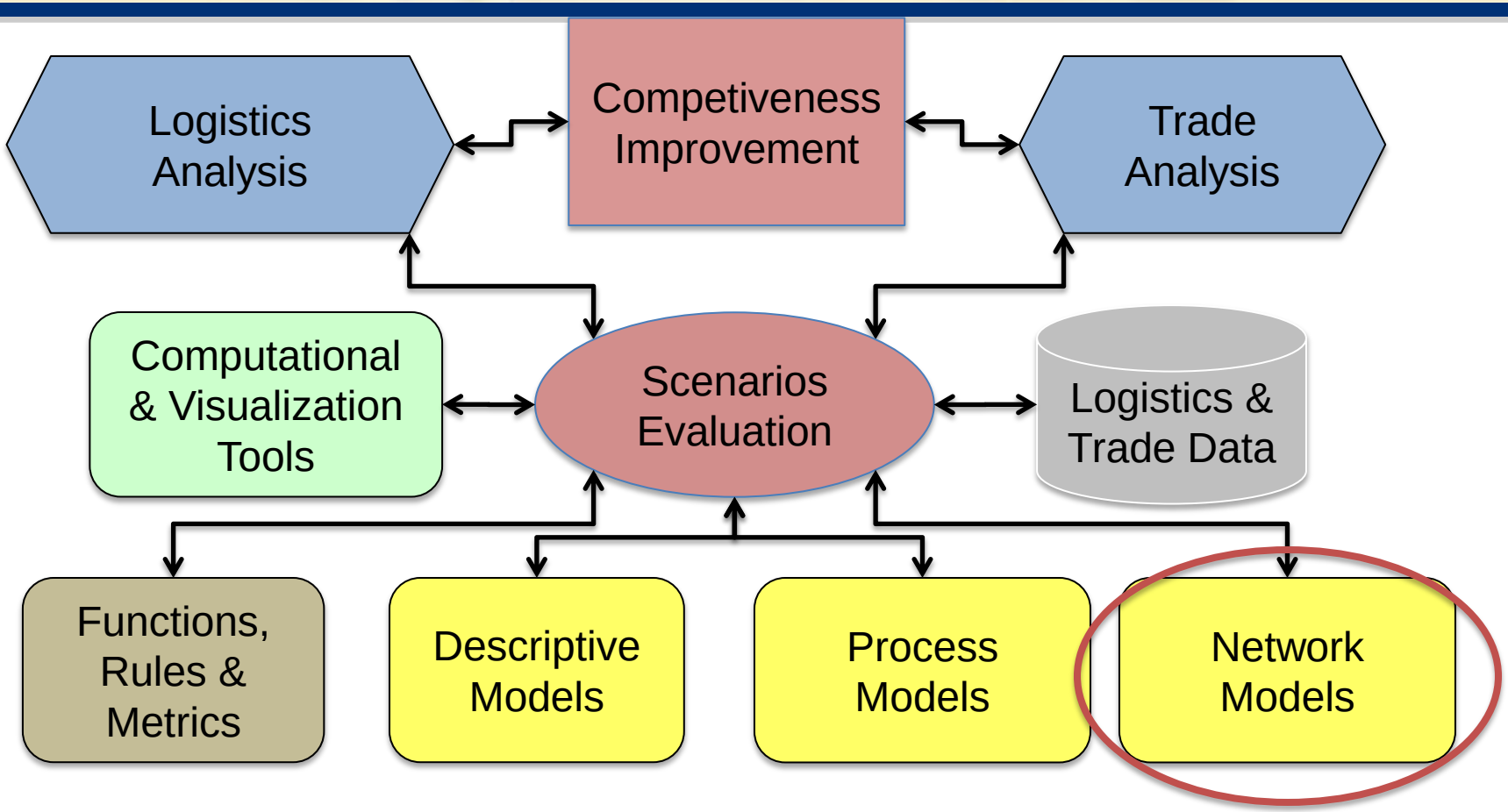


Process Models

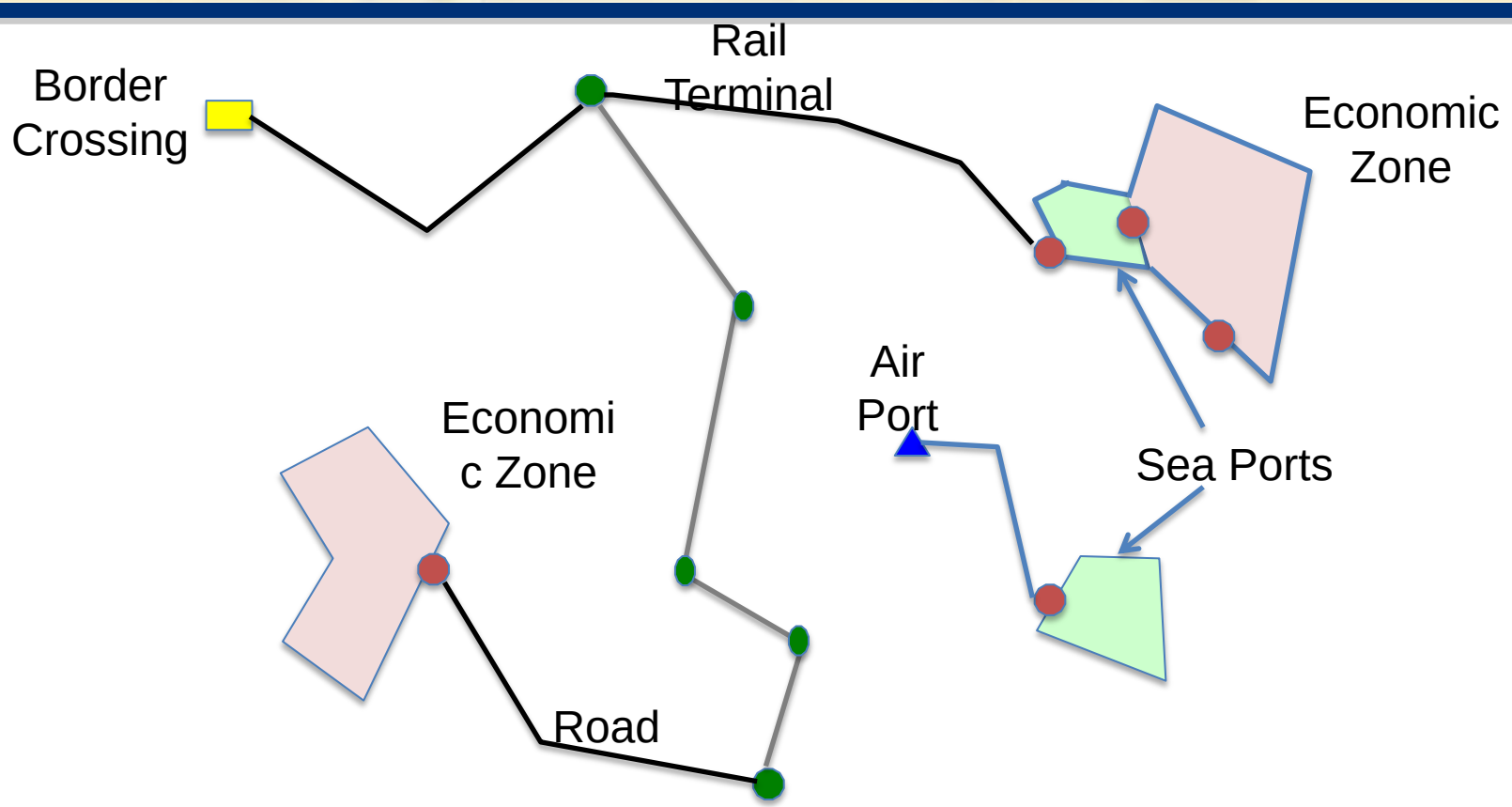


- Provide process maps of physical, financial and information flows
  - Identify opportunities for process improvement
  - Identify infrastructure and services gaps
  - Identify opportunities for improved integration
  - Identify opportunities for automation
  - Identify delays
- Develop time distributions for processes
- Provide structures for computational methods

Composite Modeling

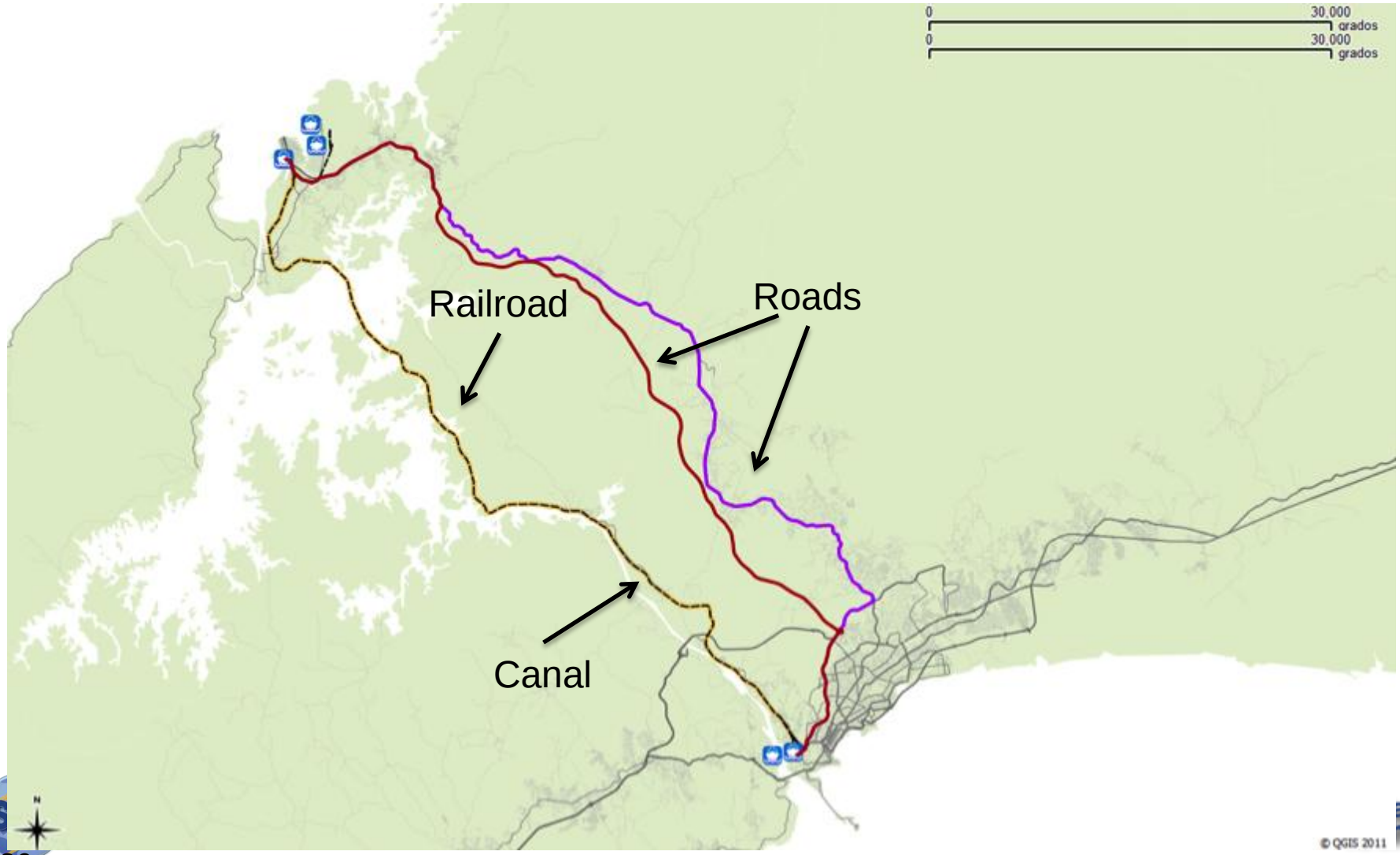


Network Models



- Provide representations of transportation connectivity and capability among logistics components (e.g., ports, economic zones, etc.)
- Provide structures for computation methods (e.g., road networks, shipping lanes, air lanes)
- Example: http://logistics.gatech.ac.pa/en/assets/airports/connectivity

North-South Port Connectivity

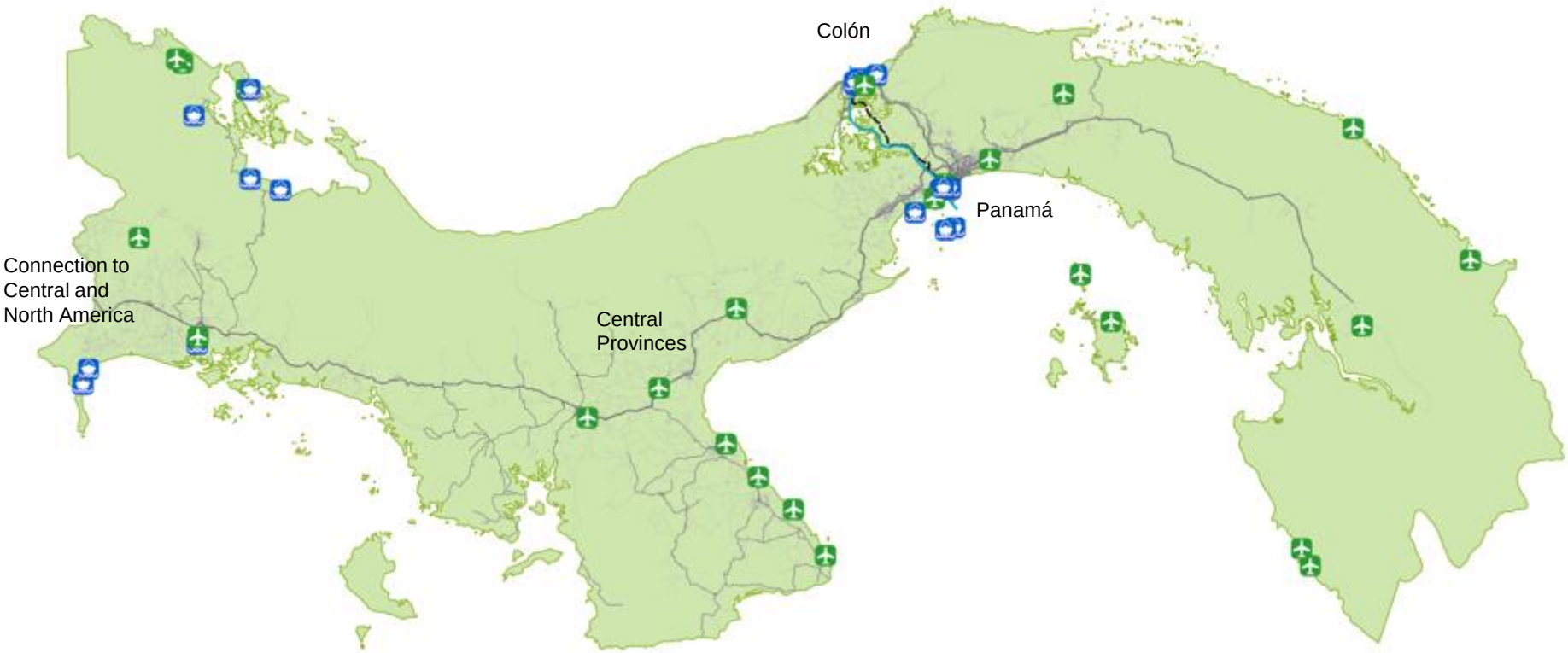


Railroad

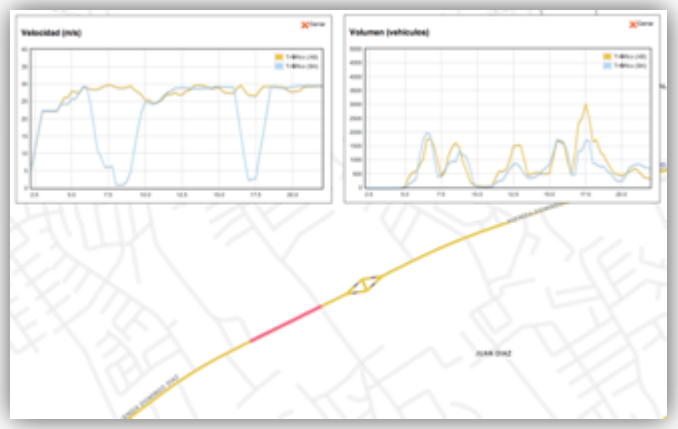
- Panama Railway Company
  - From the Atlantic to the Pacific in one hour
  - 500,000 TEU capacity
  - $14 M projected investment in infrastructure
  - Main users: Maersk, MSC, APL/MOL (multimodal operation)

Source: Panama Ministry of Commerce and Industries – *Investment Opportunities in Panama*

Panama's Logistics Platform: Ground Connectivity



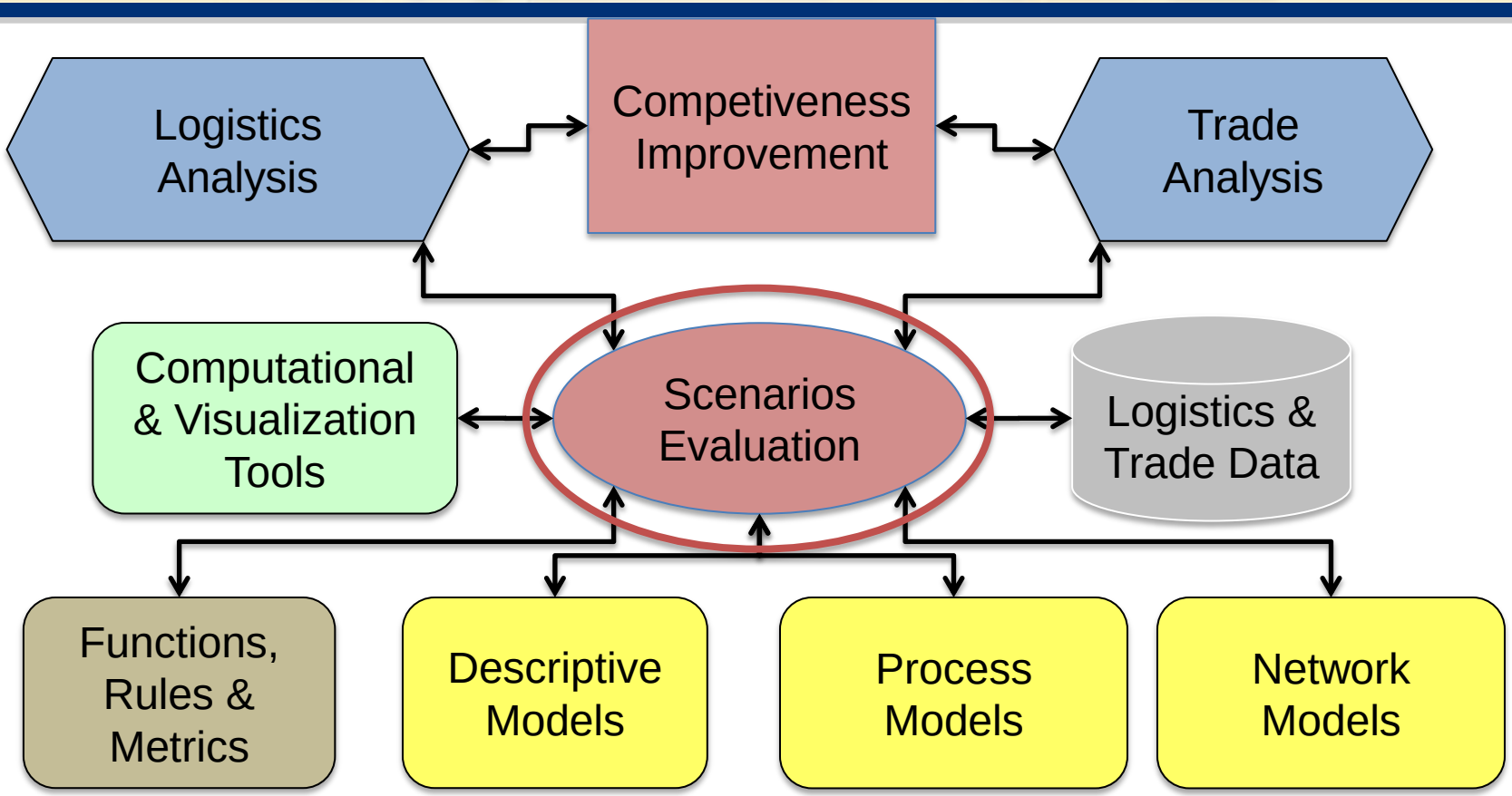
Ground Transportation Network



Development of a Port Connectivity Network

- Scheduled service from port of origin to any port of destination

Composite Modeling



Scenario Evaluation

- The Panama Canal expansion will be completed in 2014
- The expanded Canal will permit post panamax ships
- What will be the impact of these big ships
  - On the Canal?
  - On carriers?
  - On shippers?

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Increase in Post-Panamax Ships

CSAV orders two post-panamax containerships at Samsung **-** December 2010

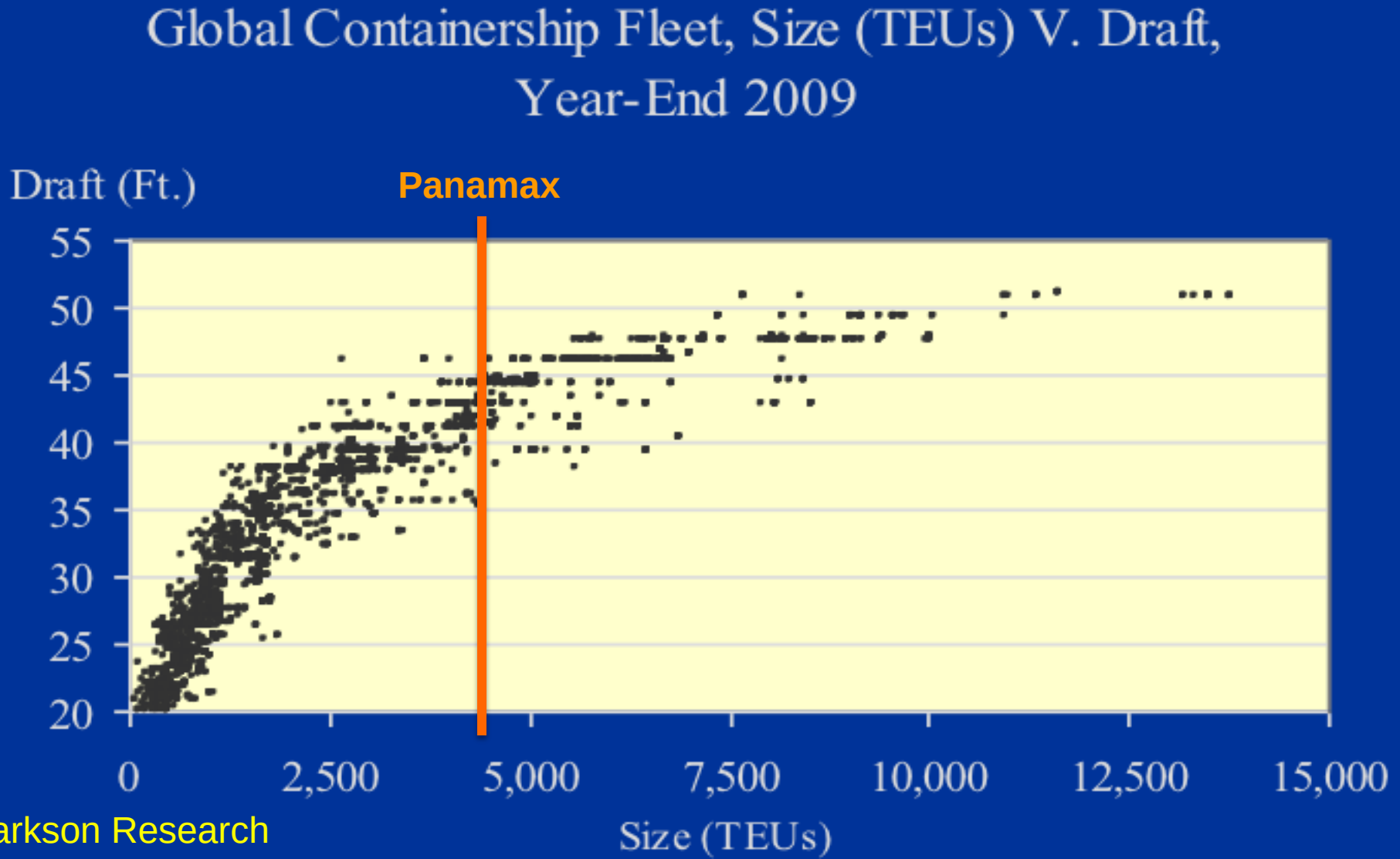
Technomar Shipping to order four post-panamax ships - May 2011

Evergreen Orders 10 Post-Panamax Ships **-** July, 2010

Neptune Orient Orders 10 14,000 teu container ships – June, 2011

Maersk orders as many as 30 18,000 teu container ships – Februrary 2011

Current Containership Fleet



Clarkson Research

Datos obtenidos del modelo de Competitividad – sin editar el Charter Rate

Estimated Service Cost for a Full Container vessel from Asia to East Coast United States (one way)

Vessel	Fuel	Charter	Ports	Canal	Cargo Handling	Service Cost
4,500 TEU	**$1,179,129.35**	**$443,432.06**	**$86,005.24**	**$412,450.00**	**$1,513,446.35**	**$3,634,463.01**
5,000 TEU	**$1,289,807.96**	**$491,697.06**	**$92,161.30**	**$449,930.00**	**$1,681,607.06**	**$4,005,203.37**
8,000 TEU	**$2,002,349.53**	**$840,310.71**	**$129,097.65**	**$696,410.00**	**$2,690,571.30**	**$6,358,739.19**
12,000 TEU	**$2,400,395.39**	**$1,053,378.23**	**$178,346.12**	**$1,016,650.00**	**$4,035,856.95**	**$8,684,626.69**

Estimated Unit Cost per TEU for a Full Container vessel from Asia to East Coast United States (one way)

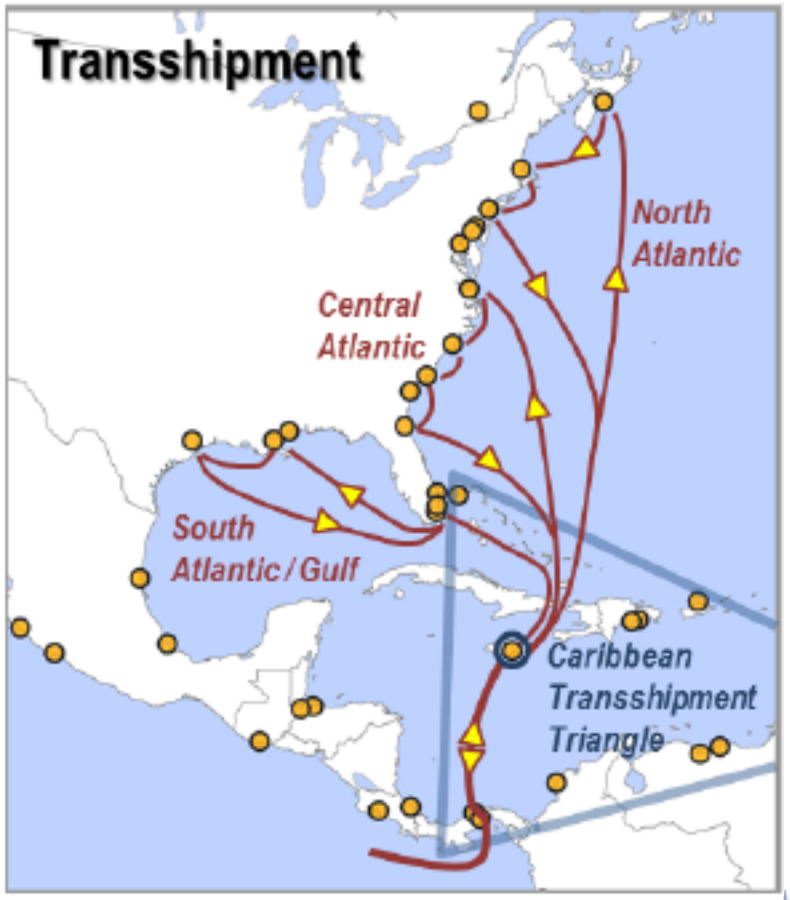
Vessel	Fuel	Charter	Ports	Canal	Cargo Handling	Cost per TEU
4,500 TEU	**$278.75**	**$104.83**	**$20.33**	**$97.51**	**$357.79**	**$859.21**
5,000 TEU	**$274.43**	**$104.62**	**$19.61**	**$95.73**	**$357.79**	**$852.17**
8,000 TEU	**$266.27**	**$111.74**	**$17.17**	**$92.61**	**$357.79**	**$845.58**
12,000 TEU	**$212.80**	**$93.38**	**$15.81**	**$90.13**	**$357.79**	**$769.91**

Note: Utilization - 87% full and 7% empty.

Source: ACP Route Competitive Analysis Model, February 2011

Impact of Post Panamax Ships

- Not likely to reduce freight rates
  - 12,000 TEU ships are about 10% per slot cheaper to operate
- Not enough freight for direct lanes
- Biggest ships can only access one east coast US port
- There is likely to be a transshipment hub in the triangle
- What is the potential for Panama to be this hub?
- What should Panama do to increase this potential?



Ref: Hofstra University, Dr. Jean-Paul Rodrigue Factors Impacting North American Freight Distribution in View of the Panama Canal Expansion 2010

Final Thoughts

- Intraregional trade
  - Growth trends will likely continue in Asia, North America and Europe
  - Potential for logistics improvement (short sea shipping) in Latin America and Africa
- Container shipping
  - Game changing trend toward service in container shipping
  - Big ships are inconsistent with better service
  - Big ships of less value in intraregional trade
- Improving logistics performance
  - Requires more structure
  - Requires more analytics
- Trade competiveness drivers
  1. Availability and cost of capital
  2. Time and dependability
  3. Transportation cost

Questions?

Comments?