

DSO 557A: Global Supply Chain Management in International Settings

How Infrastructure Affects Supply Chain Professor Nick Vyas

Infrastructure

Basic physical and organizational structures needed for the operation of a society or enterprise

Hard Infrastructure



Soft Infrastructure



Hard Infrastructure

Large physical networks necessary for the functioning of a modern Industrial Nation or Enterprise

Transport

- Road and Highway Networks
- Mass Transit Systems
- Airports
- Seaports

Energy

- Electrical power network -Generation plants, Electrical grid, etc.
- Petroleum and Natural Gas

Communication

- Mobile and Telephone networks
- Information Technology

According to you, which component of Hard Infrastructure is most critical for a Industrial Nation or Enterprise ?



Soft Infrastructure

All the Institutions are required to maintain the economic, health, and cultural and social standards of a country

Government

- Government and law enforcement
- Political, legislative
- Emergency Services
- Military
- IT

Economic

- The financial system
- Banking system, financial regulations
- Accounting standards and regulations

Social

- Health Care
- Hospitals
- Social Security
- Welfare

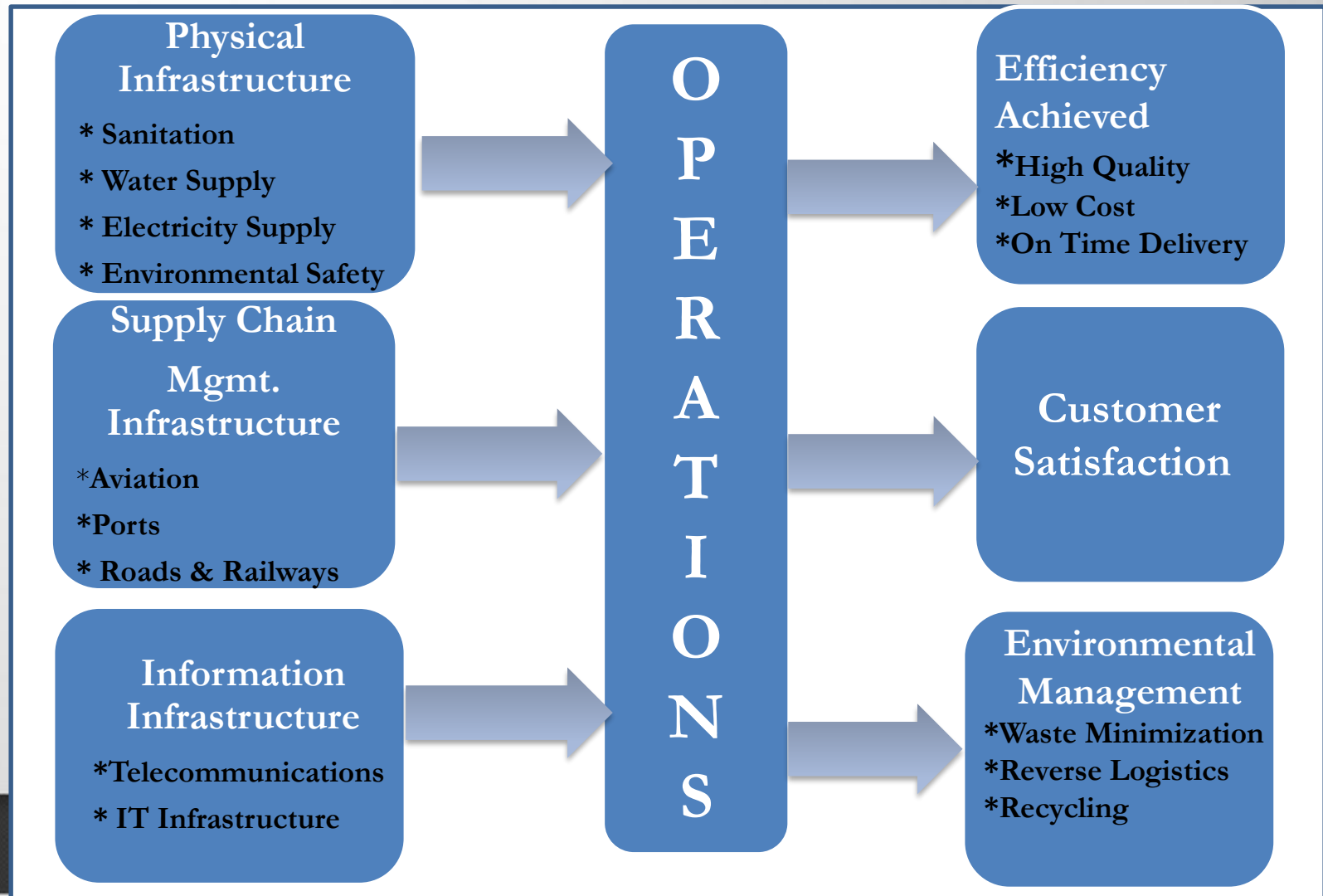
How Infrastructure Affects Supply Chain?



Supply Chain Infrastructure impact is far beyond the confines of an individual organization or enterprise

It has become a dynamic process that involves the simultaneous acquisition, evaluation and continuous reevaluation of partners, technologies, organizational structures.

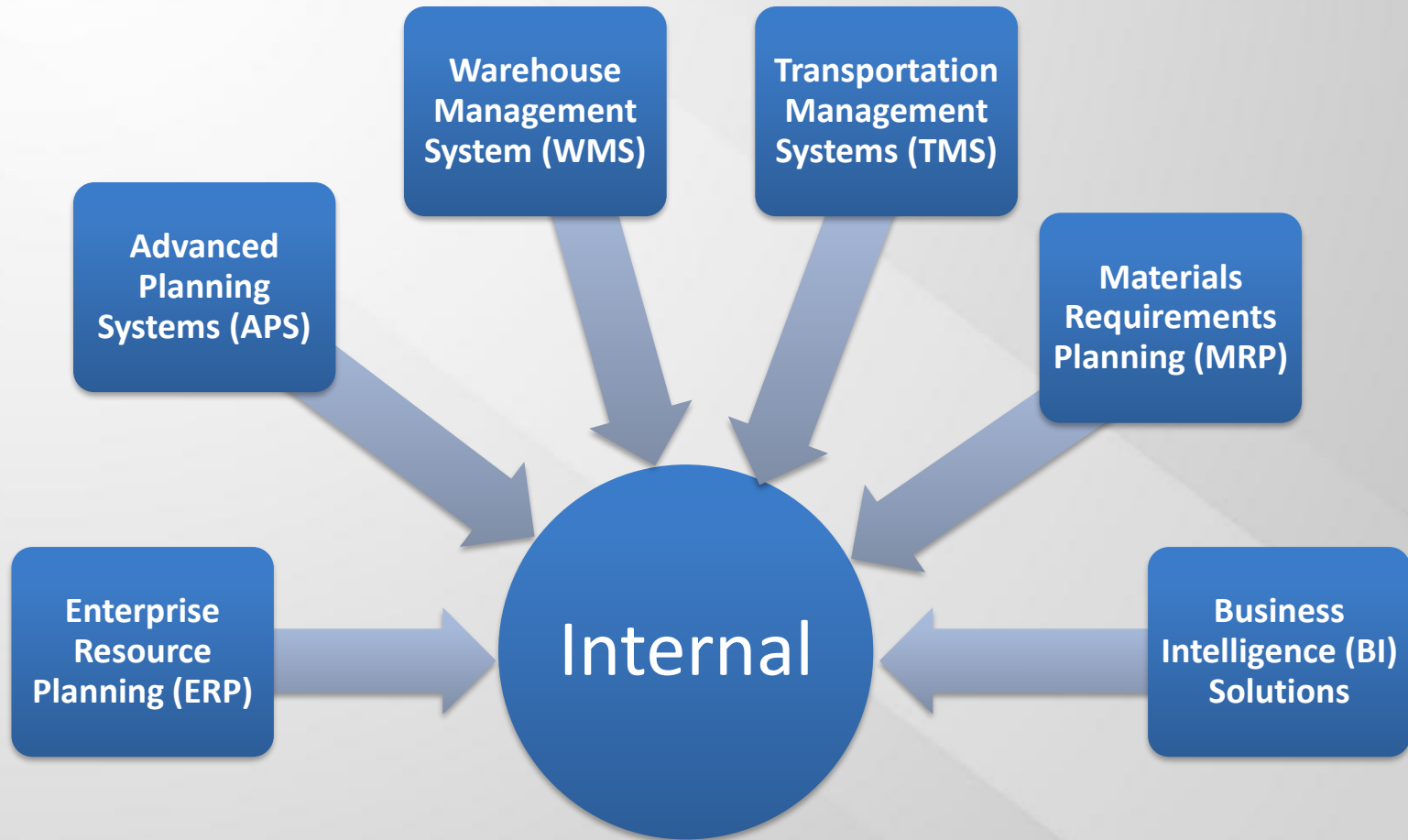
Concept of Operation Supply Chain Infrastructure



Key Factors in Supply Chain Infrastructure

- **Networks:** New or existing interactions between economic entities
- **Performance:** Improvements in cost and time attributes
- **Reliability:** Quality KPI's, On-time, Speed to market
- **Market size:** Access to a wider market base, optimizing economy of scale in production, distribution and consumption can be improved.
- **Productivity:** Increases in raw materials, parts, energy or labor and broader markets for diverse outputs (Raw material, intermediate and finished goods).

What composes the Internal Infrastructure of a company?



Enterprise Resource Planning (ERP)

ERP systems cover all computing for an organization by centralizing data from operations

Comprehensive

Integrates many business functions in a single database

Flexible

Change with enterprise needs

Modular

New modules can easily be incorporated

External Linkage

Communicates with supply chain partners outside the organization

Location & Relative Importance of Critical Factors of Infrastructure

	Starting a Business	Operating a Business	Long-term Stability
Regulations	Requirements • Screening • Regulations on Capital Movement • Local Content Access to Land • Number of Permits/ Licenses Required	• Regulations on Profit Repatriation • Restrictions of Closures, Relocations and Layoffs • Renewal /Expansion Requirements	Stability & Predictability of Regulations
Approval & Enforcement of Regulations	• Accessibility and Clarity of Regulations • Efficiency & Impartiality of Approval Process • Jurisdictional Overlap between Approving Agencies • Corruption in Approval Process	• National Treatment/Equal Treatment: Bias in Enforcement • Coordination and Alignment between National and Local Government Agencies	
Quality of Institutions	• Adoption/Acceptance of International Standards	• Property Rights Protection • Presence of Government Agency and Judicial Corruption • Intellectual Property Rights	• Political Conditions • Dispute Resolution • Inclusion in Formulating Rules and Regulation

Location & Relative Importance of Critical Factors of Infrastructure

	Demand Attractiveness	Starting a Business	Operating a Business	Long-term Stability
Enhancers	Existence of Free Trade Agreements and Investment Agreements	- Availability and Reliability of Information - Investment Opportunities - Quality of Investment Promotion Agencies - Investment & Tax Incentives		FDI is a Policy Priority
Business Conditions	- Market Size - Socio Economic Conditions - Domestic Favoritism	- Availability and Readiness of Firms for Acquisition and JV Partners - Quality of Capital Markets	- Impact of Business Networks & Cultural Embeddedness - Quality and Availability of Supply Chains Partners - Quality of Infrastructure (ICTs) - Competitiveness in Domestic Markets/ Presence of Monopolies and SOEs - Business Corruption , Physical Security and Organized Crime Tax Environment	
Human Capital		- Visa and Work Permit Restrictions - Recognition of Skills and Qualifications	- Quality of Life for Expatriates and Personal Safety - Restrictions on Hiring and Firing Domestic Workers - Quality and Availability of Human Capital	

Critical Infrastructure Barriers to Seven Sectors of Economy



Retail & Restaurants

Industries that rely on efficiencies of scale derived from multiple brick and mortar locations are stunted by a lack of coordination between municipalities.



Software, Platform & Cloud

In order to support investment in innovation industries, governments must protect intellectual property rights and invest in human capital.



Trucking Services

Commitment to the enforcement of global standards enables industries comprised of small or independent operators to expand across borders.



Life Insurance

Investment in financial services is deterred by foreign ownership restrictions and lack of high-quality of capital markets.



Container Port Services

Long-term economic, regulatory, and political stability are critical to service industries that require significant infrastructure investment.



Accounting

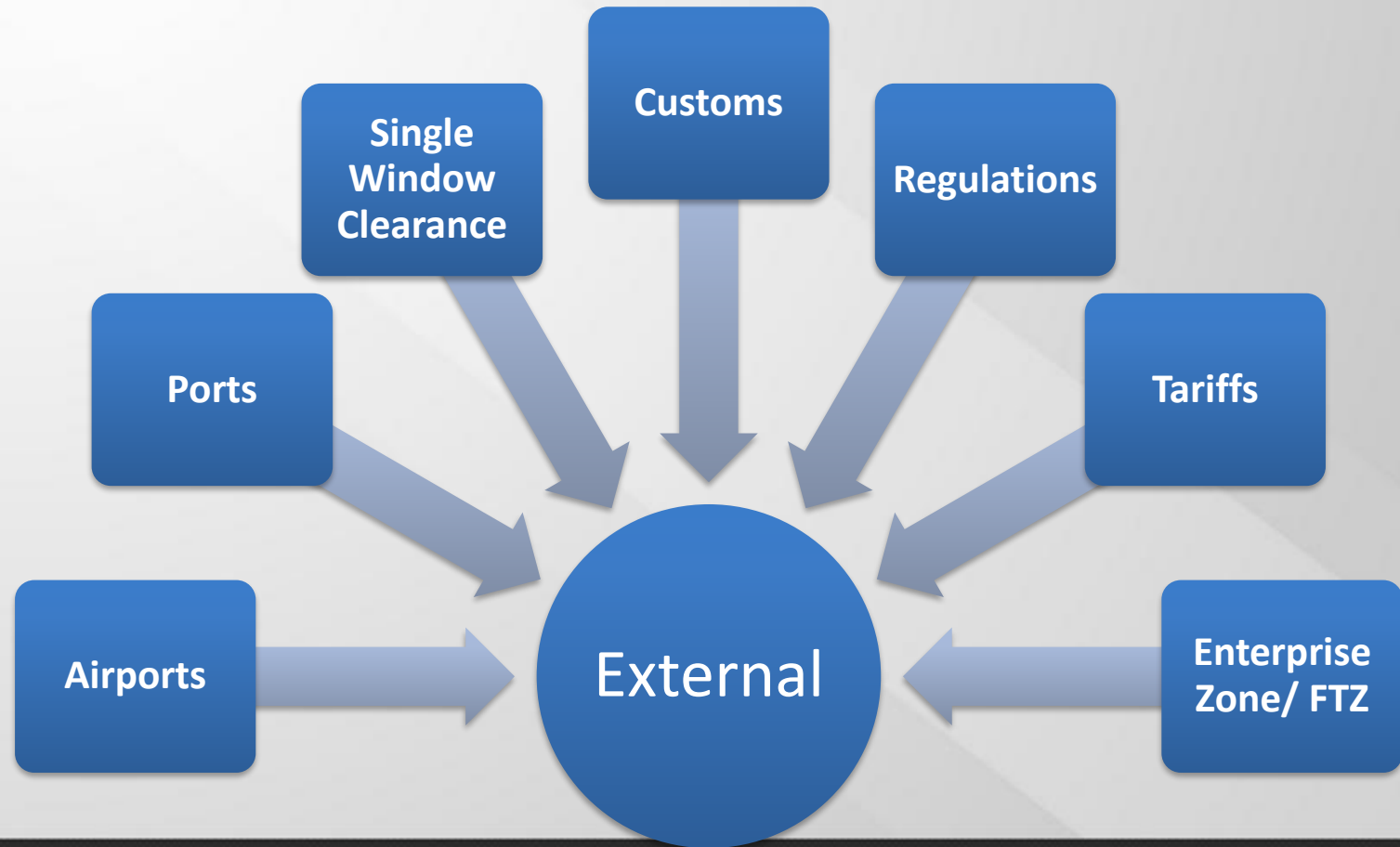
The adoption of global standards (like IFRS) and the mutual recognition of qualifications incentivizes growth in professional services.



Broadband & Telecom

Industries that rely on large shared resources require government support and regulation without biased support of of State-Owned Enterprises.

What composes the External Infrastructure of a company ?



How can good External Infrastructure benefit a company's Supply Chain?

New transportation connectors and gateways allow shippers to source from more distant suppliers from lower costs



Reduce the number of plants a company operates and increase ROI



Reduces congestion, improving reliability and reducing variability in transit time, increasing accuracy of performance predictions



Better transit time visibility, increase customer satisfaction and sales



Increased Revenue

Evolution of Supply Chain

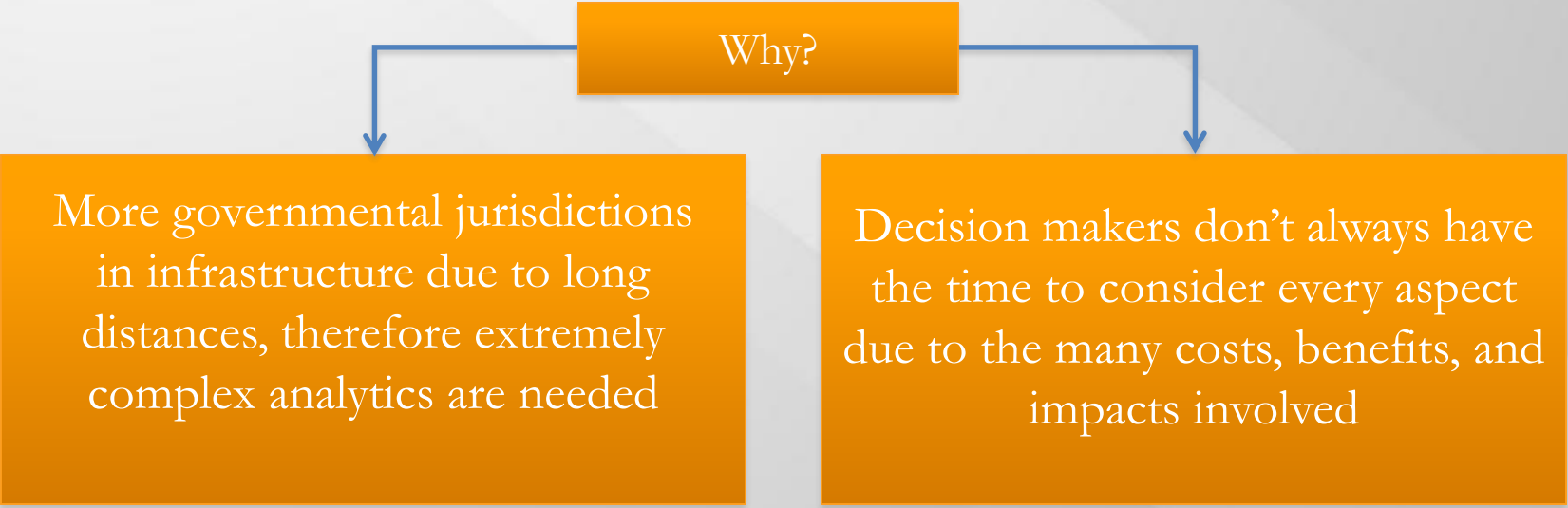
- **Increase** in the urban population on account of rapid industrialization, natural growth and migration from rural areas.
- **Alternative ways of meeting** the increasing Supply Chain demand
- **Constraints** of land, capital, and the need to control energy consumption, pollution and accidents



Government Challenges of Developing Hard Infrastructure

Government transportation officials and their consultants rarely account for short-term and long-term supply chain effects in their financial evaluations of freight transportation investments.

Why?



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graph TD; A[Why?] --> B[More governmental jurisdictions in infrastructure due to long distances, therefore extremely complex analytics are needed]; A --> C[Decision makers don't always have the time to consider every aspect due to the many costs, benefits, and impacts involved];
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More governmental jurisdictions in infrastructure due to long distances, therefore extremely complex analytics are needed

Decision makers don't always have the time to consider every aspect due to the many costs, benefits, and impacts involved

How does the Private sector affect Public Infrastructure?

Many governments do not have the financial resources and skills to provide the required infrastructure assets and look to the private sector to close the gap



Public-Private Partnerships (PPP) can accelerate infrastructure



Benefits to Private: CSR
Benefits to Public: financial



Challenges: “Project
Preparation Gap”

10 Guidelines for Supply Chain Network Infrastructure Planning



1. **Network Design:** 75%- 80% of total supply chain costs attributed to network-biggest opportunity
2. **Network Optimization:** Alignment of supply chain infrastructure to realize maximum cost, quality and speed to market
3. Determine the **changes** that can be impacted
4. Implement **technology roadmap assessment** to make the supply chain decisions

10 Guidelines for Supply Chain Network Infrastructure Planning



5. Modern infrastructure planning requires a collaborative private/public effort
6. The planning process needs to include many different scenarios to ensure a robust solution
7. Consider hybrid solutions to ensure low-cost, high level customer service...build in phases not all at once

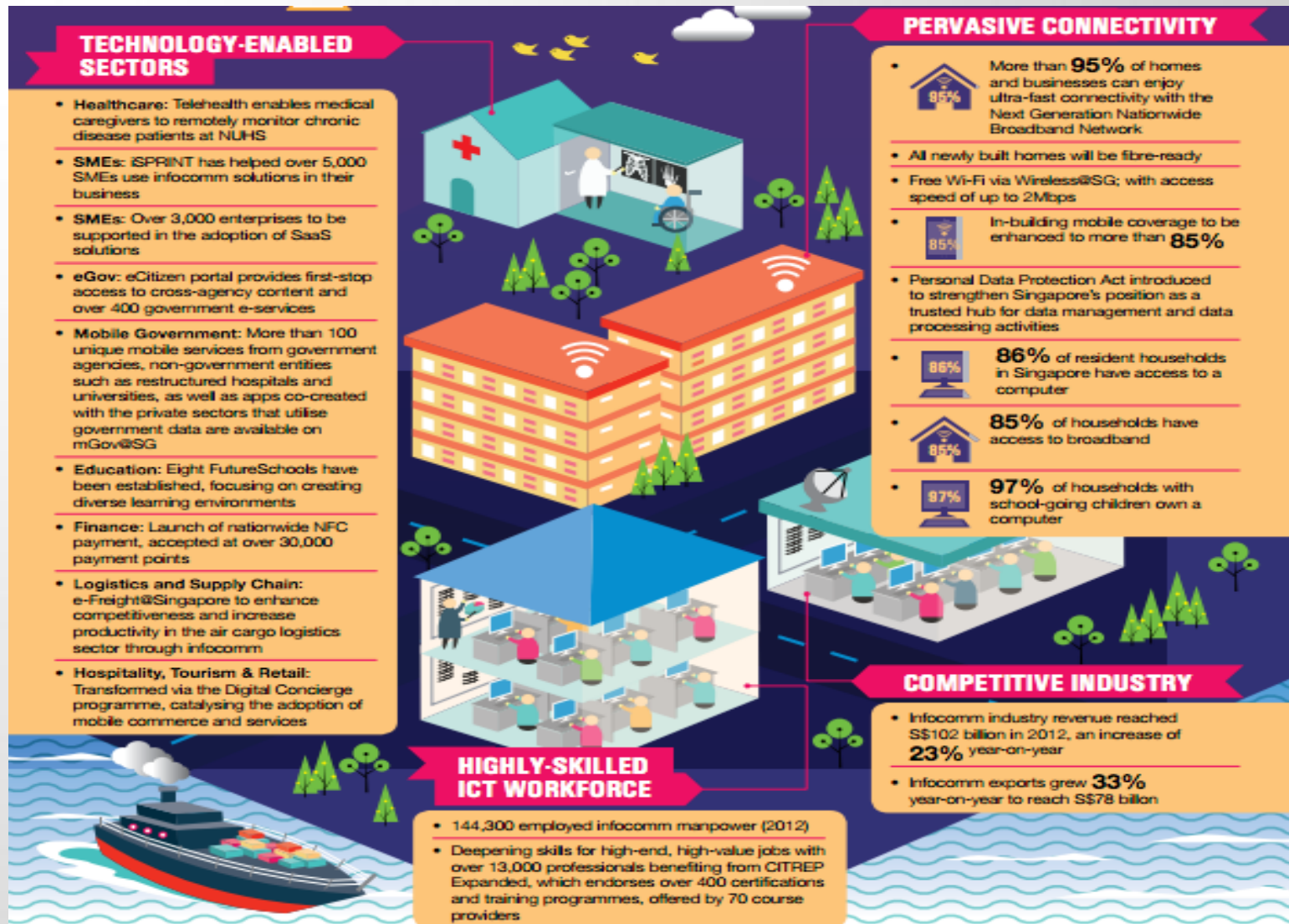
10 Guidelines for Supply Chain Network Infrastructure Planning

8. Models and analysis mean nothing without implementation plan and cost benefit analysis
9. Network design should minimize inefficiencies.
10. The answer is in the data

Why Regional Hub?

Access Asia Pacific Markets Within 24 Hours; Reduced Time-to-Market

- Singapore offers...
 - Excellent connectivity
 - Postponement strategy to reduce time-to-market
 - A reliable and secure location
 - Market-specific customization
 - Highly efficient customs and business-friendly import/export procedures,
 - Timely delivery to destinations in Asia Pacific



12 Pillar Analysis of GCI Index

1. GLOBAL COMPETITIVE INDEX

2. LOGISTICS PERFORMANCE INDEX

3. TRANSPORTASI LAUT

12 Pillars of GPI

[Link : 12 Pillars of Competitiveness Global Competitive Index](#)

The 12 Pillars of Competitiveness



Institutions



Infrastructure



Macroeconomic
environment



Health and
primary education



Higher education
and training



Goods market
efficiency



Labour market
efficiency



Financial market
development



Technological
readiness



Market size



Business
sophistication



Innovation

Source: [12 Pillars of Global Competitive Index](#)

12 Pillar Analysis

12 Pillars – World Economic Forum

The WEF framework groups 100 factors into 12 pillars that represent the structural supports of a competitive economy. With regard to a country and its economy, these pillars should be among the key areas of focus for board members and executive management of organizations with operations there or with short- or long-term plans to enter that market. Here are those pillars, and why they are important:



Digital Autonomy in Transformation

Redesigning The Landscape

DIGITAL ASSETS : MARKETING, BRANDING, BUSINESS

TECHNOLOGY: TESTING, NEWS, LEARNING

#Pi

Author: <https://blog.privvi.com/2013/09/26/evaluating-global-risk-wef-and-the-12-pillars/>

12 Pillar Analysis

THE GLOBAL COMPETITIVENESS INDEX



Measures of Productivity

Partial Measures	$\frac{\text{Output}}{\text{Labor}}$	$\frac{\text{Output}}{\text{Machine}}$	$\frac{\text{Output}}{\text{Capital}}$	$\frac{\text{Output}}{\text{Energy}}$
Multifactor Measures	$\frac{\text{Output}}{\text{Labor} + \text{Machine}}$	$\frac{\text{Output}}{\text{Labor} + \text{Capital} + \text{Energy}}$		
Total Measure	$\frac{\text{Goods or Services Produced}}{\text{All inputs used to produce them}}$			

12 Pillar Analysis

The level of productivity, in turn, sets the level of prosperity that can be reached by an economy.

12 Pillar Analysis

First pillar: Institutions

The institutional environment is determined by the legal and administrative framework within which individuals, firms, and governments interact to generate wealth.

12 Pillar Analysis

Second pillar: Infrastructure

Extensive and efficient infrastructure is critical for ensuring the effective functioning of the economy, as it is an important factor in determining the location of economic activity and the kinds of activities or sectors that can develop within a country.

12 Pillar Analysis

* **Third pillar: Macroeconomic environment**

The stability of the macroeconomic environment is important for business and, therefore, is significant for the overall competitiveness of a country.

12 Pillar Analysis

Fourth pillar: Health and primary education

A healthy workforce is vital to a country's competitiveness and productivity. Workers who are ill cannot function to their potential and will be less productive. Poor health leads to significant costs to business, as sick workers are often absent or operate at lower levels of efficiency.

12 Pillar Analysis

Fifth pillar: Higher education and training

Quality higher education and training is crucial for economies that want to move up the value chain beyond simple production processes and products.

12 Pillar Analysis

Sixth pillar: Goods market efficiency

Countries with efficient goods markets are well positioned to produce the right mix of products and services given their particular supply-and-demand conditions, as well as to ensure that these goods can be most effectively traded in the economy.

12 Pillar Analysis

Seventh pillar: Labor market efficiency

The efficiency and flexibility of the labor market are critical for ensuring that workers are allocated to their most effective use in the economy and provided with incentives to give their best effort in their jobs.

12 Pillar Analysis

Eighth pillar: Financial market development

The financial and economic crisis has highlighted the central role of a sound and well-functioning financial sector for economic activities. An efficient financial sector allocates the resources saved by a nation's citizens, as well as those entering the economy from abroad, to their most productive uses.

12 Pillar Analysis

Ninth pillar: Technological readiness

The technological readiness pillar measures the agility with which an economy adopts existing technologies to enhance the productivity of its industries, with specific emphasis on its capacity to fully leverage information and communication technologies (ICTs) in daily activities and production processes for increased efficiency and enabling innovation for competitiveness.

12 Pillar Analysis

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12 Pillar Analysis

Tenth pillar: Market size

Traditionally, the markets available to firms have been constrained by national borders. In the era of globalization, international markets have become a substitute for domestic markets, especially for small countries. Vast empirical evidence shows that trade openness is positively associated with growth.

12 Pillar Analysis

Eleventh pillar: Business sophistication

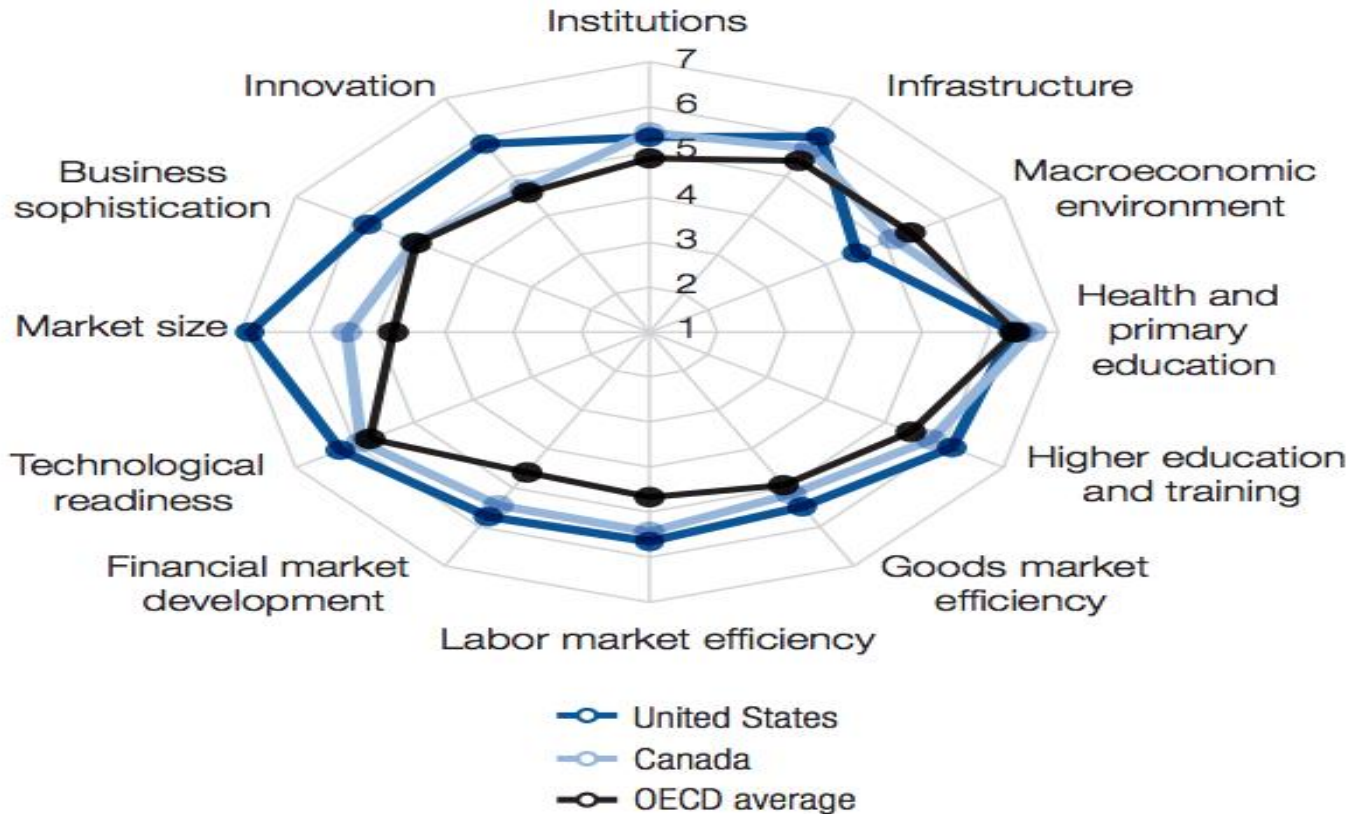
Innovation can emerge from new technological and non-technological knowledge. Non-technological innovations are closely related to the know-how, skills, and working conditions that are embedded in organizations and are therefore largely covered by the eleventh pillar of the GCI.

12 Pillar Analysis

Twelfth pillar: Innovation

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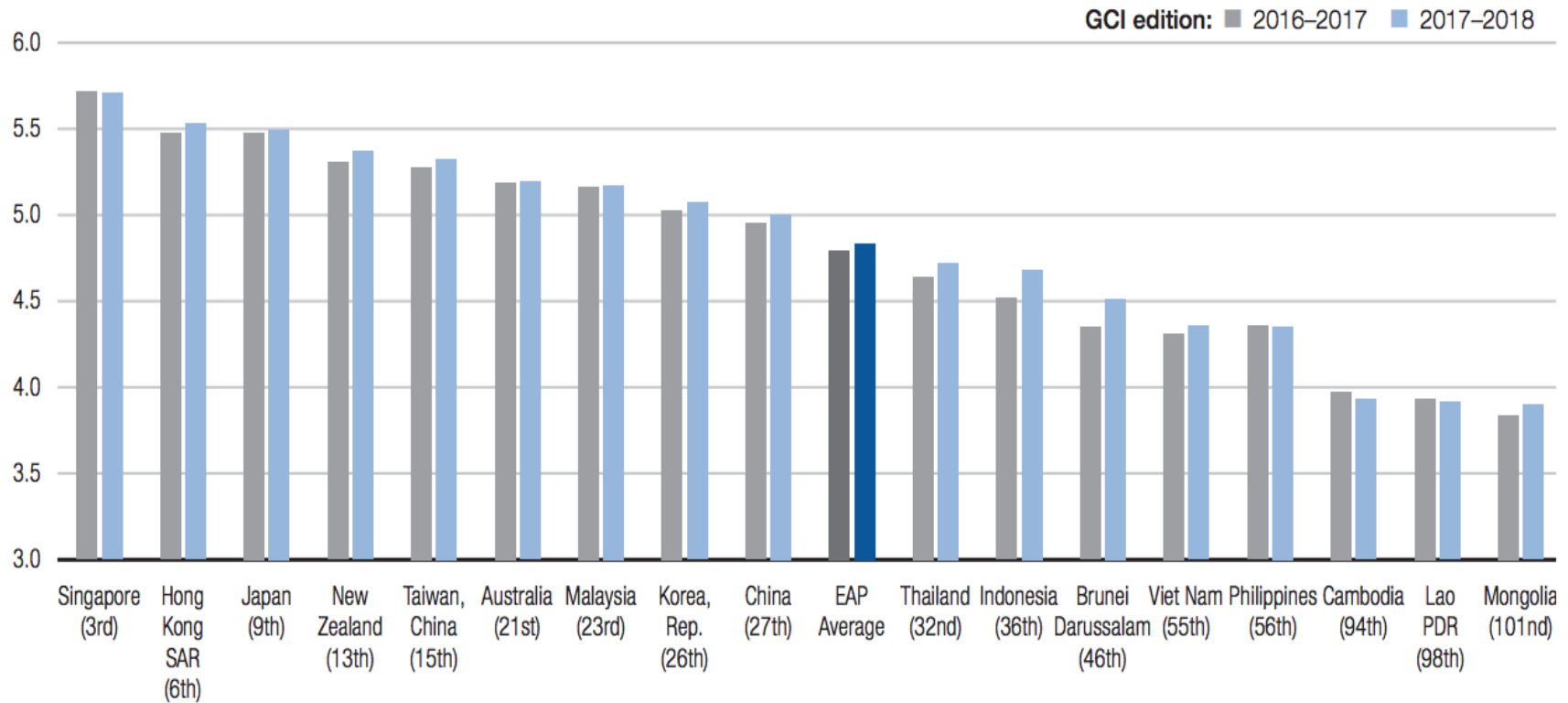
12 Pillars Comp. US vs. OECD



Source: Calculations based on the results of the Global Competitiveness Index 2017–2018.
Note: OECD = Organisation for Economic Co-operation and Development.

Singapore vs. Rest of the Asia CGI USC

Figure 3: Overall GCI scores for East Asia and Pacific (EAP) for 2016–2017 and 2017–2018



Source: Calculations based on the results of the Global Competitiveness Index 2016–2017 and 2017–2018.

GCI vs. Sub Category Comp.

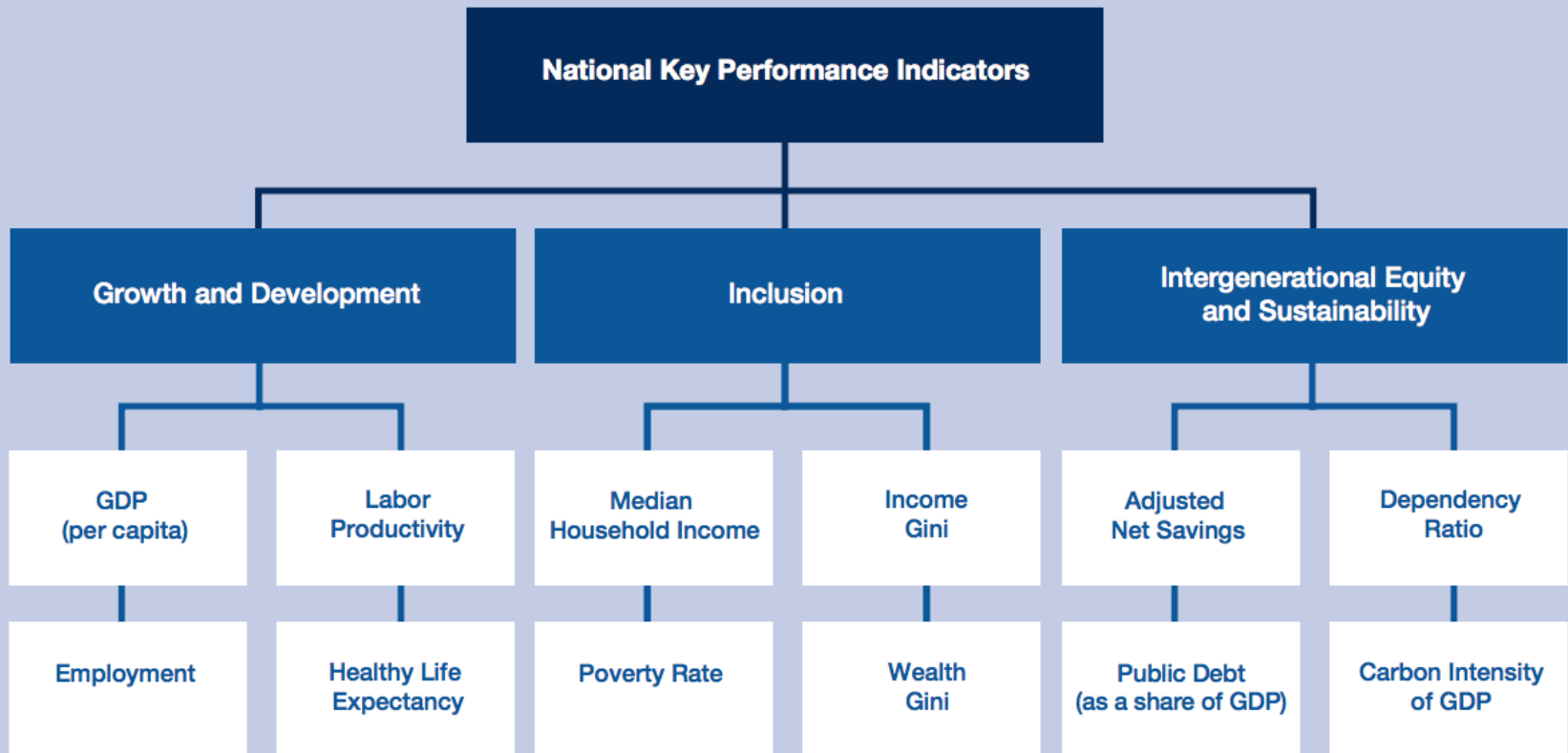


Economy	OVERALL INDEX		SUBINDEXES					
	Rank	Score	Basic requirements		Efficiency enhancers		Innovation and sophistication factors	
			Rank	Score	Rank	Score	Rank	Score
Switzerland	1	5.86	1	6.39	3	5.65	1	5.86
United States	2	5.85	25	5.54	1	6.01	2	5.80
Singapore	3	5.71	2	6.34	2	5.72	12	5.25
Netherlands	4	5.66	4	6.24	8	5.46	4	5.62
Germany	5	5.65	11	5.97	6	5.53	3	5.65
Hong Kong SAR	6	5.53	3	6.26	4	5.58	18	4.96
Sweden	7	5.52	8	6.00	12	5.30	5	5.57
United Kingdom	8	5.51	23	5.65	5	5.55	9	5.34
Japan	9	5.49	21	5.66	10	5.39	6	5.55
Finland	10	5.49	9	5.98	11	5.30	8	5.48
Norway	11	5.40	6	6.02	14	5.29	13	5.19
Denmark	12	5.39	13	5.90	15	5.26	11	5.28
New Zealand	13	5.37	5	6.05	9	5.43	25	4.81
Canada	14	5.35	17	5.72	7	5.52	24	4.82
Taiwan, China	15	5.33	15	5.84	16	5.25	15	5.12
Israel	16	5.31	28	5.48	19	5.12	7	5.53
United Arab Emirates	17	5.30	7	6.02	17	5.23	20	4.93
Austria	18	5.25	19	5.70	22	5.03	10	5.30
Luxembourg	19	5.23	10	5.98	23	5.01	16	5.11
Belgium	20	5.23	27	5.48	18	5.15	14	5.18
Australia	21	5.19	18	5.70	13	5.29	27	4.68
France	22	5.18	26	5.54	20	5.10	17	5.07
Malaysia	23	5.17	24	5.55	24	4.94	21	4.91
Ireland	24	5.16	20	5.68	21	5.09	19	4.93
Qatar	25	5.11	12	5.91	25	4.94	22	4.85

WEF Rankings for Trade 2018 USC

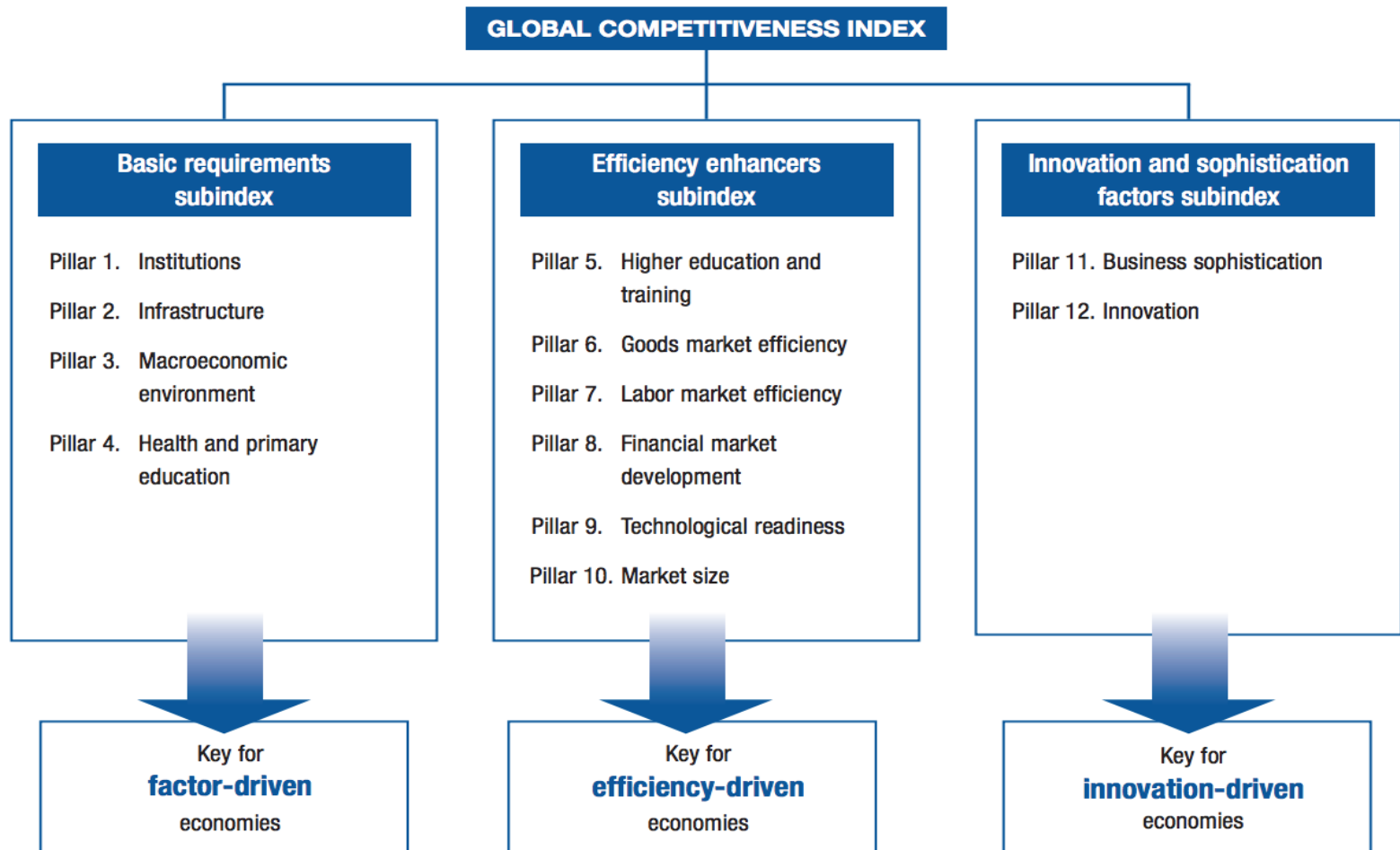
	Economy	Score ¹	Prev. ²	Trend ³
1	Switzerland	5.86	1	
2	United States	5.85	3	
3	Singapore	5.71	2	
4	Netherlands	5.66	4	
5	Germany	5.65	5	
6	Hong Kong SAR	5.53	9	
7	Sweden	5.52	6	
8	United Kingdom	5.51	7	
9	Japan	5.49	8	
10	Finland	5.49	10	
11	Norway	5.40	11	
12	Denmark	5.39	12	
13	New Zealand	5.37	13	
14	Canada	5.35	15	
15	Taiwan, China	5.33	14	
16	Israel	5.31	24	
17	United Arab Emirates	5.30	16	
18	Austria	5.25	19	
19	Luxembourg	5.23	20	
20	Belgium	5.23	17	

National KPI's



Source: World Economic Forum 2017.

What is Global Competitiveness Index? USC



See Appendix A for the detailed structure of the GCI.

Which out of the following, according to you, is absolutely critical while considering your option to set up trade relations with a country? Please click on one of the options below.

Domestic Market Access

Foreign Market Access

Operating Environment

Key Indicator Comparisons

Singapore

Malaysia

The Global Competitiveness Index 2017-2018 edition



Key indicators, 2016

Source: International Monetary Fund; World Economic Outlook Database (April 2017)

Population millions	5.6	GDP per capita US\$	52,960.7
GDP US\$ billions	297.0	GDP (PPP) % world GDP	0.41

Key indicators, 2016

Source: International Monetary Fund; World Economic Outlook Database (April 2017)

Population millions	31.7	GDP per capita US\$	9,360.5
GDP US\$ billions	296.4	GDP (PPP) % world GDP	0.72

Performance overview

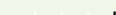
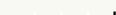
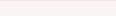
Index (Components) Overall Index Score (1-7) Trend Distance from best Edition 2013-13 2014-14 2015-15 2016-16 2017-17

Key Indicators Comparison

Singapore

Index Component	Rank/137	Score (1-7)	Trend	Distance from best
Global Competitiveness Index	3	5.7		
Subindex A: Basic requirements	2	6.3		
 1st pillar: Institutions	2	6.1		
 2nd pillar: Infrastructure	2	6.5		
 3rd pillar: Macroeconomic environment	18	6.0		
 4th pillar: Health and primary education	3	6.8		
Subindex B: Efficiency enhancers	2	5.7		
 5th pillar: Higher education and training	1	6.3		
 6th pillar: Goods market efficiency	1	5.8		
 7th pillar: Labor market efficiency	2	5.8		
 8th pillar: Financial market development	3	5.7		
 9th pillar: Technological readiness	14	6.1		
 10th pillar: Market size	35	4.8		
Subindex C: Innovation and sophistication factors	12	5.2		
 11th pillar: Business sophistication	18	5.2		
 12th pillar: Innovation	9	5.3		

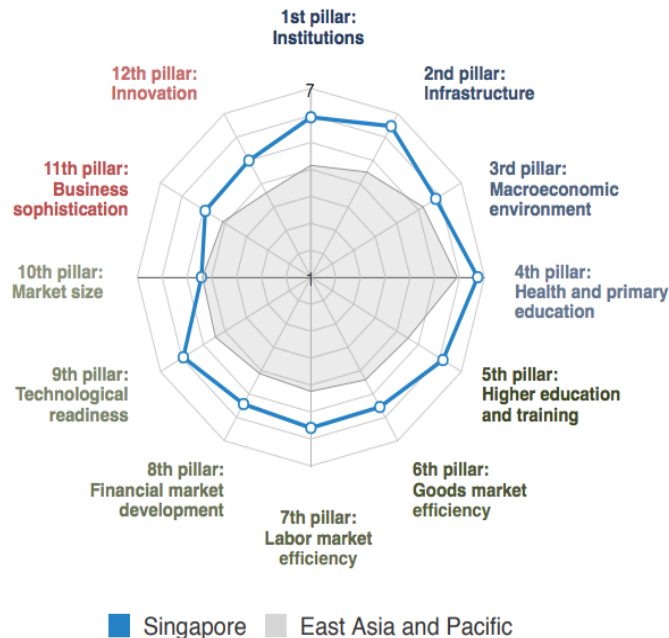
Malaysia

Index Component	Rank/137	Score (1-7)	Trend	Distance from best
Global Competitiveness Index	23	5.2		
Subindex A: Basic requirements	24	5.5		
 1st pillar: Institutions	27	5.0		
 2nd pillar: Infrastructure	22	5.5		
 3rd pillar: Macroeconomic environment	34	5.4		
 4th pillar: Health and primary education	30	6.3		
Subindex B: Efficiency enhancers	24	4.9		
 5th pillar: Higher education and training	45	4.9		
 6th pillar: Goods market efficiency	20	5.1		
 7th pillar: Labor market efficiency	26	4.7		
 8th pillar: Financial market development	16	5.0		
 9th pillar: Technological readiness	46	4.9		
 10th pillar: Market size	24	5.1		
Subindex C: Innovation and sophistication factors	21	4.9		
 11th pillar: Business sophistication	20	5.1		
 12th pillar: Innovation	22	4.7		

Key Indicator Comparisons

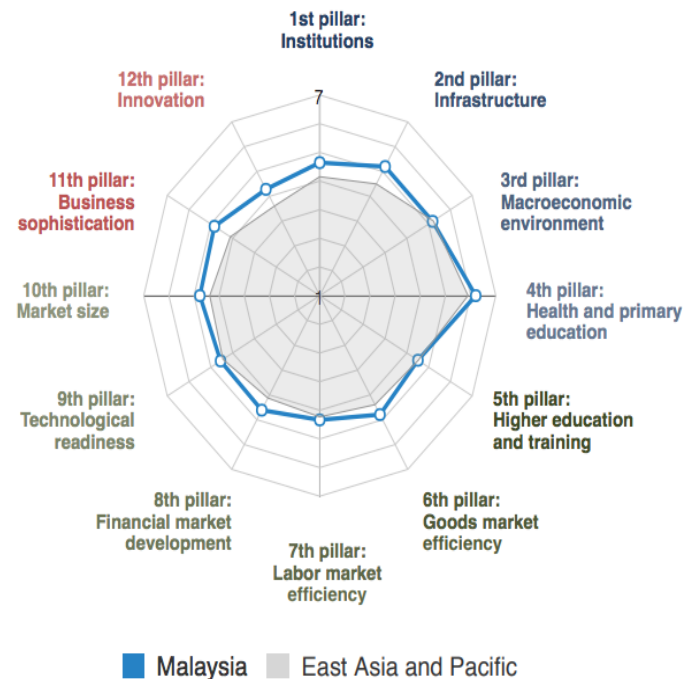
Singapore

Edition	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rank	2 / 144	2 / 148	2 / 144	2 / 140	2 / 138	3 / 137
Score	5.7	5.6	5.6	5.7	5.7	5.7



Malaysia

Edition	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rank	25 / 144	24 / 148	20 / 144	18 / 140	25 / 138	23 / 137
Score	5.1	5.0	5.2	5.2	5.2	5.2

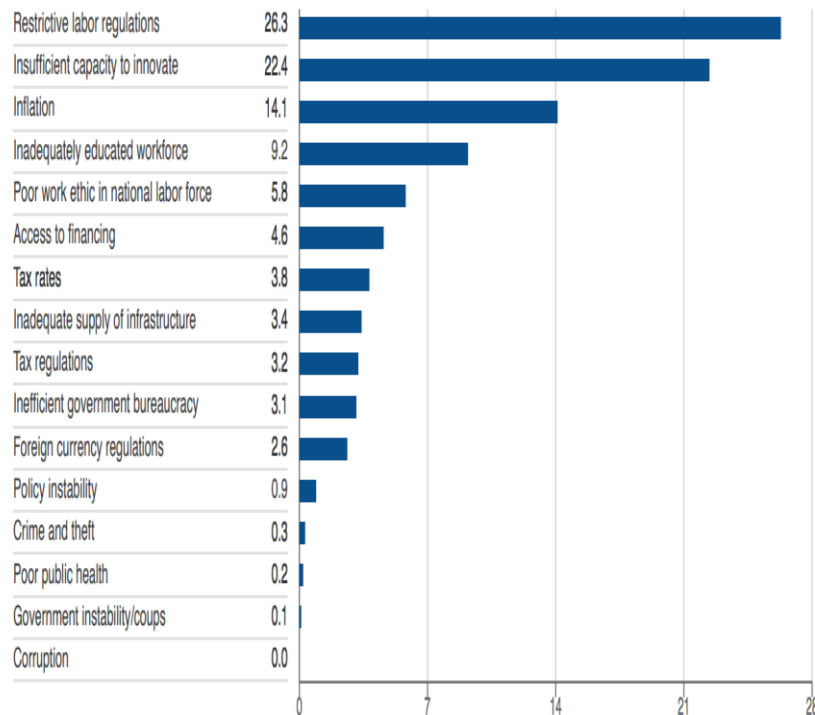


Key Indicators

Singapore

Most problematic factors for doing business

Source: World Economic Forum, Executive Opinion Survey 2017



Malaysia

Most problematic factors for doing business

Source: World Economic Forum, Executive Opinion Survey 2017



HW Assignment # 2

Assignment 2 will test your knowledge about how Infrastructure affects supply-chain?

Q1. What do you think are the pros & cons of a WEF 12 Pillars Analysis to produce GCI? How would you improve it?

Q2. Read the Four Compass article published in SCMR. Provide your view point and narrative to see how do you the trends.

Please use the link on blackboard to submit the assignment and posted deadline.

Link to current Singapore schedule

- <https://drive.google.com/drive/folders/18cVCmTUadln2SW8F5XdvvrTocUeGBqU6>

Sources

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http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf
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- Wikipedia
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- Supply Chain Information Technology : Olson, David
- Business Intelligence: Making Decisions Through Data Analytics: Jerzy Surma
- Singapore: Asia's Nerve Centre for Global Supply Chains (2010) (Singapore Economic Development Board)
- Alan Kosansky and Ted Schaefer(2011)