



MONASH University

# Multiple Innovation Ecologies and Sustainable Development: Challenges and Opportunities for Malaysia

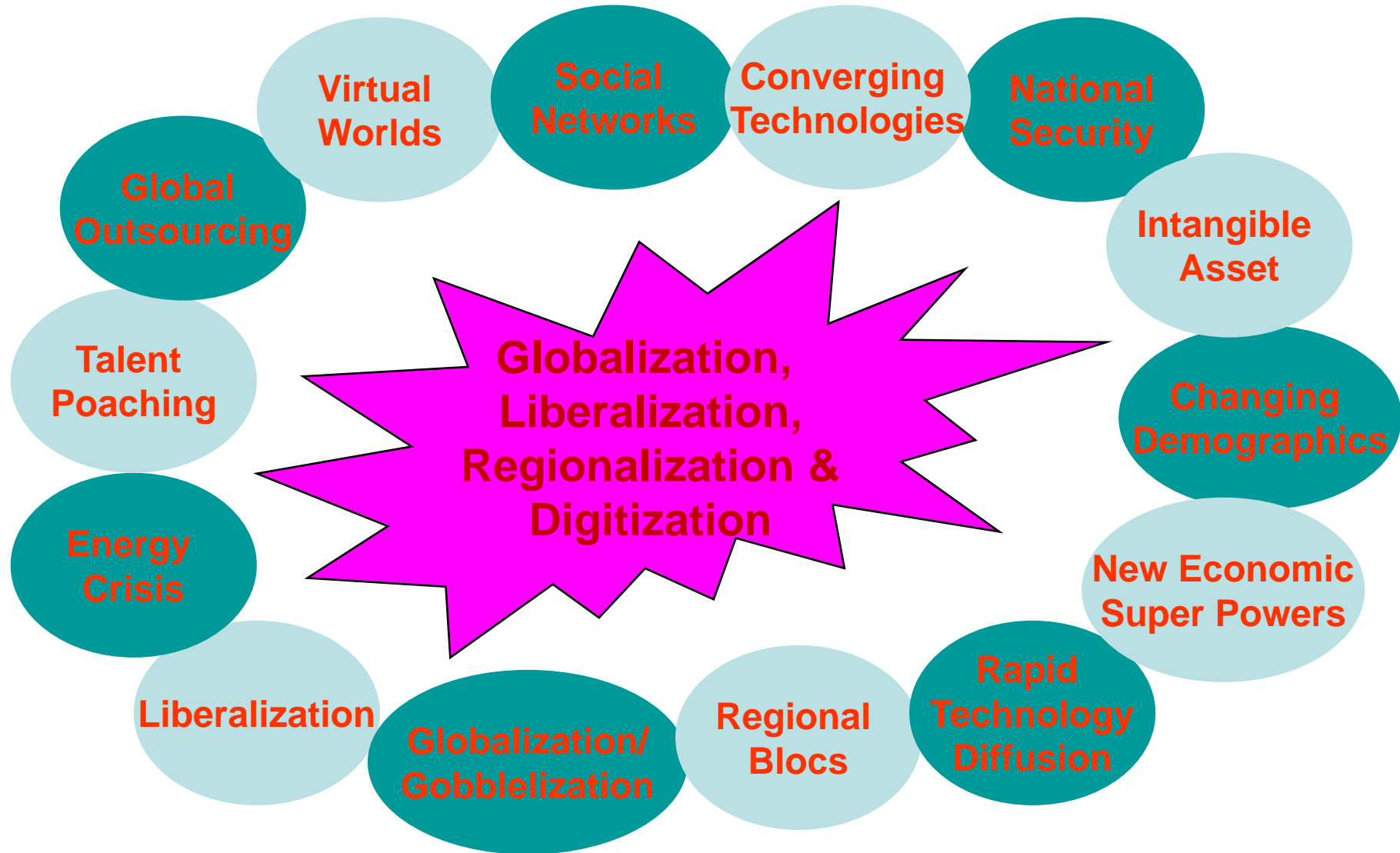
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*Kuala Lumpur Innovation Forum 2010  
3 November, 2010*

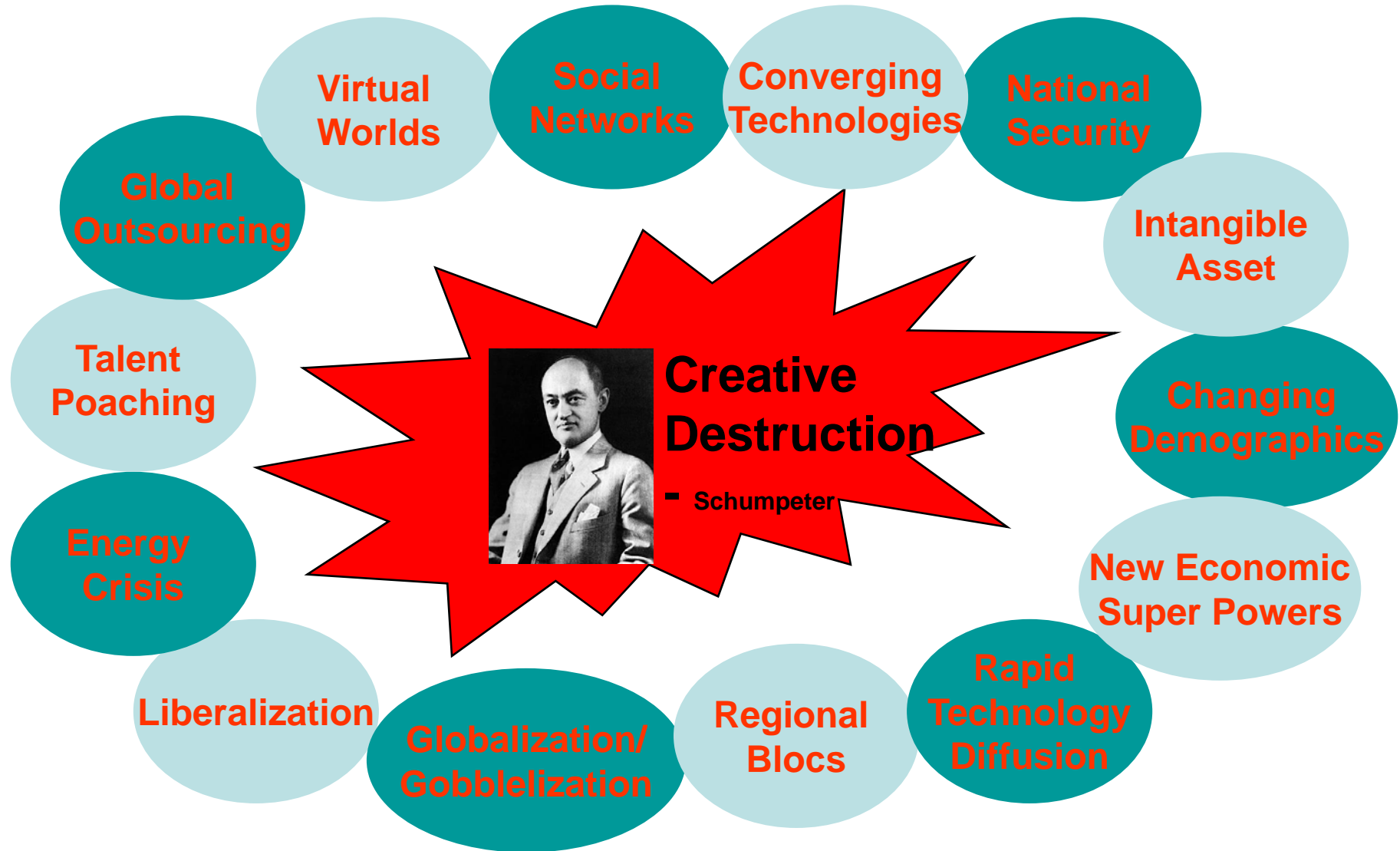
## Questions

1. What is the old economy & new/innovation economy?
2. What is National Innovation Ecosystem/Ecology (NIE)?
3. Why is the NIE important?
4. How have other countries leap-frogged to the new economy?
5. Can developing countries (Malaysia) 'leap-frog' to the new economy? Challenges & Drivers
6. Possible trajectories for a new economy ? (econometric simulations)
7. Concluding remarks (interesting quotes!)

# Global Forces: Opportunities & Challenges

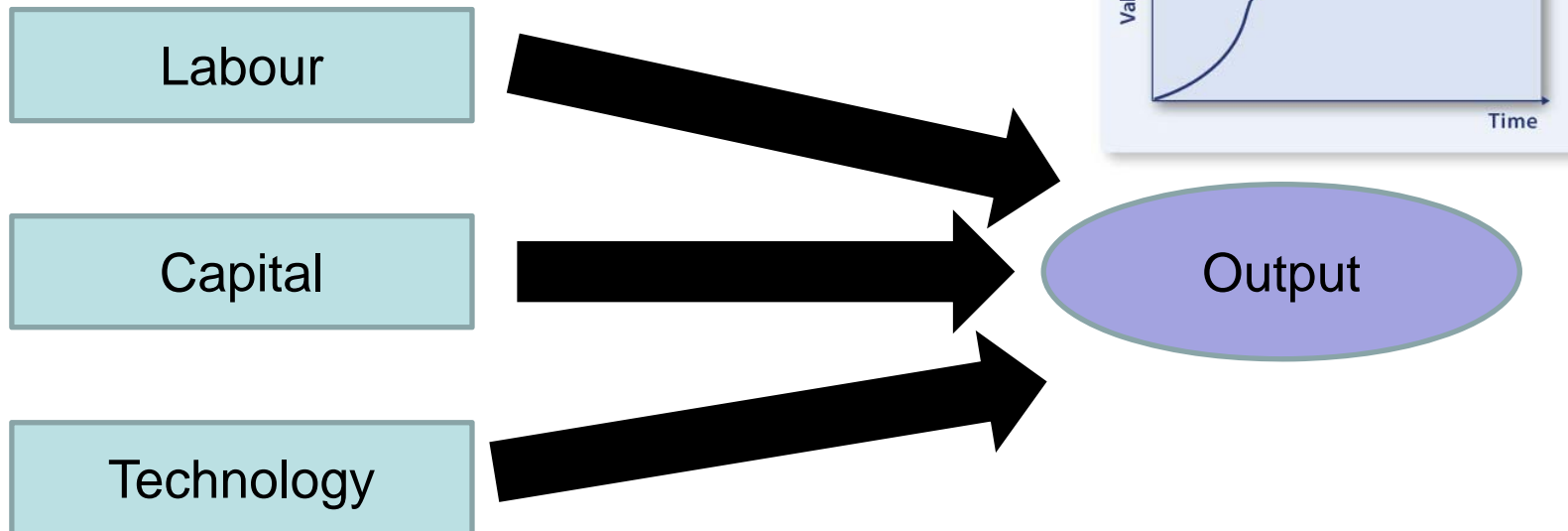


# Global Forces: Opportunities & Challenges



# 1a. What is the old economy?

## Input-Driven Growth Models



### Limitations:

1. Cannot explain long-term growth.
2. Cannot explain the problem that face poor countries – debt crisis, capital-flight brain-drain & financial crisis.
4. No mention of role of institutions, governance and market failures (corruption and lack of transparency)

## 1b. What is the new economy?

- An economy where the socioeconomic development & welfare gains are predominantly dependent on the production, diffusion and utilization of *information*, *ideas* and *innovation*.
- Knowledge & Innovation are key factors for societal development & wealth creation
  - *source of increasing returns (productivity gains)*.
- Transformation of traditional factors of production
  - *[LAND] “Places to Spaces”*
  - *[LABOUR] “Outsourcing”*
  - *[CAPITAL] “Global Financial Markets”*

## 2. What is an NIE? [The 7i Ecosystem]

- **REACH-factor [Foundation Condition] (Necessary)**

**I**nfrastructure that facilitate connectivity to the global community - 'highway' for the flow of information and knowledge.

- **RICHNESS-factor [Driver Conditions]**

*(Necessary & Sufficient)*

Factors which deepens knowledge intensity in a society (**I**ntellectual capital, **I**nteraction, **I**ncentives, **I**nstitutions, **I**ntegrity, **I**nnovation).

Source:

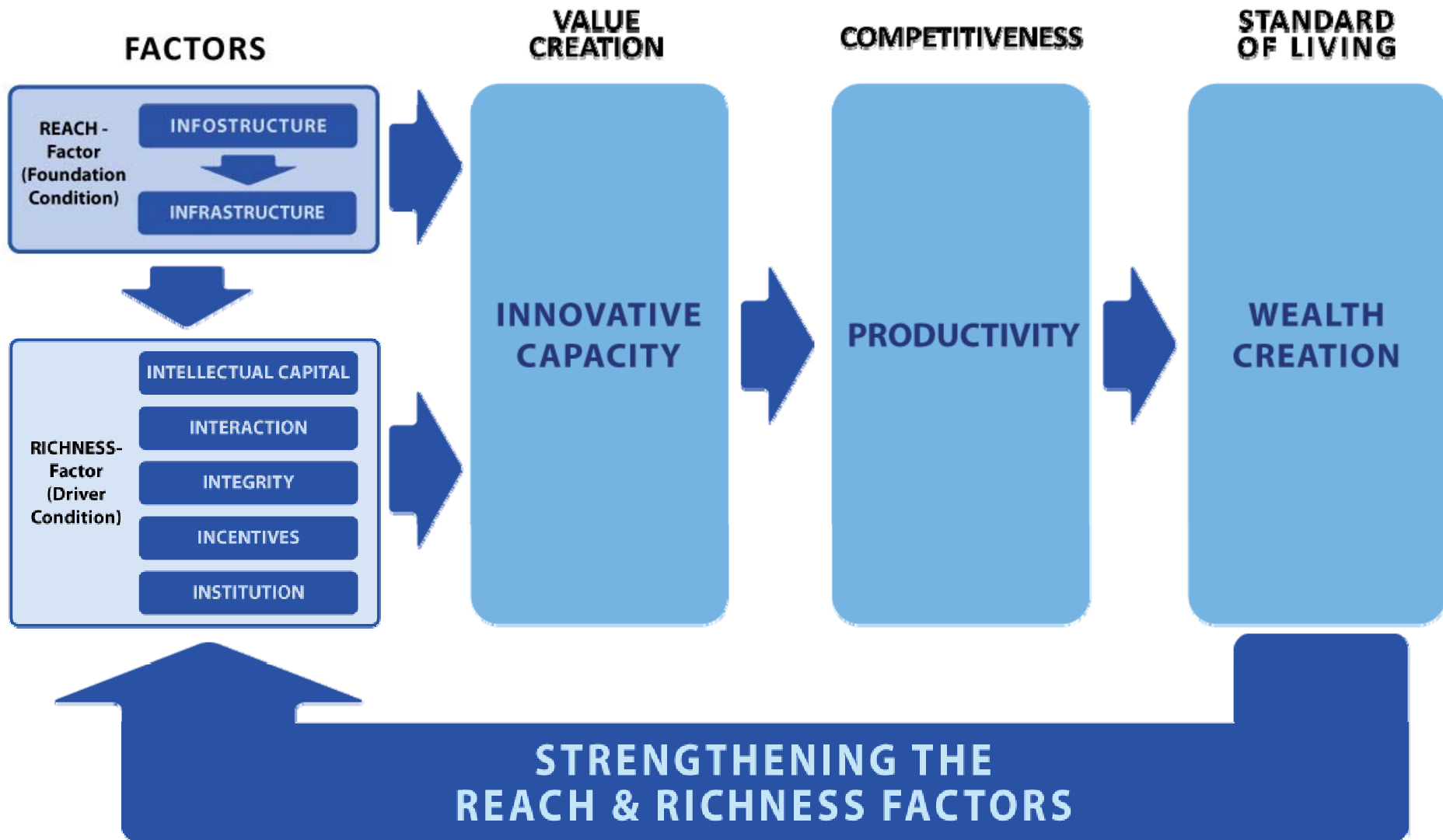
Nair, M. (2007), "The 'DNA' of the new economy," *Economic Bulletin*, Volume 8, December, 27-59.

# 7i Ecosystem





# 7i Framework



# Innovation is a Process

A process which leads to the following:

- new products/services; and/or
- new ways of improving the efficiency of traditional factors of knowledge-buildup modes, invention, production and commercialization; and/or
- New production and diffusion methods of knowledge, inventions, products/services; and/or
- Enhance the reach and richness of goods/services and knowledge to society.

# Types of Innovation

- **Business Model Innovation** – eg. Franchise
- **Process Innovation** – eg. Lean Six-Sigma
- **Product/Service Innovation**
- **Systemic Innovation** (new industrial sector & social networks)
- **Social Innovation** – changes in society/culture
- **Position Innovation** – changes in the context in which product/services, reputation and location
- **Paradigm Innovation** – changes in the underlying mental models (eg. Look East Policy under Dr. Mahathir)

## Types of Innovation (cont'd)

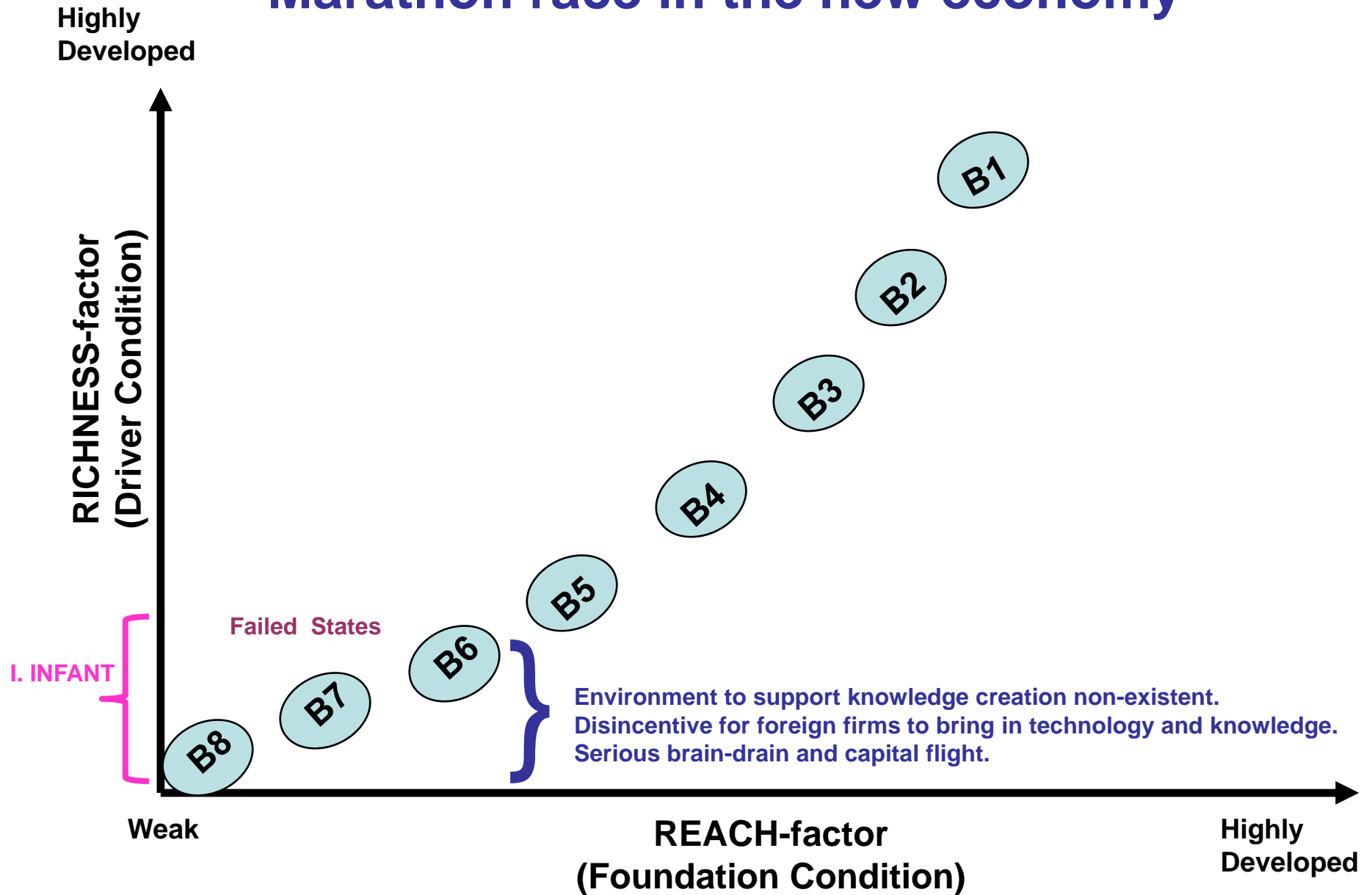
- Radical Innovation – existing knowledge obsolete
- Incremental Innovation – knowledge to build on existing knowledge

### 3. Why is NIE important? Marathon race in the new economy



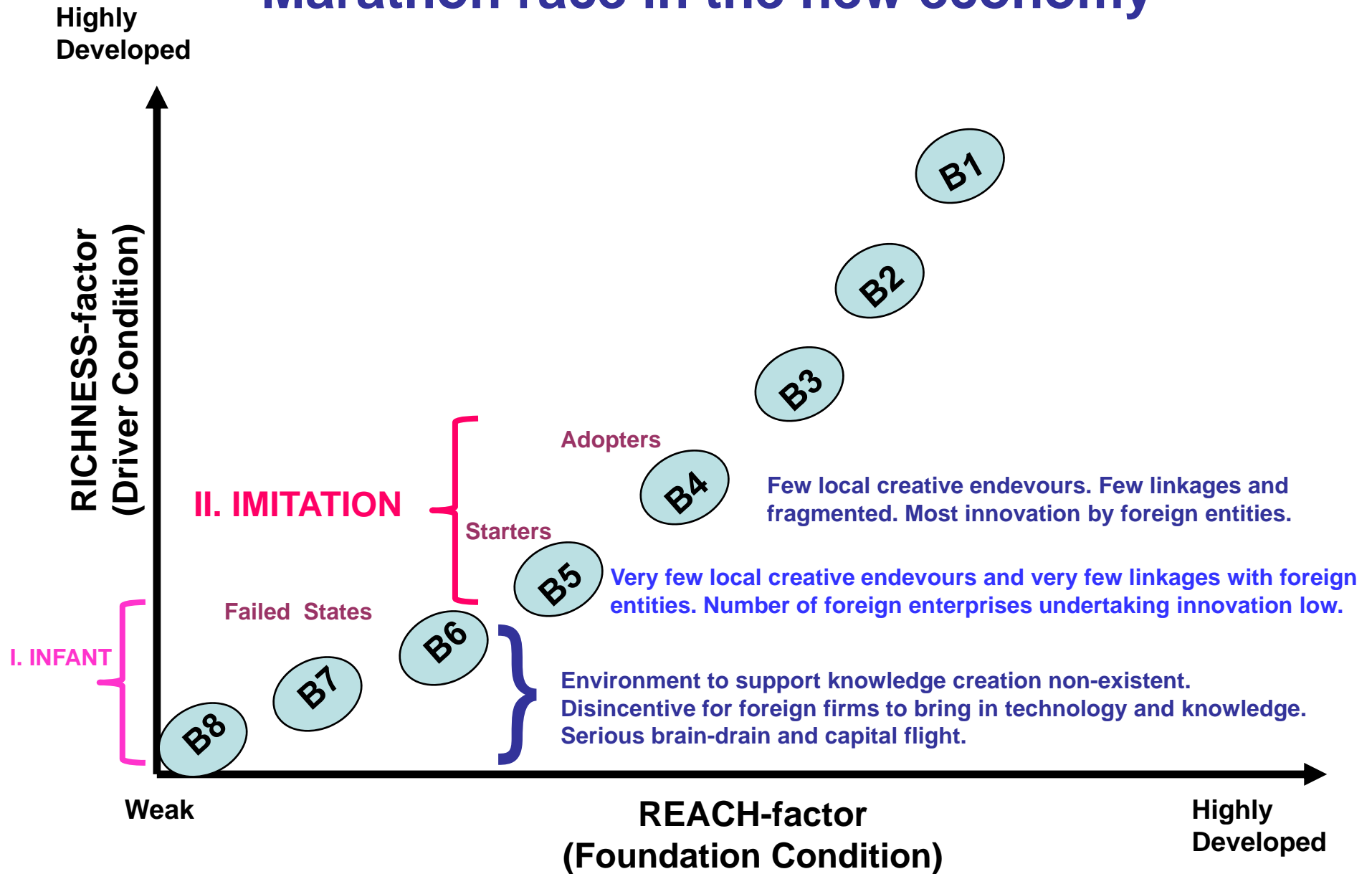
Source: Nair (2008)

# Marathon race in the new economy



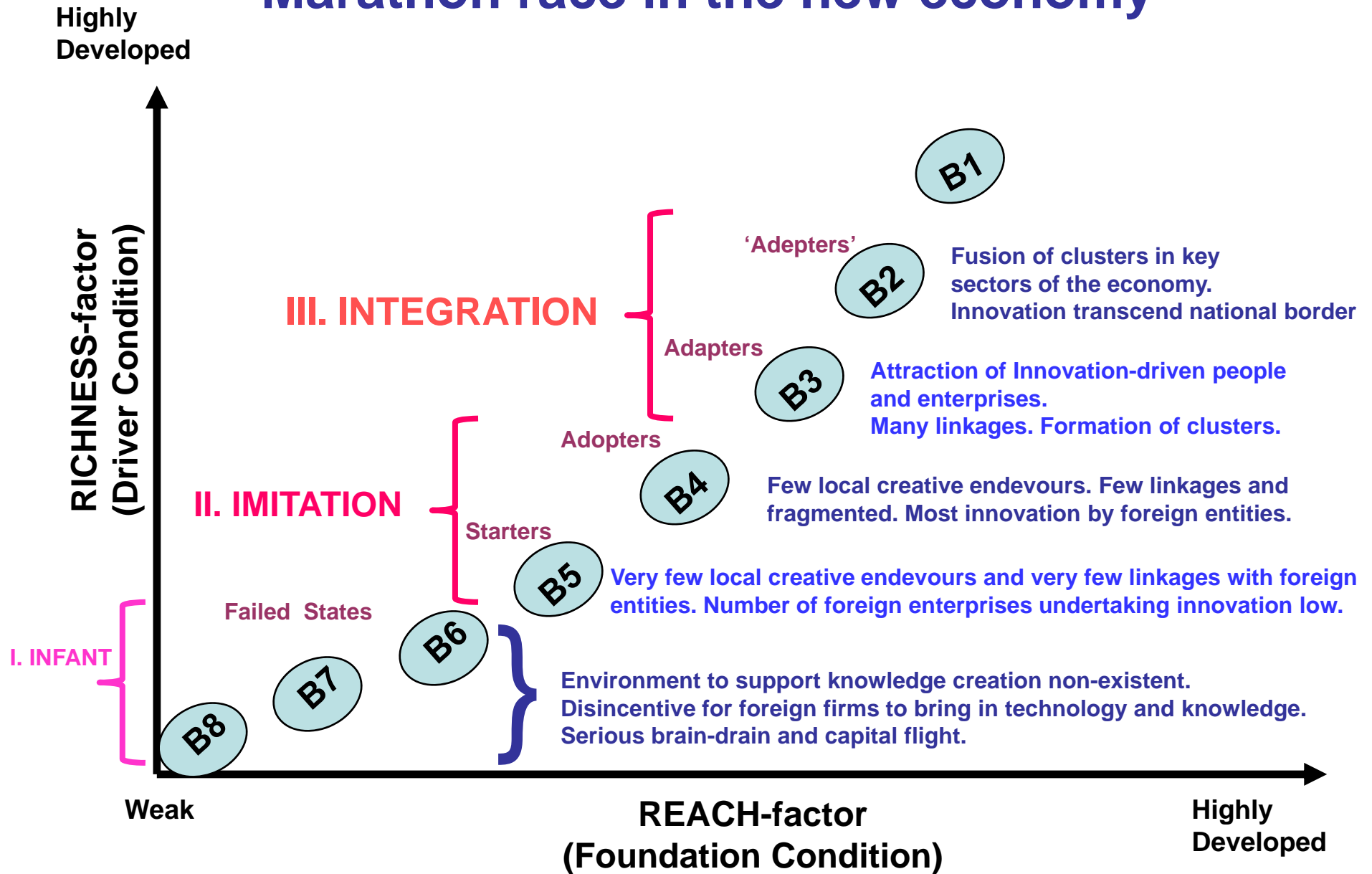
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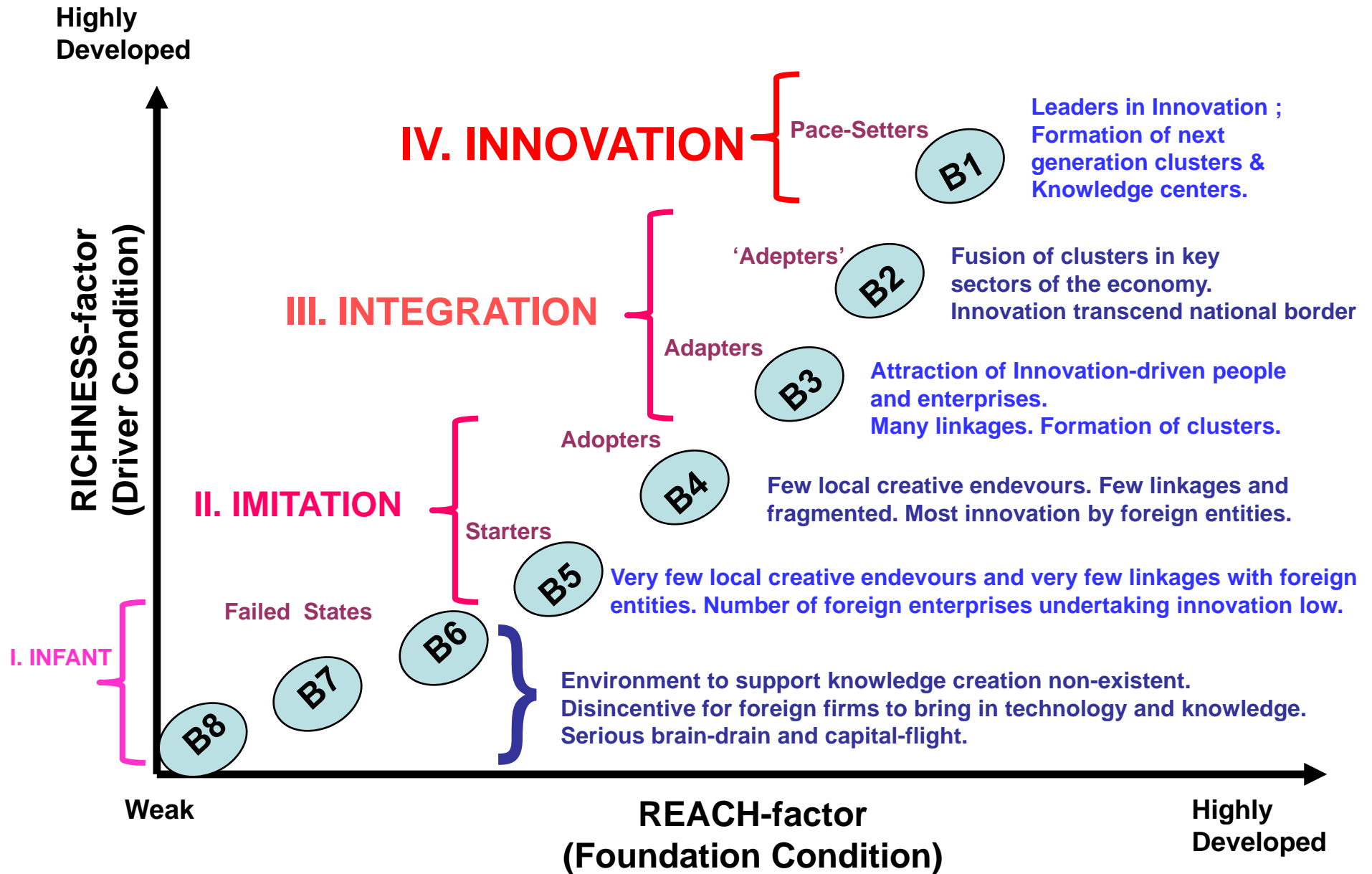
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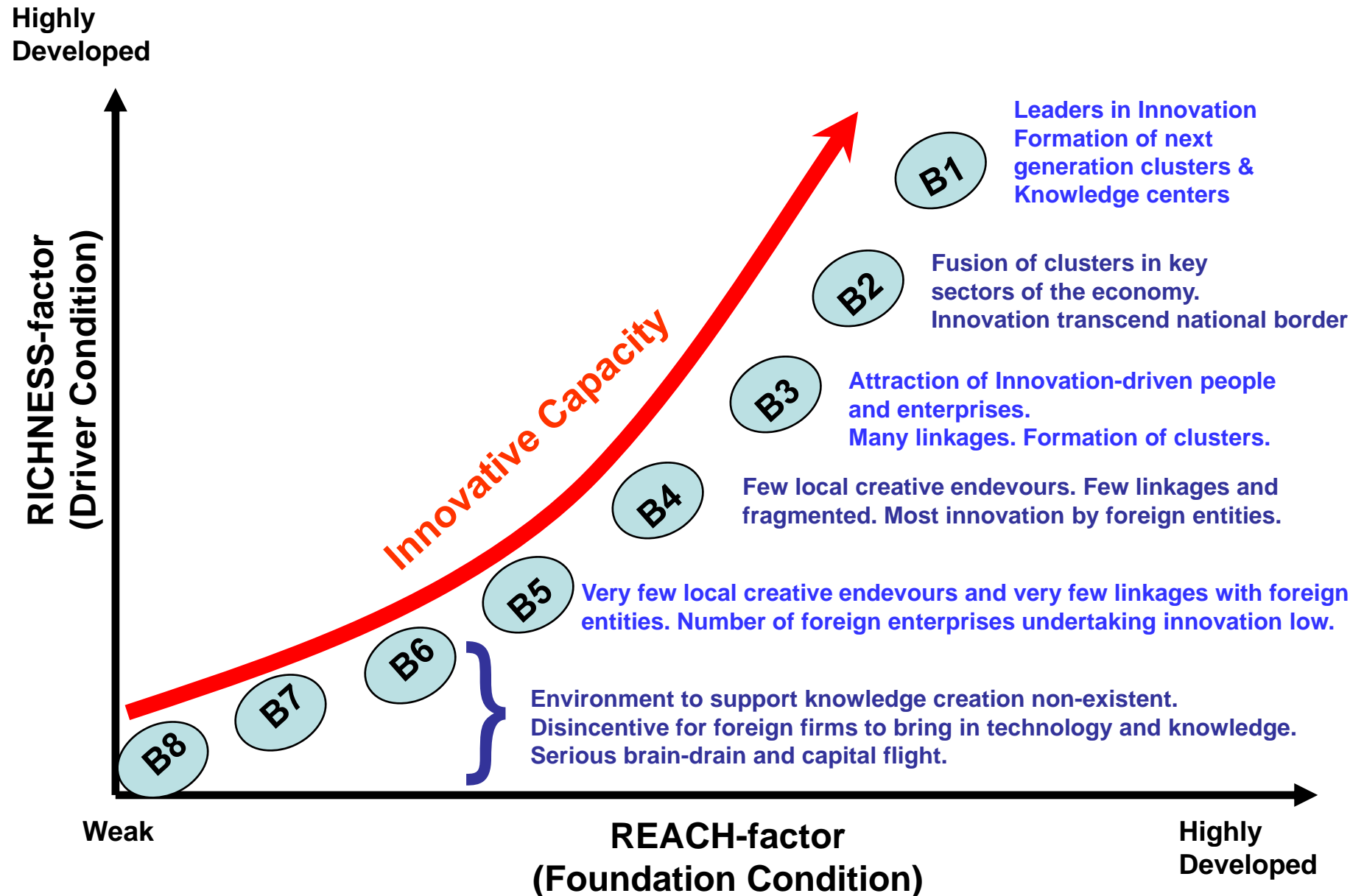


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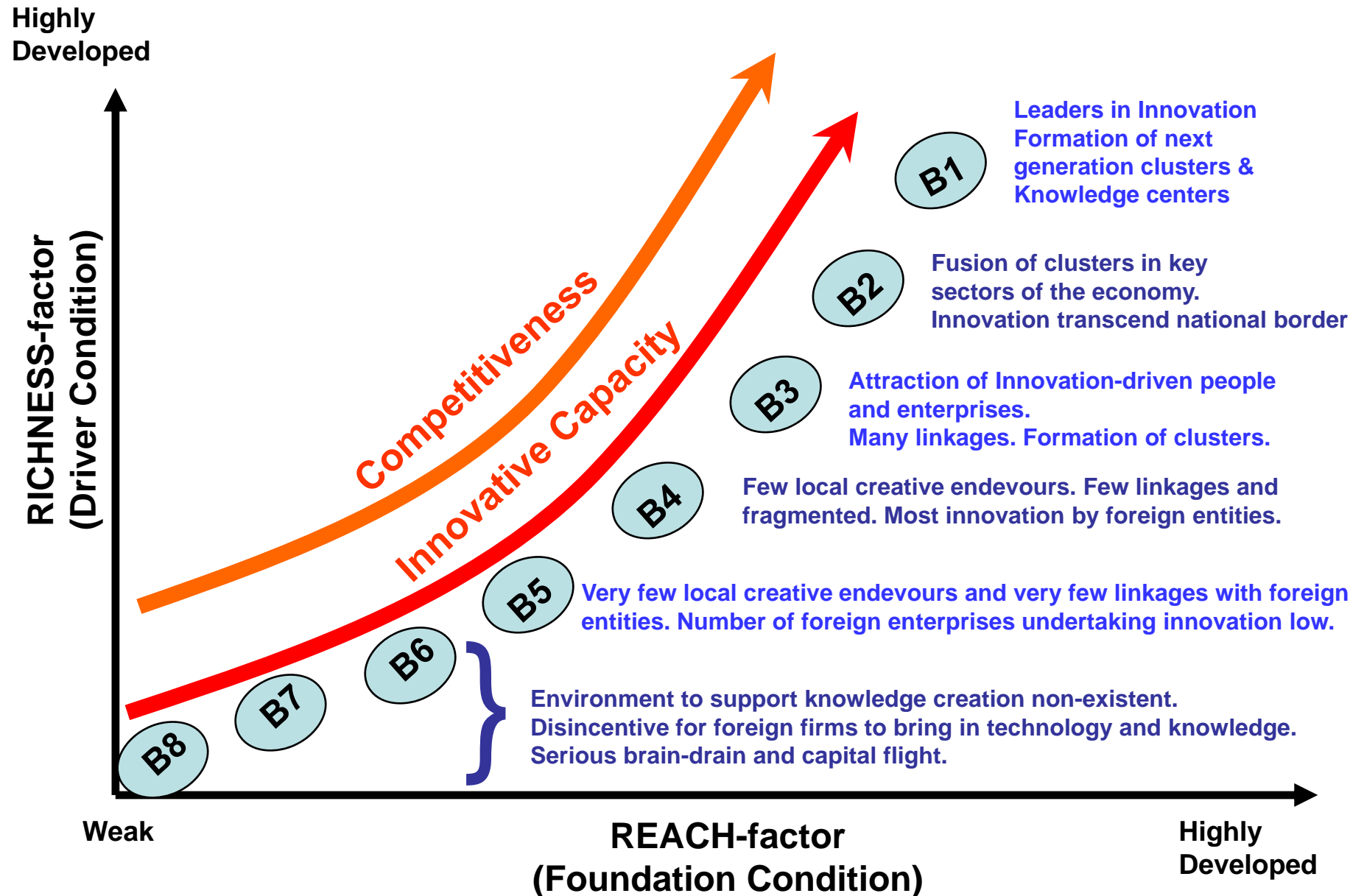
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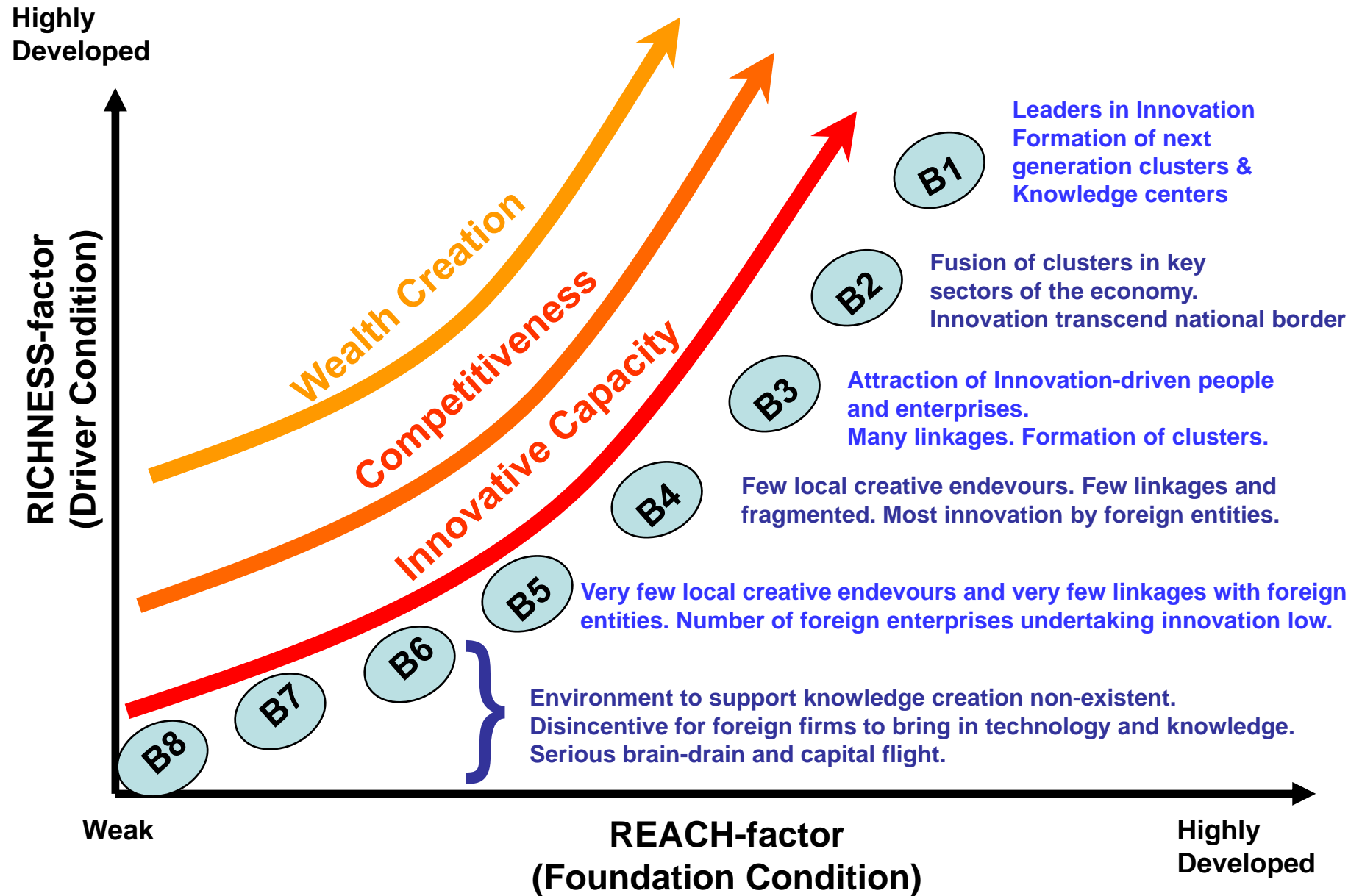
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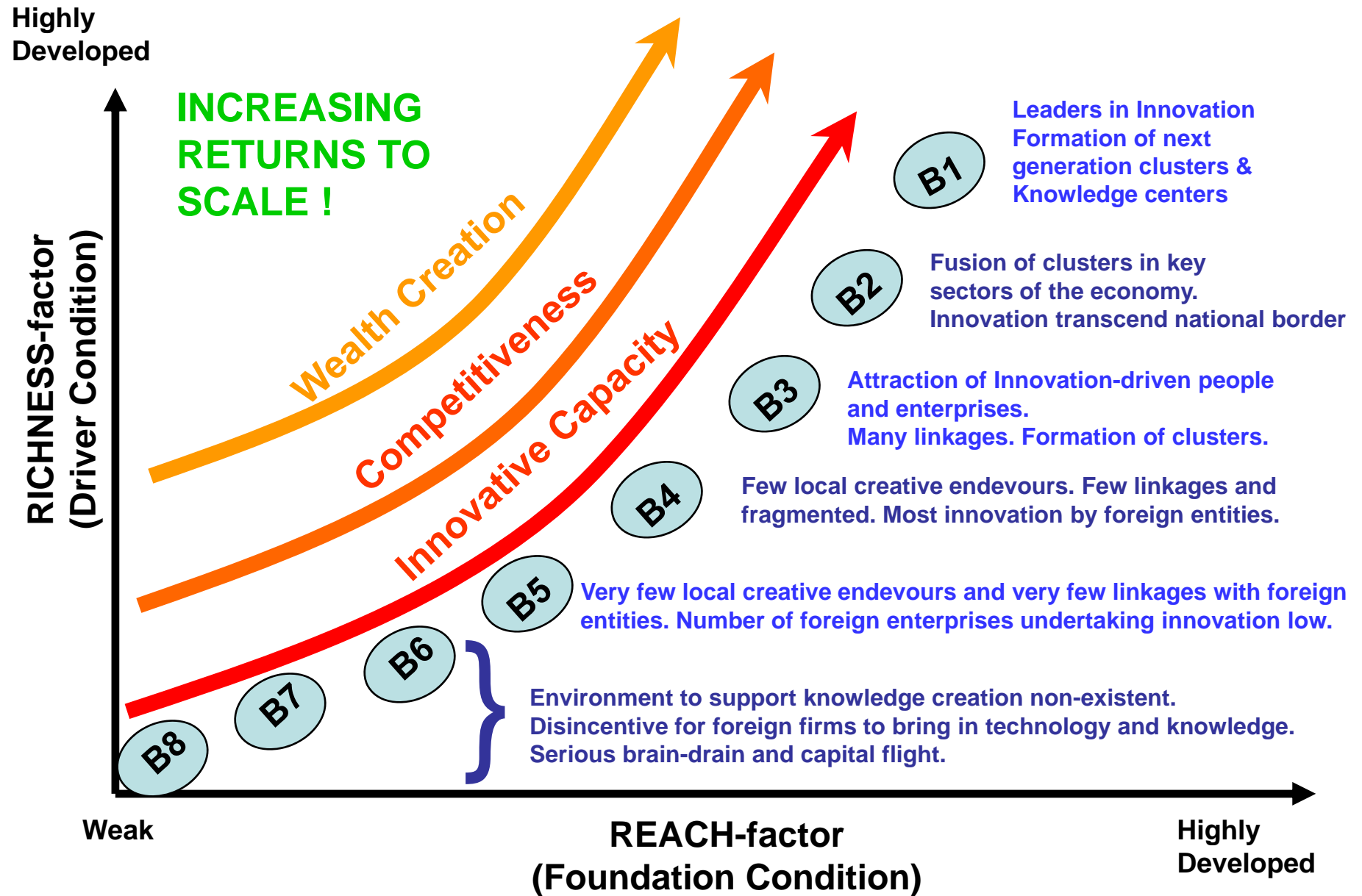
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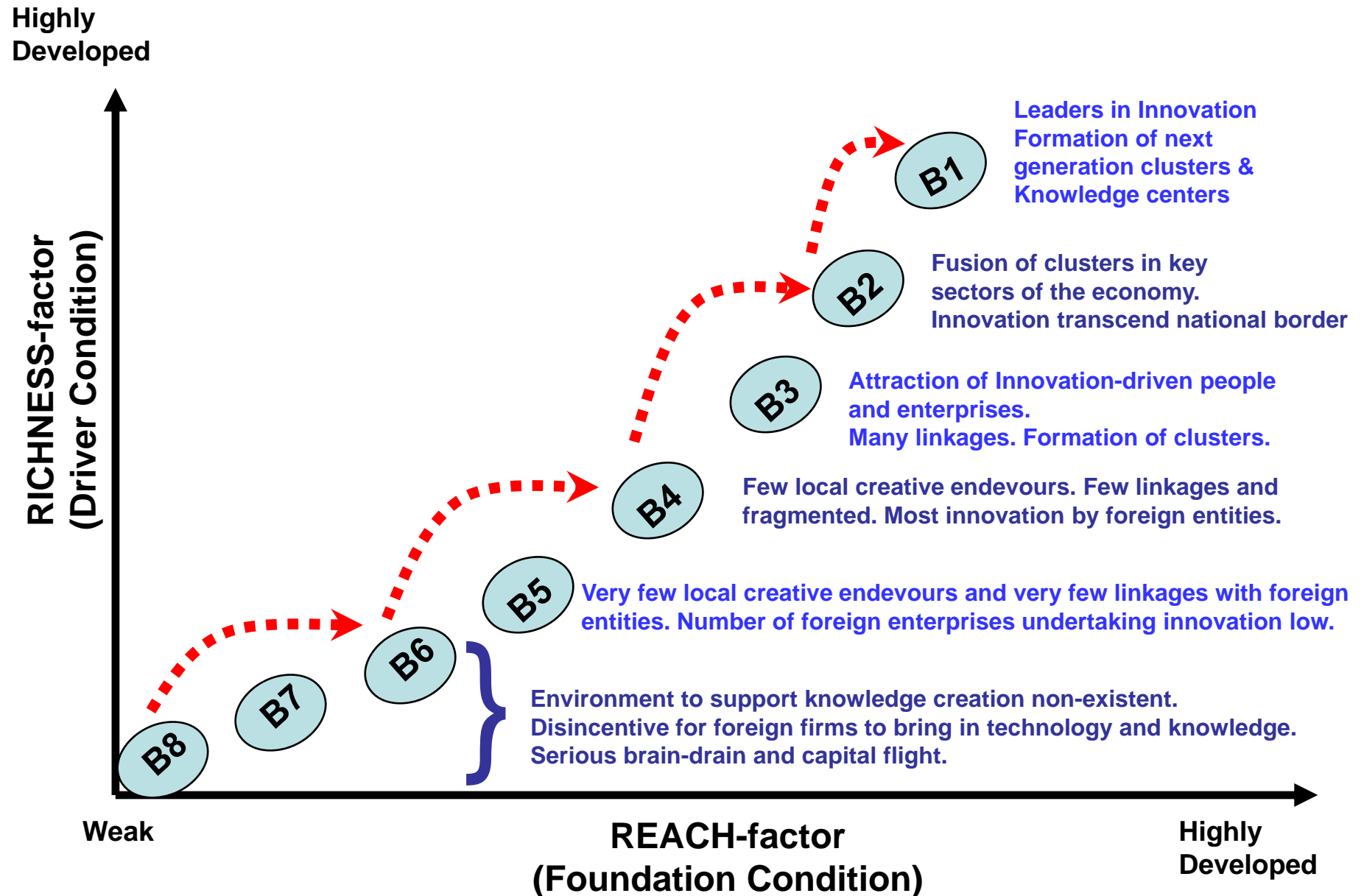
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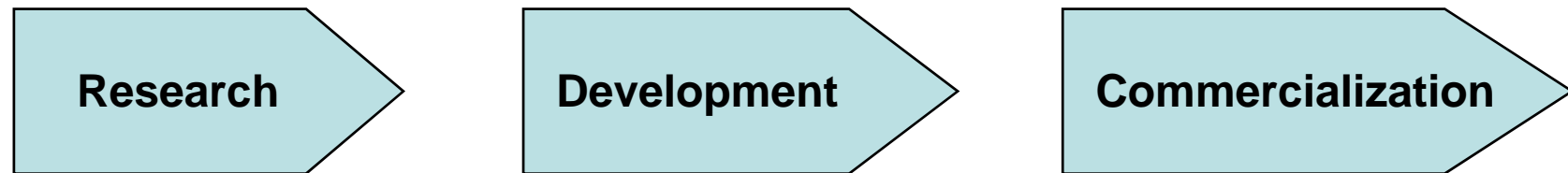
# Leapfrogging in the new economy



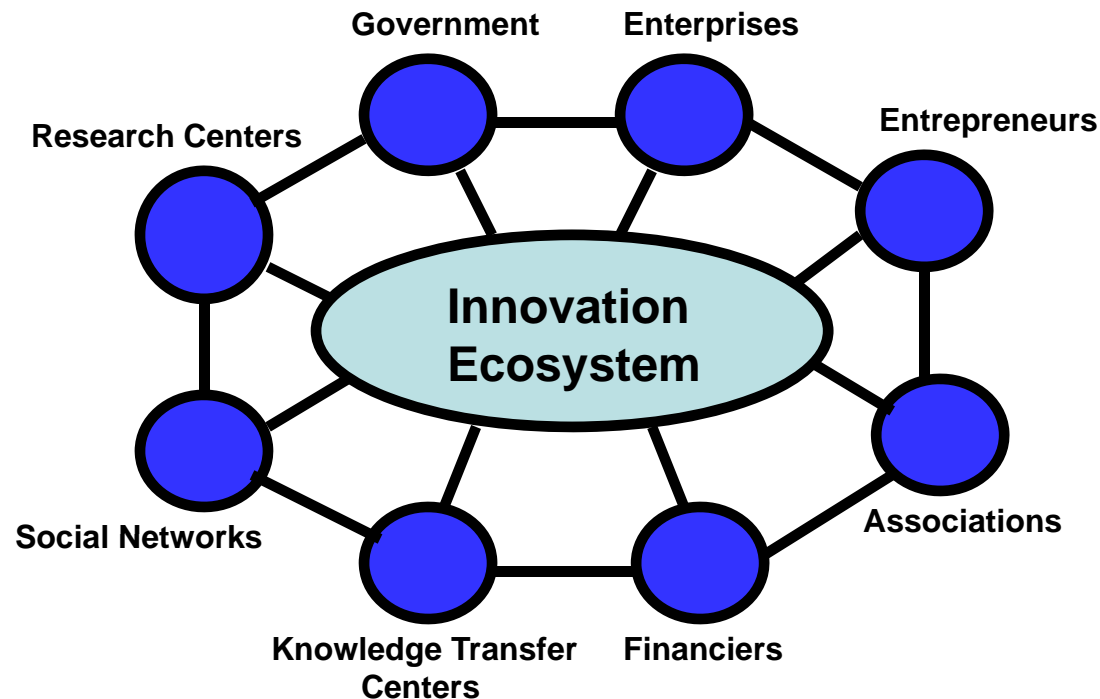
Source: Nair (2008)

# Static to Dynamic Innovation Model

## 1. Static Model (Linear) – **Production Economy**

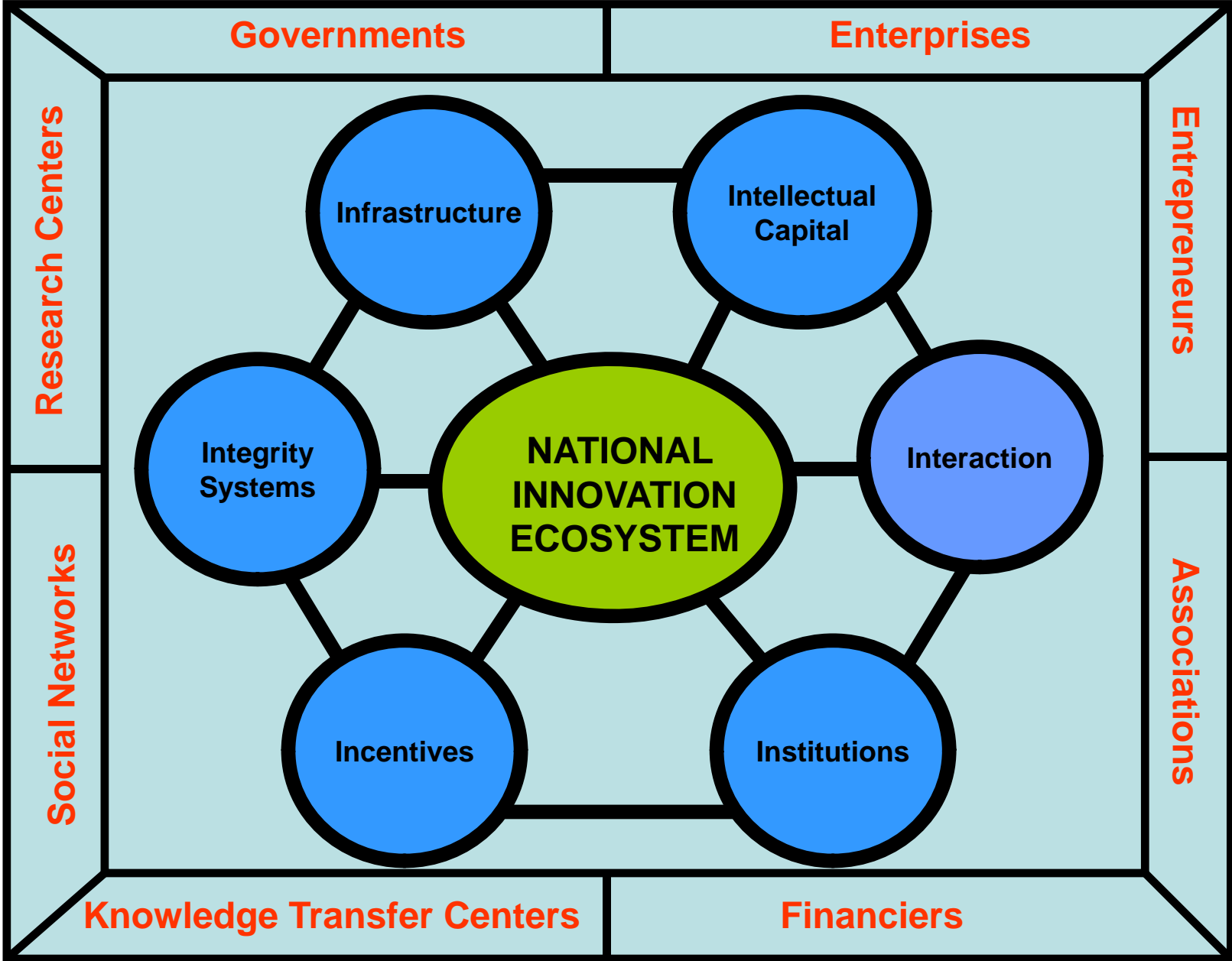


## 2. Dynamic National Innovation Ecosystem (NIE) – **New Economy**



# Building Blocks of National Innovation Ecosystem



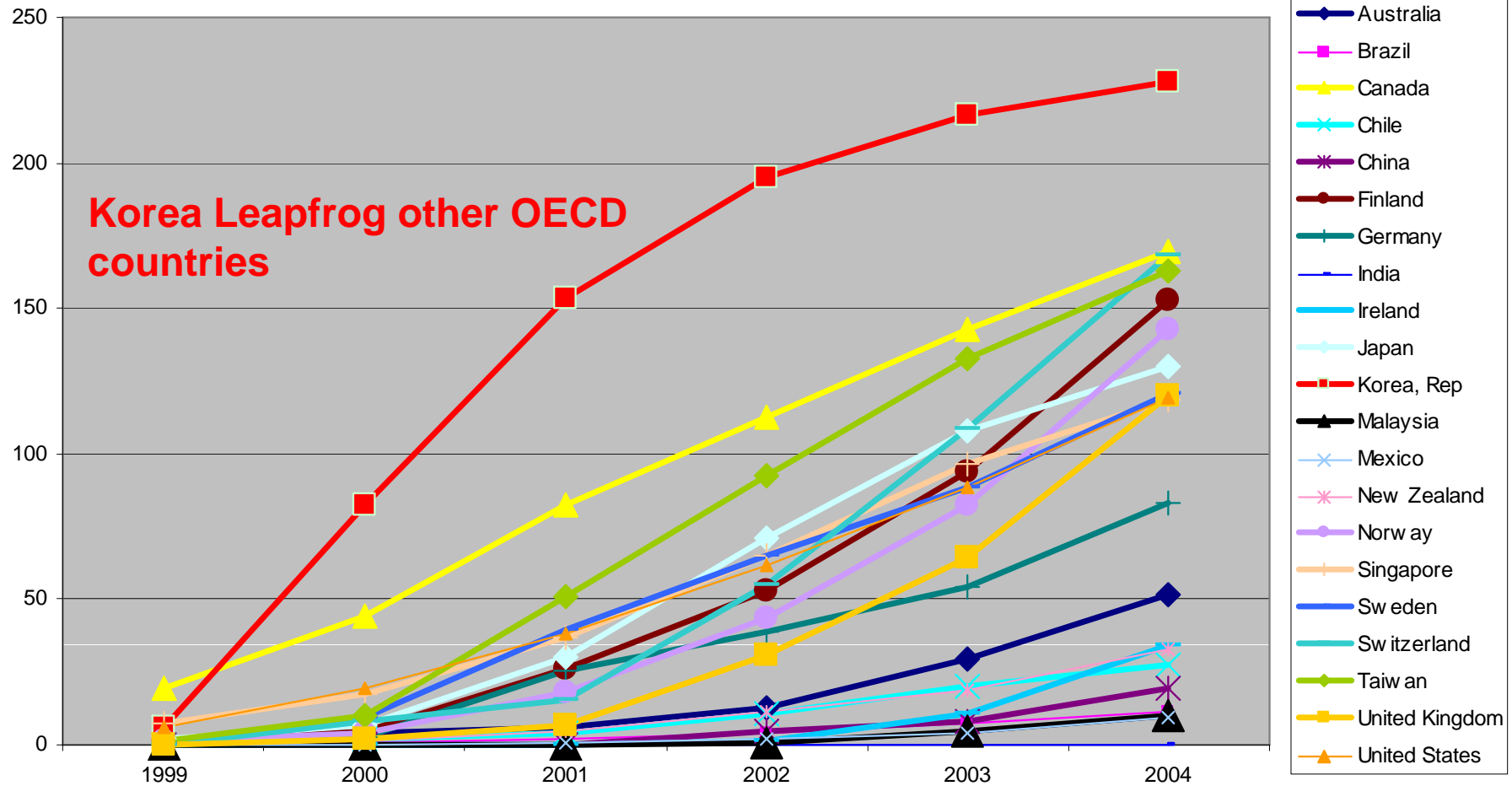


Source:  
Nair(2008)

# Infrastructure

- **1. Physical Infrastructure**
  - Movement of goods and people (roads, ports and airports, etc.)
  - Schools, libraries, laboratories
- **2. Infostructure**
  - Affordable Instantaneous and global connectivity
  - Broadband and ‘quadruple-play’ is the standard.
  - Bridging the digital divide

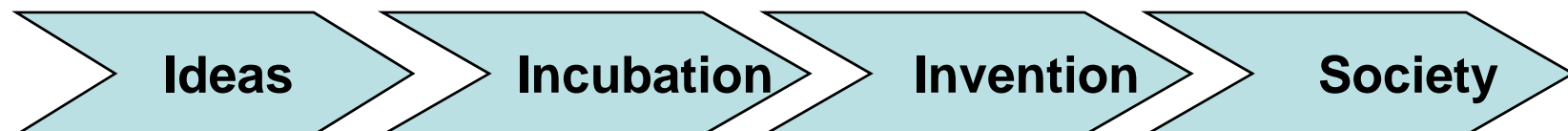
# Broadband penetration rate per 1000 people



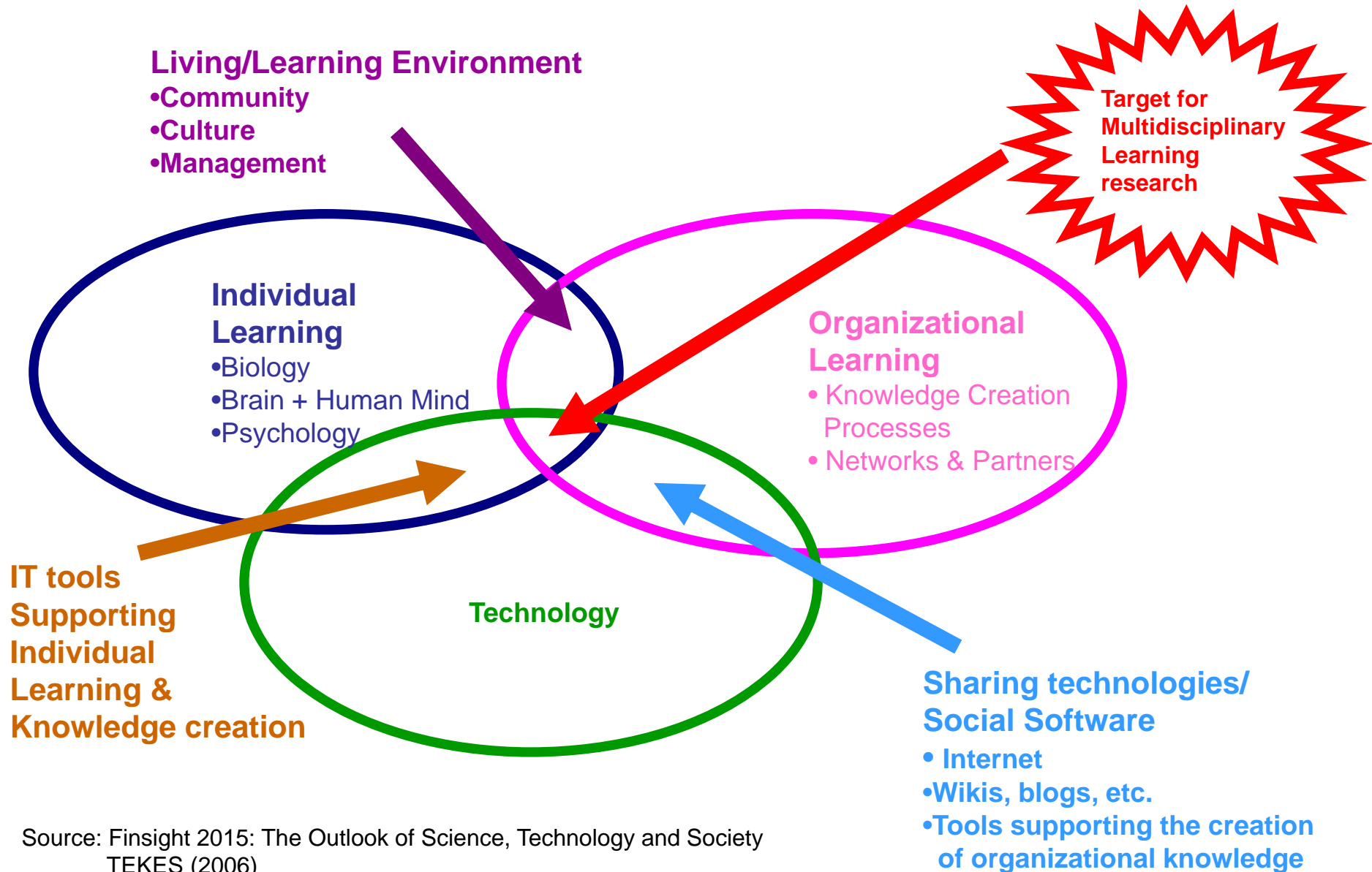
Data Source: EarthTrends, World Resources Institute

## 2. Intellectual Capital

- Education – universal access (pre-school to university)
- Training Research Personnel (HDR programs)
- Entrepreneurship development programs in Institutions of Higher Learning
- Creative Learning Environment



# Creative Learning & Research Environment in Finland



Source: Finsight 2015: The Outlook of Science, Technology and Society  
TEKES (2006)

# 3. Integrity

- Transparent processes
- Instilling good governance
- Best practices
- Global benchmarks & standards
- Safety and Security

# 4. Incentives

- Access to public funded research (2%-4%of GDP).
- Policy to enhance resource to support R&D, patenting and commercialization.
- Fiscal and non-fiscal policies to encourage R&D activities among firms.
- Target policy to enhance resources (priority areas and target clusters).
- Private funding (Angel funds, VCs)
- Equity markets to fund technology and knowledge-intensive companies
- Innovation futures market

## - Comprehensive Fiscal Incentives to support Innovation In Korea

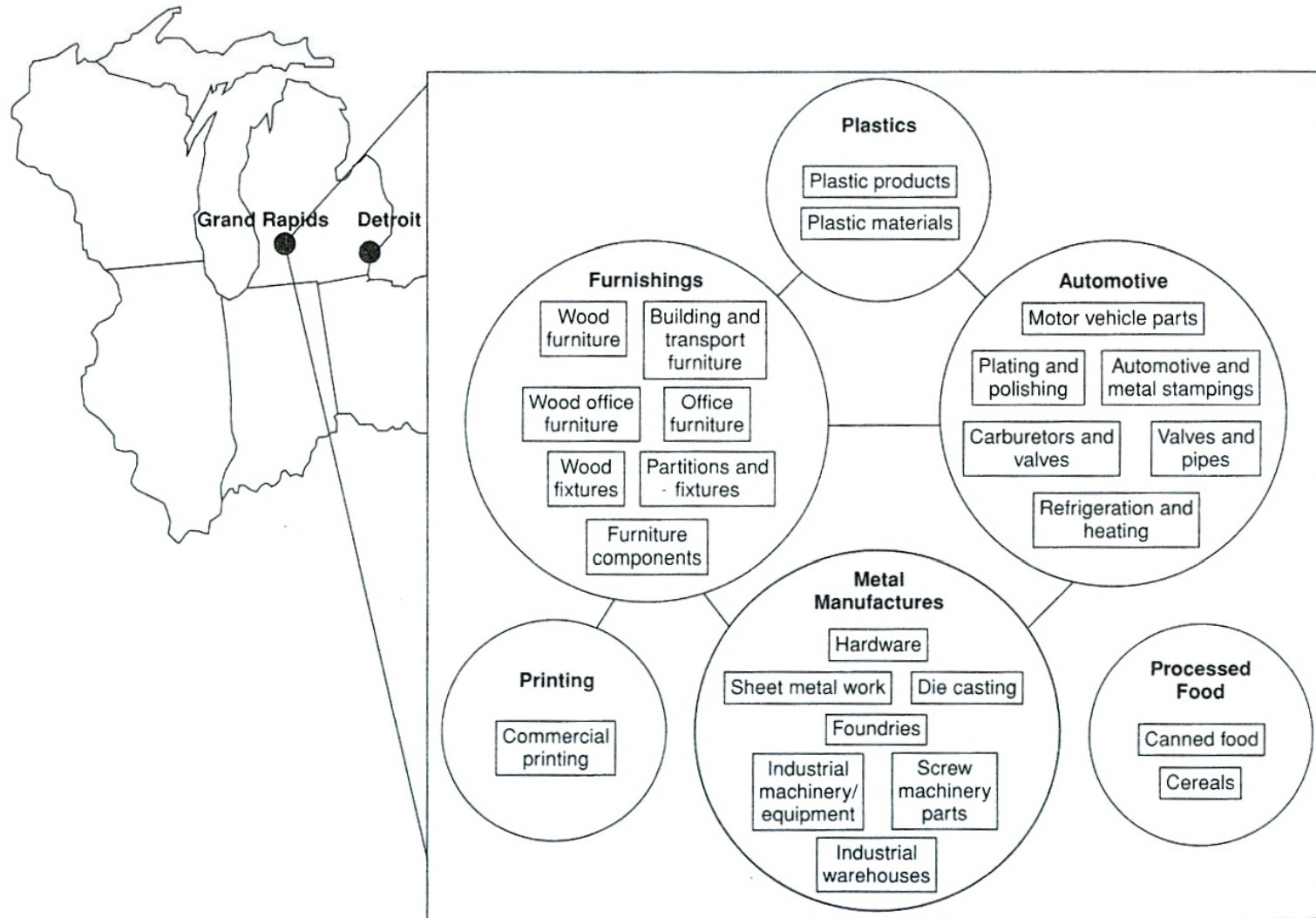
Nature of the Scheme	Scope and Coverage
Government Grants	
<ul style="list-style-type: none"> <li>National Research Program</li> </ul>	<ul style="list-style-type: none"> <li>Established in 1982</li> <li>Designed to promote joint R&amp;D between private firms and public R&amp;D institutions</li> <li>Focussed on basic technology development</li> <li>Large companies: up to 50% funding support</li> <li>Small enterprises: up to 80% funding support</li> </ul>
<ul style="list-style-type: none"> <li>Industrial Basic Technology Development Program</li> </ul>	<ul style="list-style-type: none"> <li>Established in 1987</li> <li>Designed for the commercialization of locally developed technologies</li> <li>Large companies: 40-50%</li> <li>Small companies: 50-60%</li> </ul>
Government's Loan Program: Government funds which are utilized to Provide firms with loans at concessional rate	<ul style="list-style-type: none"> <li>Industrial Promotion Fund</li> <li>Industrial Technology Promotion Fund</li> <li>SMI Restructuring Fund</li> <li>National Investment Fund</li> <li>Special Facilities Fund</li> <li>Information and Communication Technology Development Fund</li> <li>Science and Technology Promotion Fund</li> <li>Manufacturing Industry Competitiveness Promotion Fund</li> <li>Alternative Energy Technology Development Fund</li> <li>Excellent Demonstration Prototype Support Fund</li> <li>SMI Start-Up Fund</li> </ul>
Loan Financing of Special Financial Institutions	<ul style="list-style-type: none"> <li>Korea Development Bank Program</li> <li>Industrial Bank of Korea Program</li> <li>Citizens National Bank Program</li> </ul>
New Technologies Financing and Start-Up Financing	<ul style="list-style-type: none"> <li>Korea Technology Bank and three other new technology financing companies</li> <li>Korea Technology Investment Corporation and 52 other start-up support financing companies</li> </ul>
Technology Credit Guarantee Fund	<ul style="list-style-type: none"> <li>Credit guarantee is provided to firms developing new technology</li> </ul>



# 5. Interaction

- Communication between government agencies
- Communication between government agencies and private sector
- Communication to the general public and social groups
- Role of bringing organizations and knowledge centers – e.g. TEKES, Innovation Exchange in Malaysia & Australia
- Enhancing Industrial Clusters and regional Industrial clusters (as part of the **Regional Innovation System**)

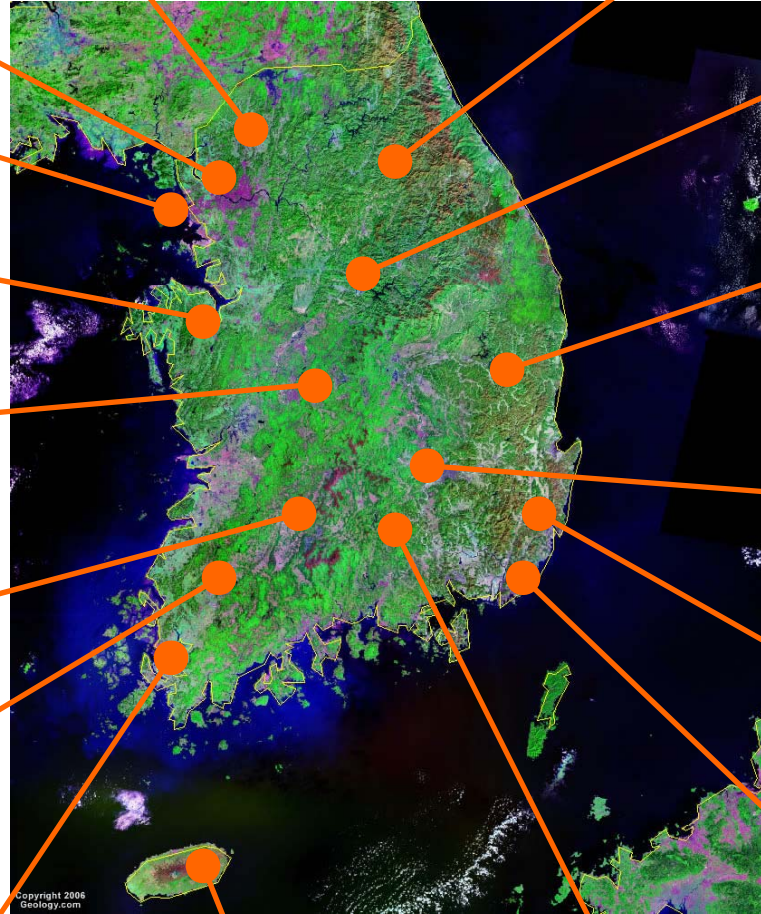
# Example of Regional Clusters: Greater Grand Rapids



# Innovation Accelerators-Finland



## Innovation Accelerators SOUTH KOREA



### Seoul

- Digital contents,
- Information & telecommunication,
- Bio
- Financial corporation support

### Gyeonggi

- Information & telecommunication
- Life, Cultural Contents,
- International logistics

### Chungbuk

- Bio-medical equipments
- New materials & disaster prevention
- Culture & tourism

### Incheon

- Logistics Automobile,
- Machinery & metal
- Informtion & telecommunication

### Chungu

- Bio,
- Semiconductor,
- Mobile communication
- Next generation battery

### Chungnam

- Electronics & information devices
- Automobile parts,
- High-end culture
- Agriculture & stock bio

### Gyeongbuk

- Electronics & information devices,
- New materials & parts
- Biology & herbal medicine
- Culture & tourism

### Daejeon

- Information & telecommunication
- Bio
- Cutting edge parts & materials
- Mechatronics

### Daegu

- Mechatronics
- Electronics & information devices
- Textile & biology

### Jeonbuk

- Automobile & Machinery
- Biology
- Alternate energy
- Culture & tourism

### Ulsan

- Automobile
- Urban maritime
- Precision chemistry,
- Environment

### Chungbuk

- Bio-medical equipments
- New materials & disaster prevention
- Culture & tourism

### Jeonnam

- Biology
- New materials ship building
- Logistics
- Culture & tourism

### Jeju

- Tourism
- Health & beauty
- Friendly agriculture
- Digital contents

### Gyeongman

- Knowledge-based machinery
- Robot,
- Intelligent home,
- Bio

### Busan

- Seaport logistics,
- Machine parts
- Tourism contents,
- Video IT

# 6. Institutional Coordination

- Science Technology & Innovation Policy Council (General Policy Framework)
- Relevant ministries and agencies for STI formulation, regulating, financing and coordination
- RDC facilitating and modulating institutions (technology transfer & advice agencies)
- R&D performers
- Knowledge & technology transfer centers
- Goods and service providers
- Chambers of Commerce
- Science Parks / technopoles
- Associations, Social Networks, Groups and NGOs

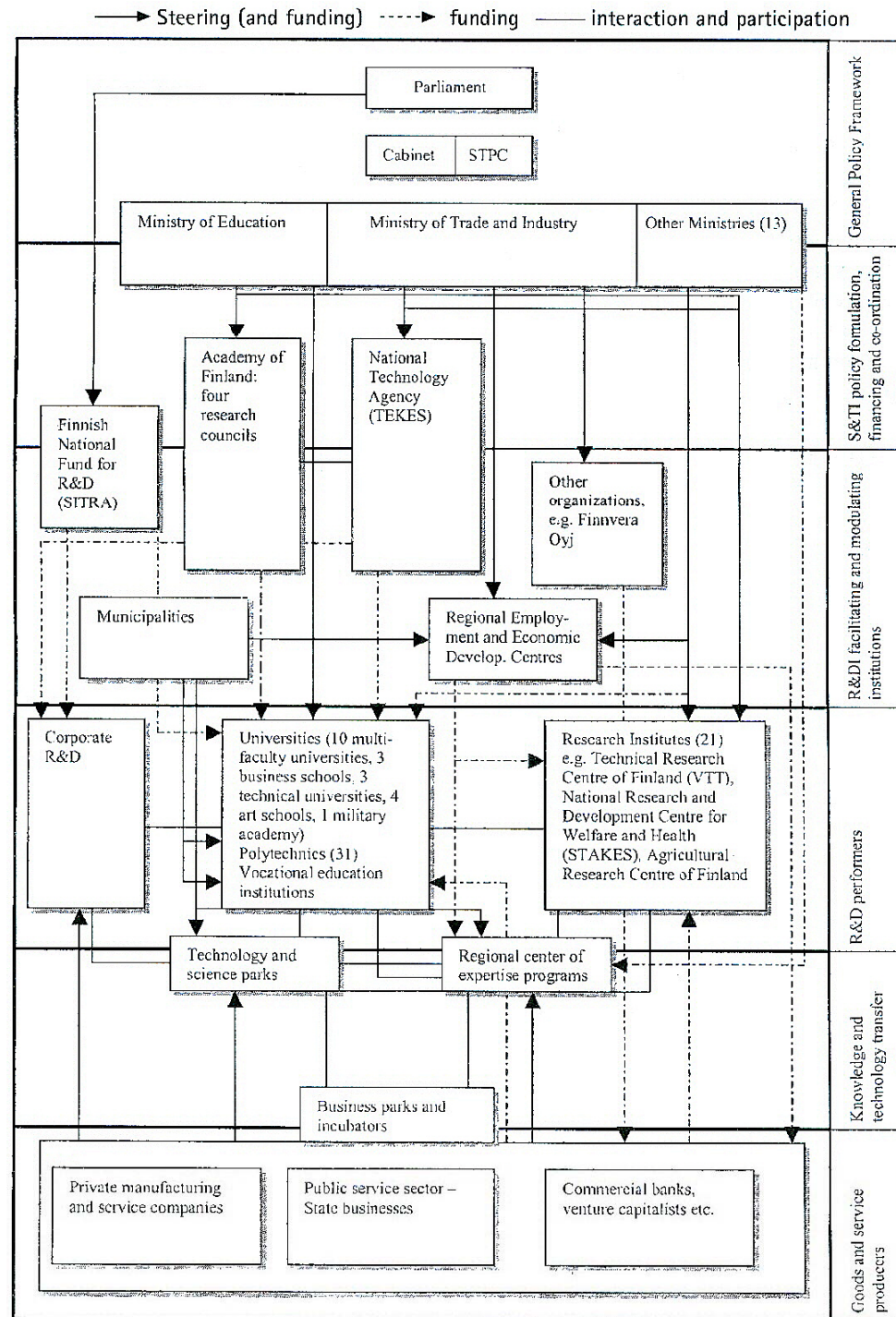
# Institutional Coordination

## The Finnish National Innovation System

Key organisations:

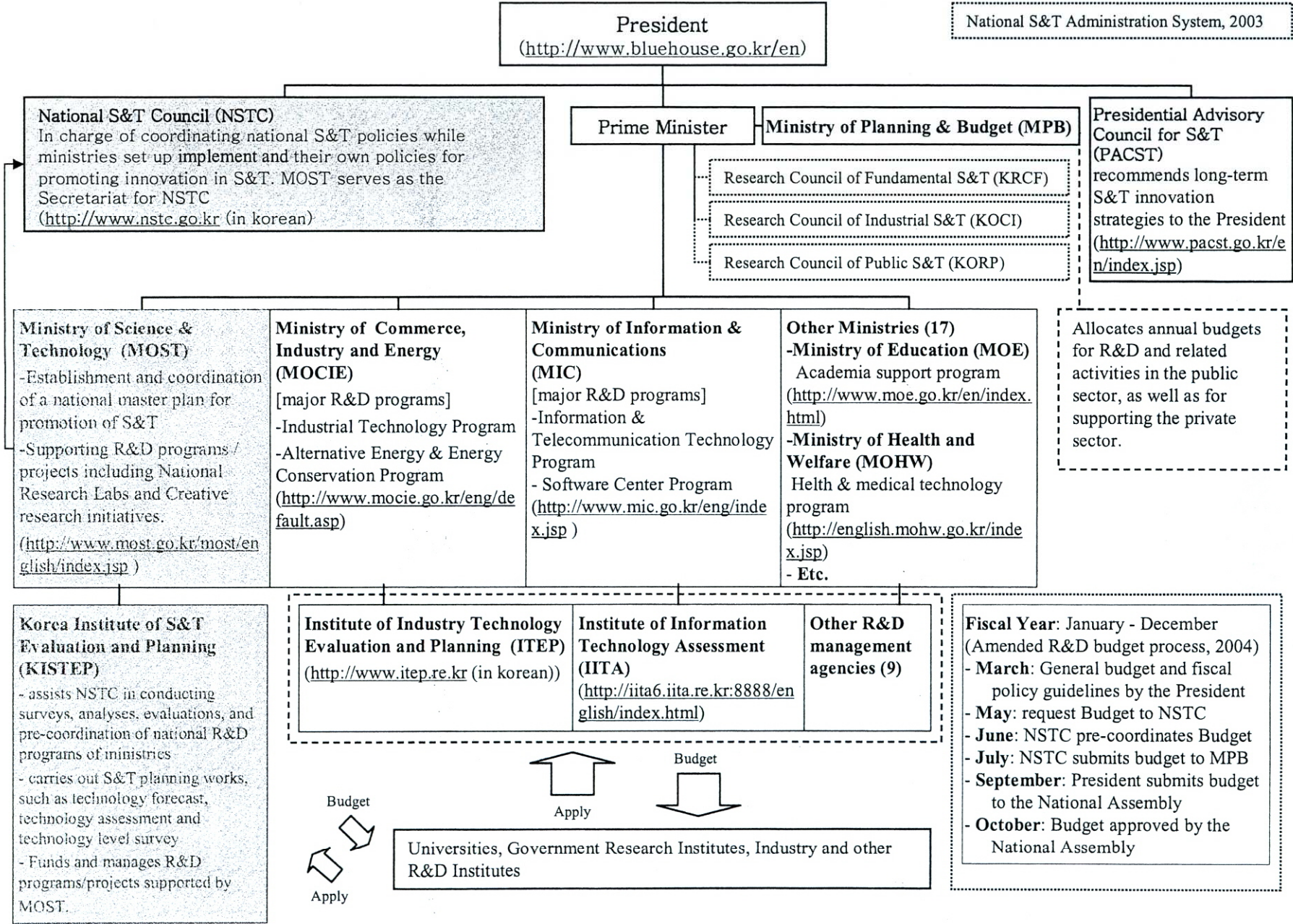
- Academy of Finland
- National Technology Agency of Finland (TEKES)
- Public research & development organisations
- Technology transfer agencies
- Capital providers

Source: Nieminen, M. and Kaukonen, E. (2001), "Universities and R&D Networking In a Knowledge-based Economy – A Glance At Finnish Development", Sitra Report Series 11, Helsinki.



# KOREAN NIS

National S&T Administration System, 2003



**National S&T Council (NSTC)**  
In charge of coordinating national S&T policies while ministries set up implement and their own policies for promoting innovation in S&T. MOST serves as the Secretariat for NSTC  
(<http://www.nstc.go.kr> (in korean))

**Prime Minister** | **Ministry of Planning & Budget (MPB)**  
 - Research Council of Fundamental S&T (KRCF)  
 - Research Council of Industrial S&T (KOICI)  
 - Research Council of Public S&T (KORP)

**Presidential Advisory Council for S&T (PACST)**  
recommends long-term S&T innovation strategies to the President  
(<http://www.pacst.go.kr/en/index.jsp>)

**Ministry of Science & Technology (MOST)**  
- Establishment and coordination of a national master plan for promotion of S&T  
- Supporting R&D programs / projects including National Research Labs and Creative research initiatives.  
(<http://www.most.go.kr/most/english/index.jsp>)

**Ministry of Commerce, Industry and Energy (MOCIE)**  
[major R&D programs]  
- Industrial Technology Program  
- Alternative Energy & Energy Conservation Program  
(<http://www.mocie.go.kr/eng/default.asp>)

**Ministry of Information & Communications (MIC)**  
[major R&D programs]  
- Information & Telecommunication Technology Program  
- Software Center Program  
(<http://www.mic.go.kr/eng/index.jsp>)

**Other Ministries (17)**  
- **Ministry of Education (MOE)** Academia support program  
(<http://www.moe.go.kr/en/index.html>)  
- **Ministry of Health and Welfare (MOHW)** Health & medical technology program  
(<http://english.mohw.go.kr/index.jsp>)  
- Etc.

Allocates annual budgets for R&D and related activities in the public sector, as well as for supporting the private sector.

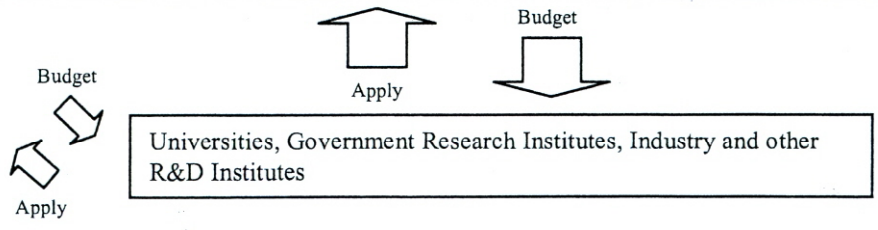
**Korea Institute of S&T Evaluation and Planning (KISTEP)**  
- assists NSTC in conducting surveys, analyses, evaluations, and pre-coordination of national R&D programs of ministries  
- carries out S&T planning works, such as technology forecast, technology assessment and technology level survey  
- Funds and manages R&D programs/projects supported by MOST.

**Institute of Industry Technology Evaluation and Planning (ITEP)**  
(<http://www.itep.re.kr> (in korean))

**Institute of Information Technology Assessment (IITA)**  
(<http://iita6.iita.re.kr:8888/english/index.html>)

**Other R&D management agencies (9)**

**Fiscal Year: January - December** (Amended R&D budget process, 2004)  
 - **March:** General budget and fiscal policy guidelines by the President  
 - **May:** request Budget to NSTC  
 - **June:** NSTC pre-coordinates Budget  
 - **July:** NSTC submits budget to MPB  
 - **September:** President submits budget to the National Assembly  
 - **October:** Budget approved by the National Assembly



# Institutional Coordination of Innovation – a staged approach in Korea

1960s	1970s	1980s	1990s	2000	2002-2025
<b>Scientific Institution Building</b>	<b>Scientific Infrastructure Setting</b>	<b>R&amp;D and Private Research Lab Promotion</b>	<b>Leading role in strategic areas</b>	<b>Nationwide innovation creation</b>	<b>Global Innovation creation</b>
<ul style="list-style-type: none"> <li>• Establishing of MOST</li> <li>• S&amp;T Promotion Laws</li> <li>• Human Resource Development</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of GRIs</li> <li>• R&amp;D Promotion Law</li> <li>• Highly Qualified Personnel Development</li> </ul>	<ul style="list-style-type: none"> <li>• National R&amp;D Funds</li> <li>• Promotion of establishment of private labs</li> <li>• Promotion of industrial R&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>• HAN Project</li> <li>• Enhancing university research capability</li> <li>• University-industry-GRI linkages</li> </ul>	<ul style="list-style-type: none"> <li>• CyberKorea 21 (1999-2002)</li> </ul>	<ul style="list-style-type: none"> <li>• e-Korea Vision 2007</li> <li>• S&amp;T(2007)</li> <li>• <b>Goals by 2025</b></li> </ul>



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## **Phase I (~2005)** **Leapfrog other Asian Nations**

- Increase R&D Expenditures & efficiency
- Expend Infrastructure
- Reform S&T Education
- Perform Future-oriented frontier research

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**Phase I (~2005)**  
**Leapfrog other Asian Nations**

- Increase R&D Expenditures & efficiency
- Expend Infrastructure
- Reform S&T Education
- Perform Future-oriented frontier research

**Phase II (~2015)**  
**Research Hub in Asia-Pacific**

- World class information
- Embrace globalization & promote global networking system
- Establish and diffuse a novel S&T culture
- Foster New Knowledge-based industries
- Advanced Basic-Science & Nurture World Class Scientists



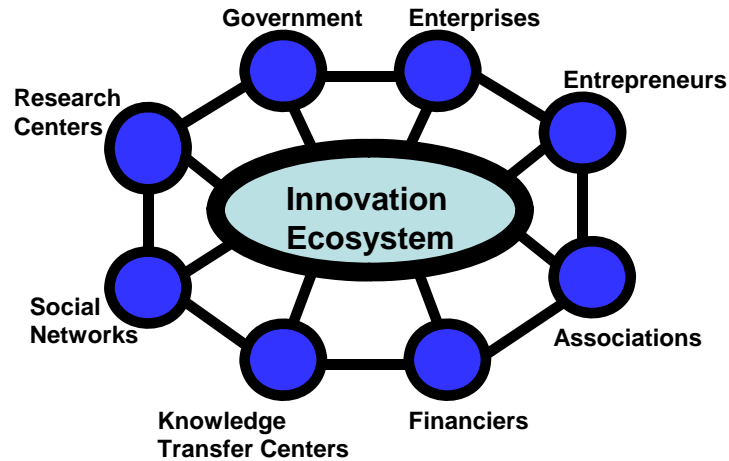
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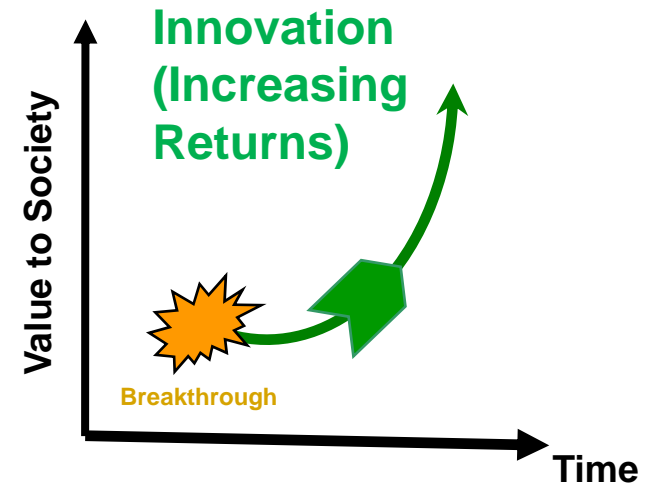


# Linkage: Institutional, Social Capital Theories & Sustainable Development

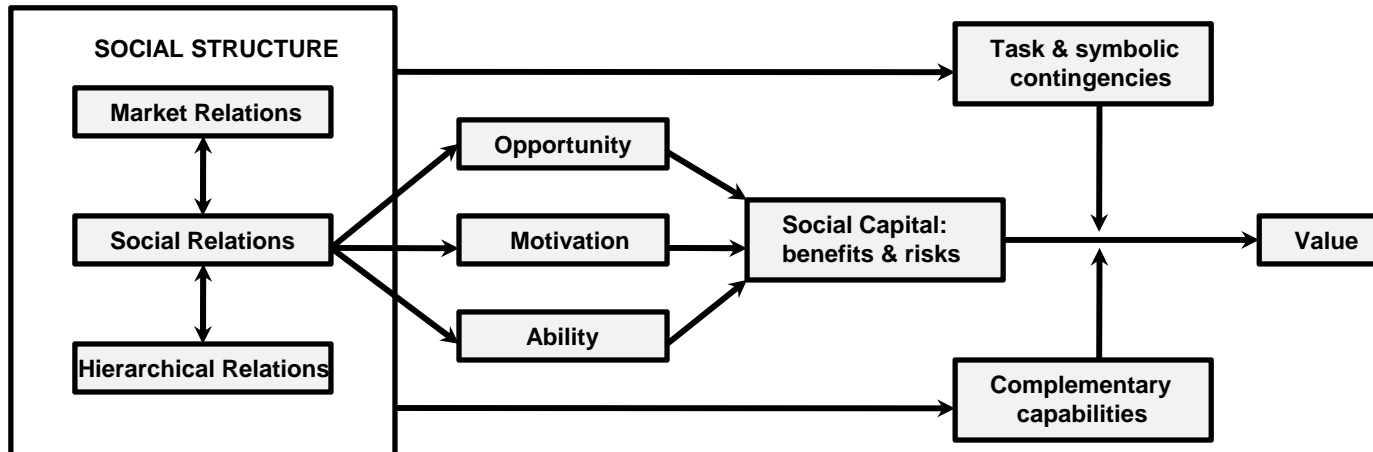
Source: Nair (2009)



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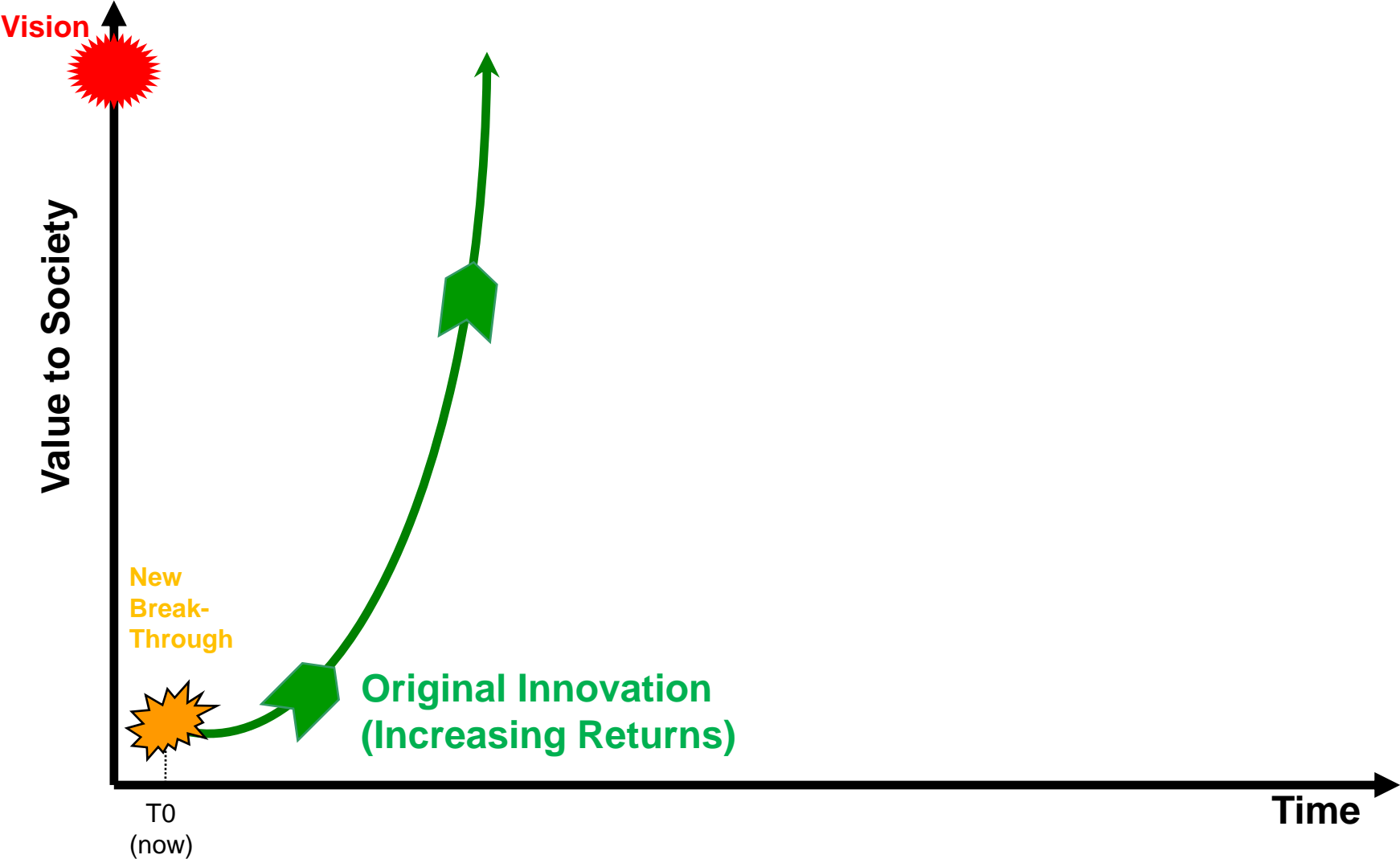


## Adler-Kwon Model



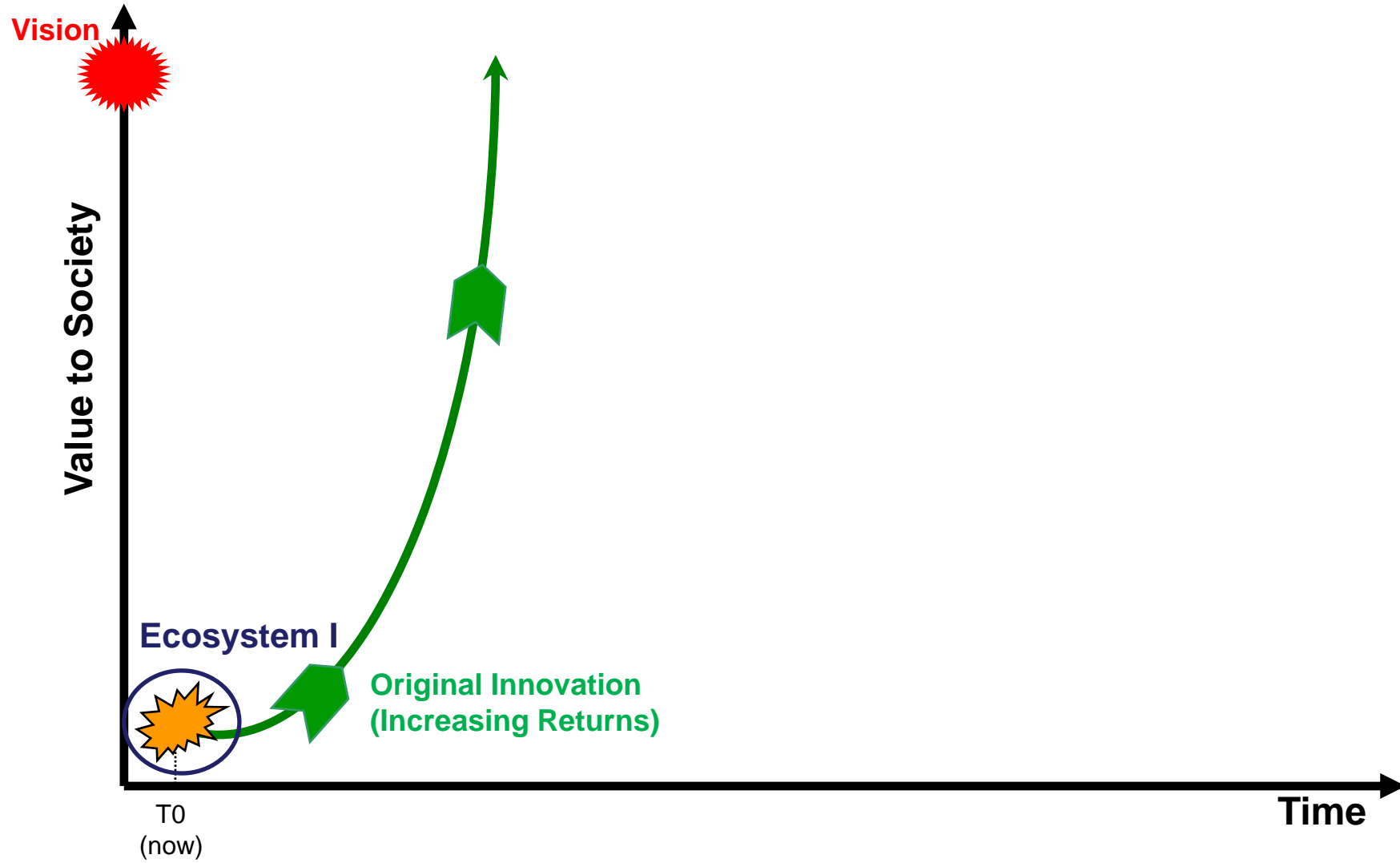
# Innovation Ecology Model

Nair (2010)



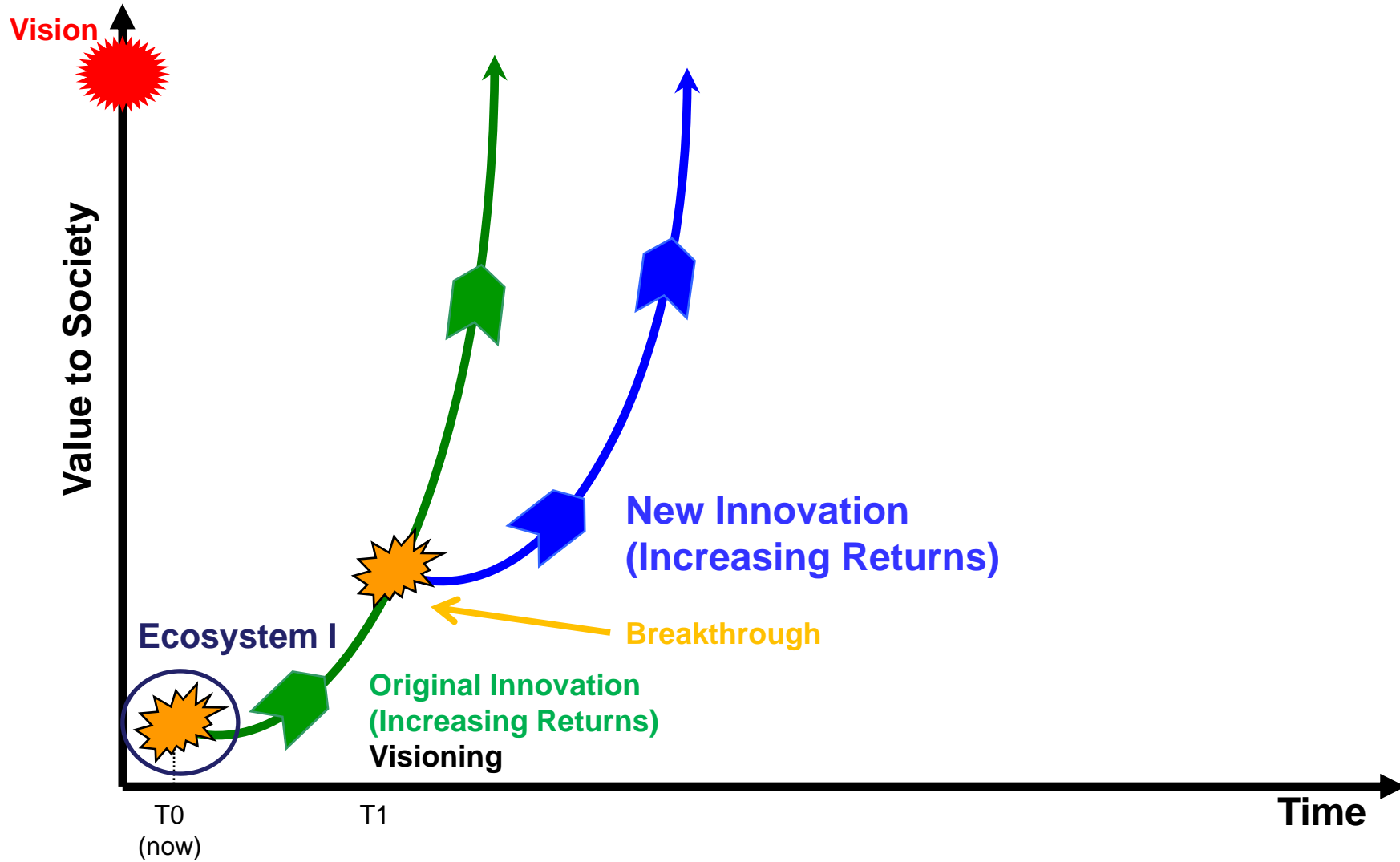
# Innovation Ecology Model

Nair (2010)



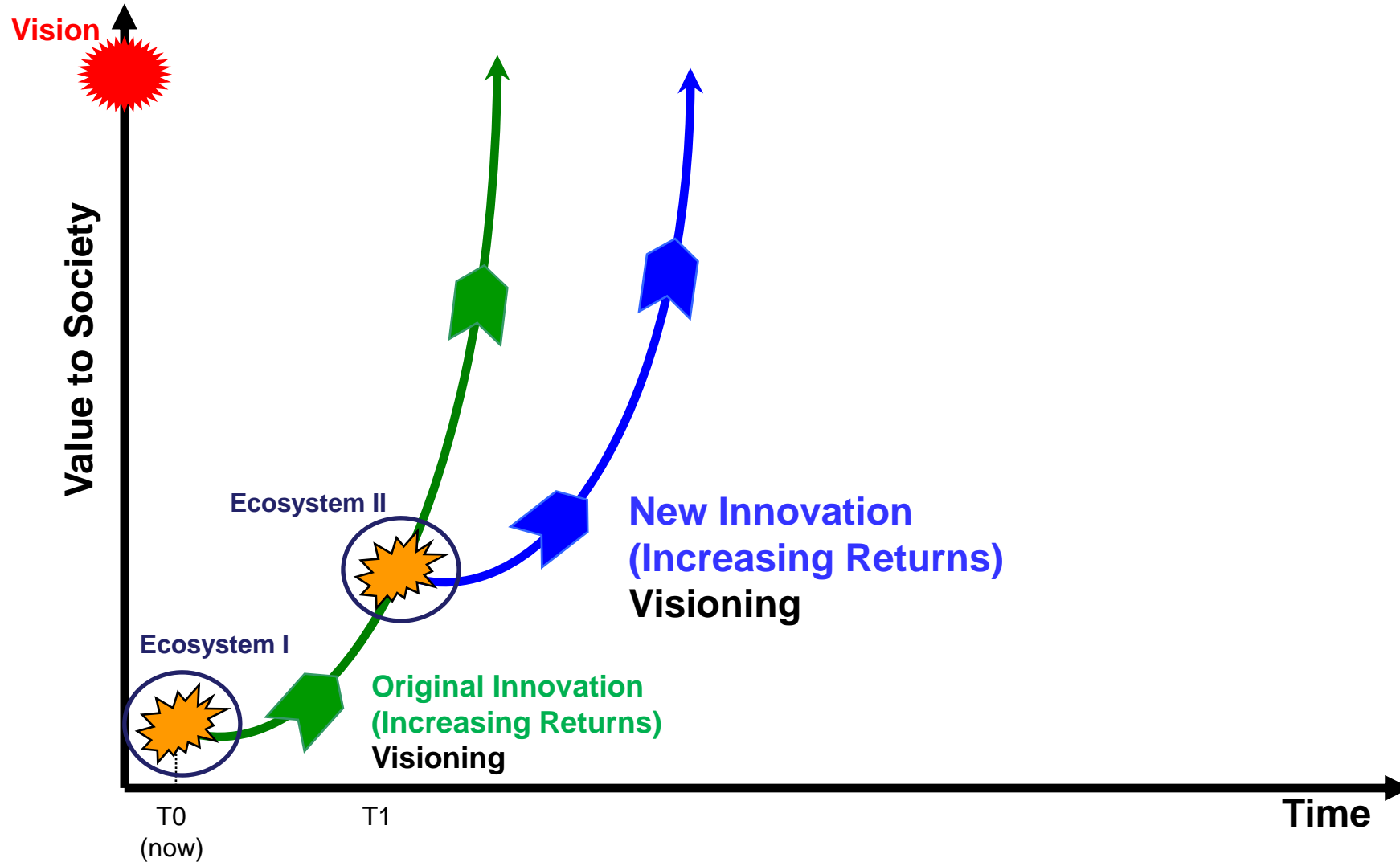
# Innovation Ecology Model

Nair (2010)



# Innovation Ecology Model

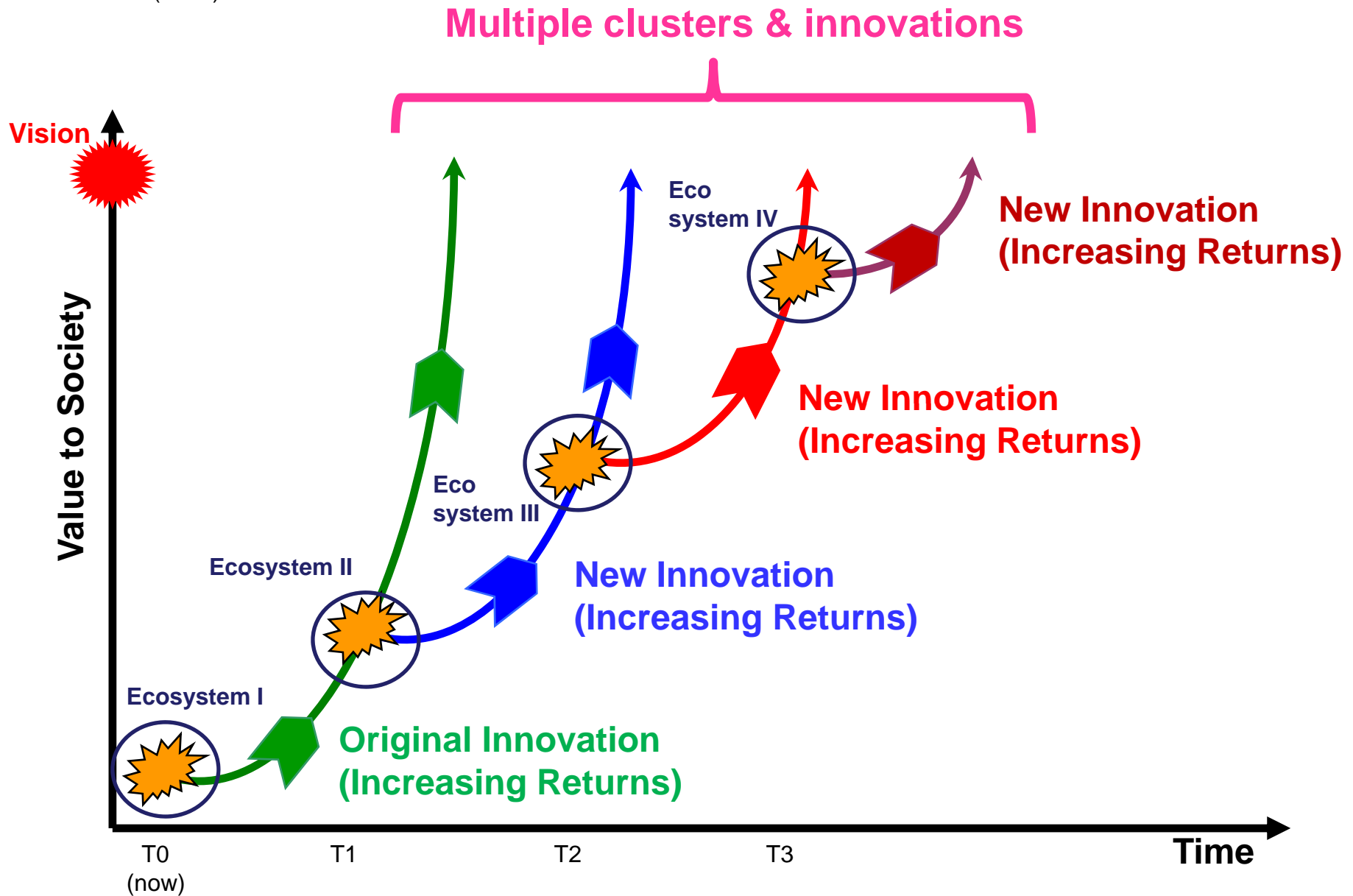
Nair (2010)





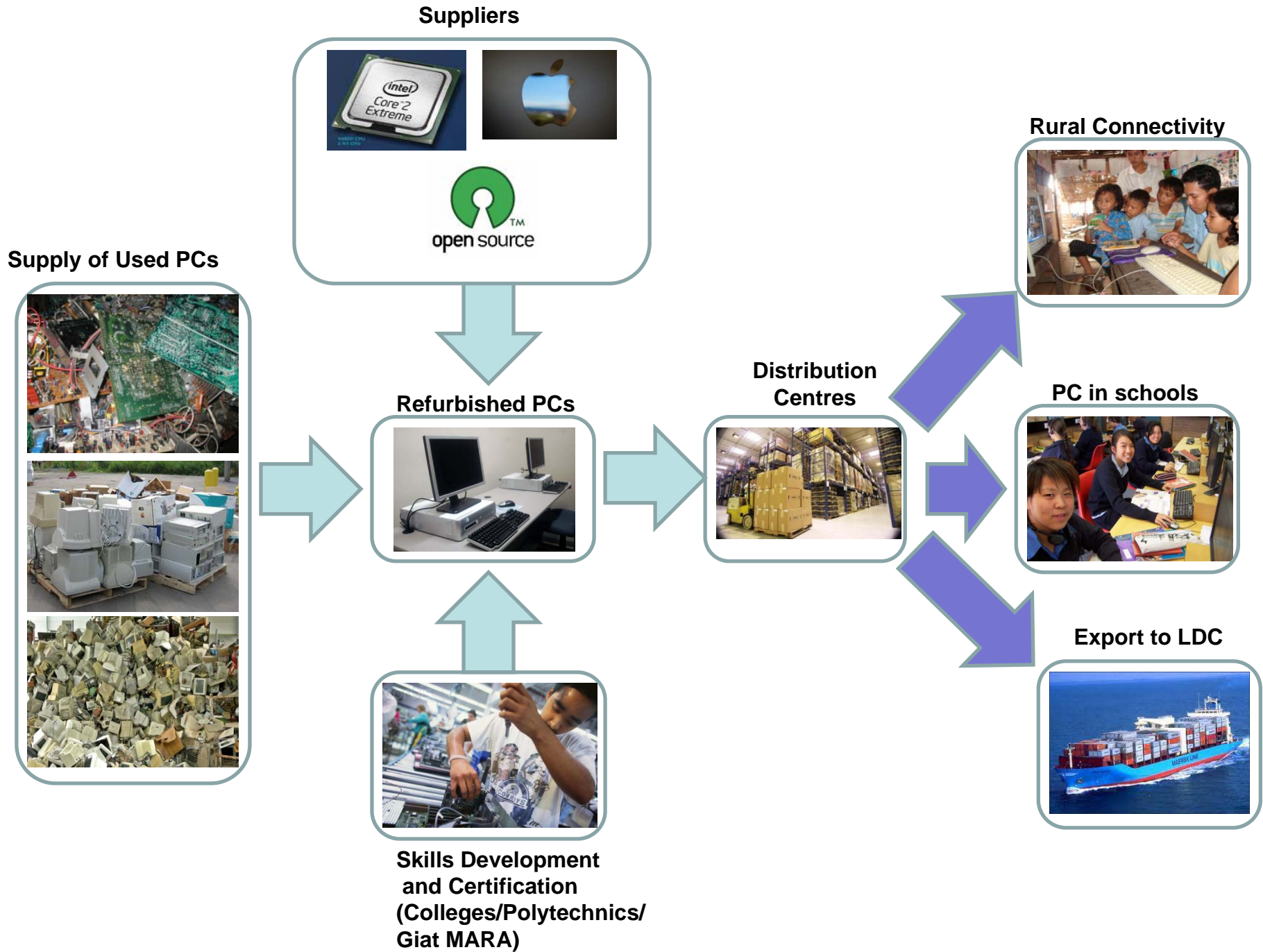
# Innovation Ecology Model

Nair (2010)



# **Case Study 1:**

Sustainable Modern Agriculture & Rural Transformation  
(S.M.A.R.T.)



**Suppliers**



**Supply of Used PCs**



**Refurbished PCs**



**Skills Development and Certification  
(Colleges/Polytechnics/  
Giat MARA)**



**Distribution Centres**



**Rural Connectivity**



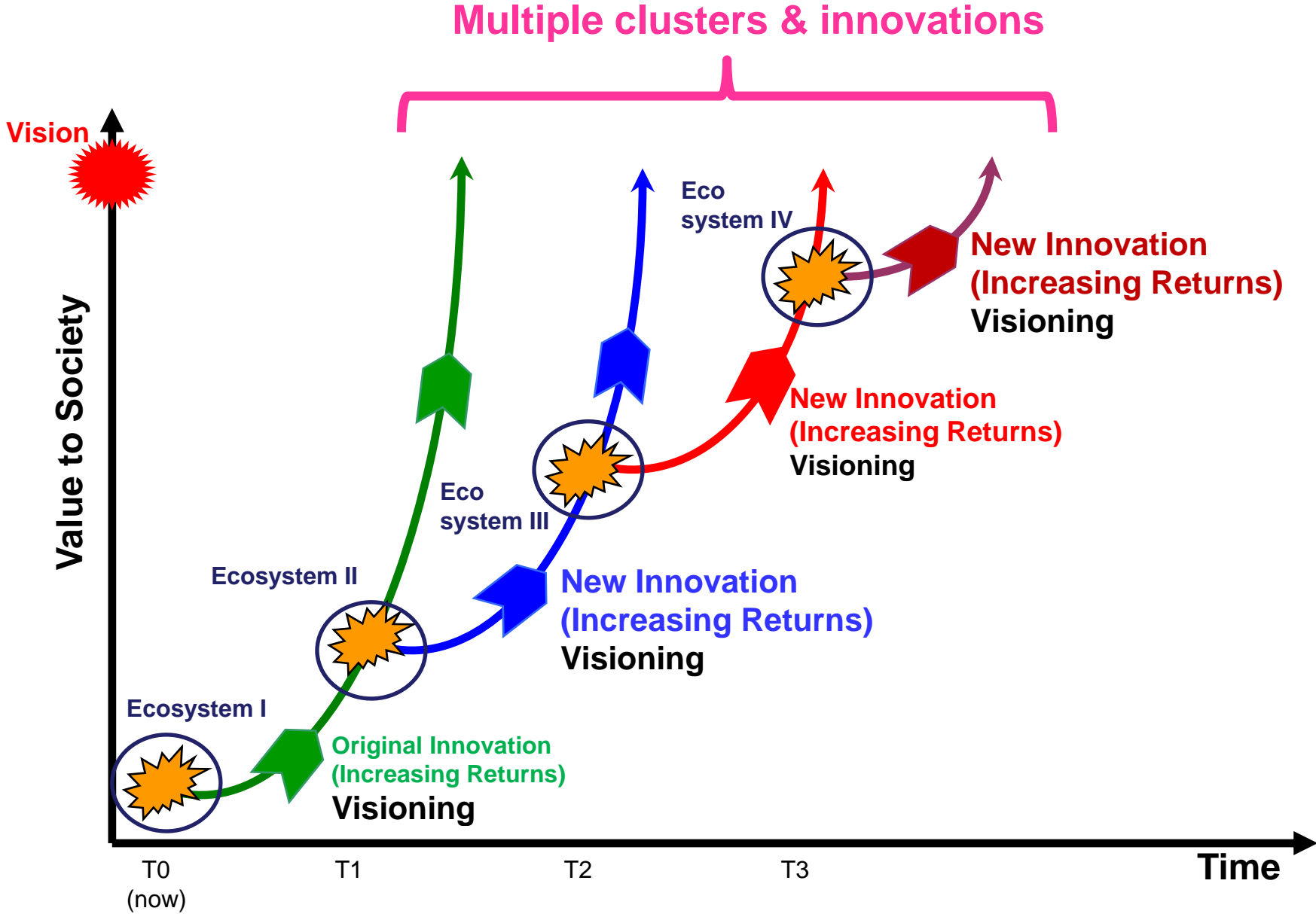
**PC in schools**



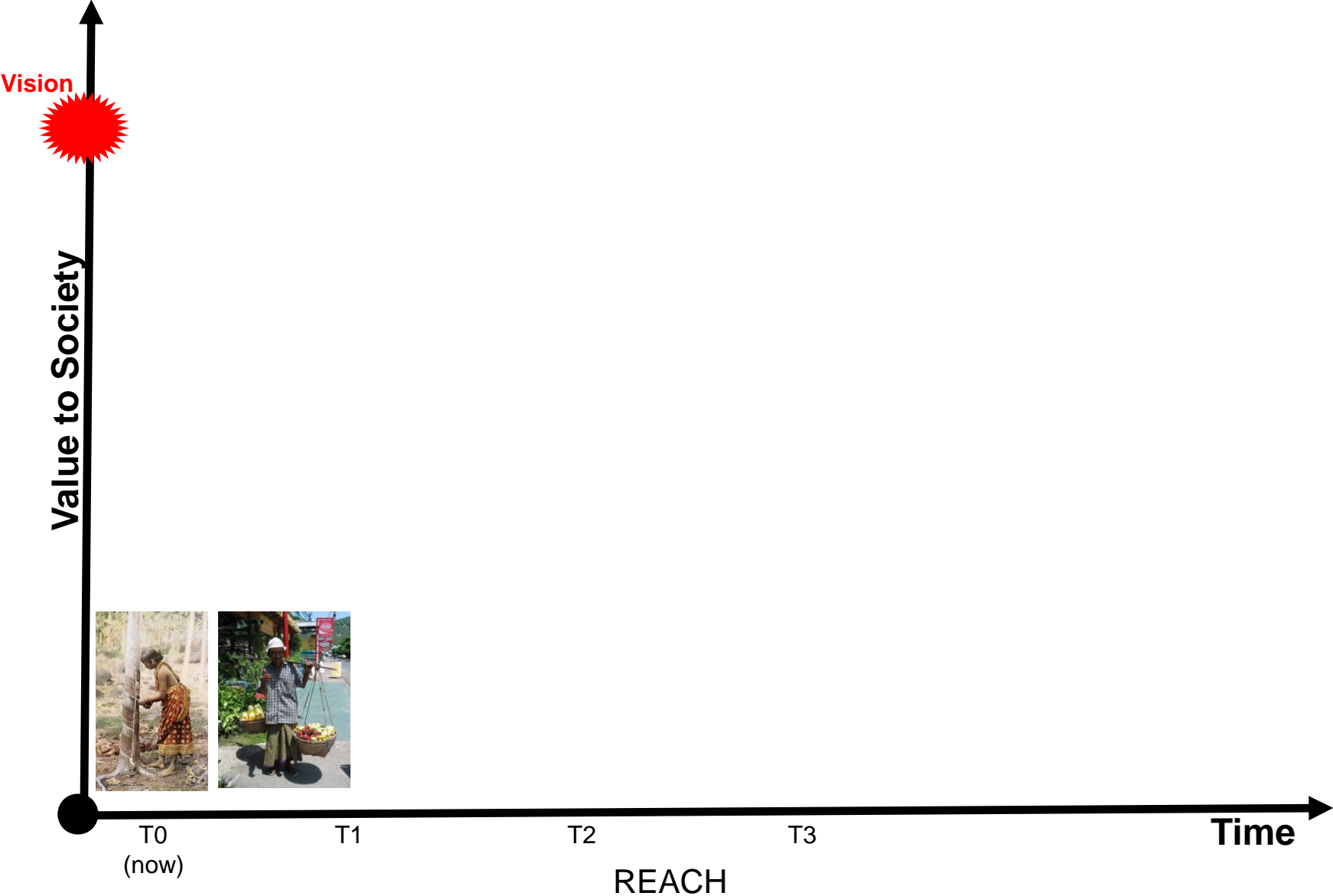
**Export to LDC**



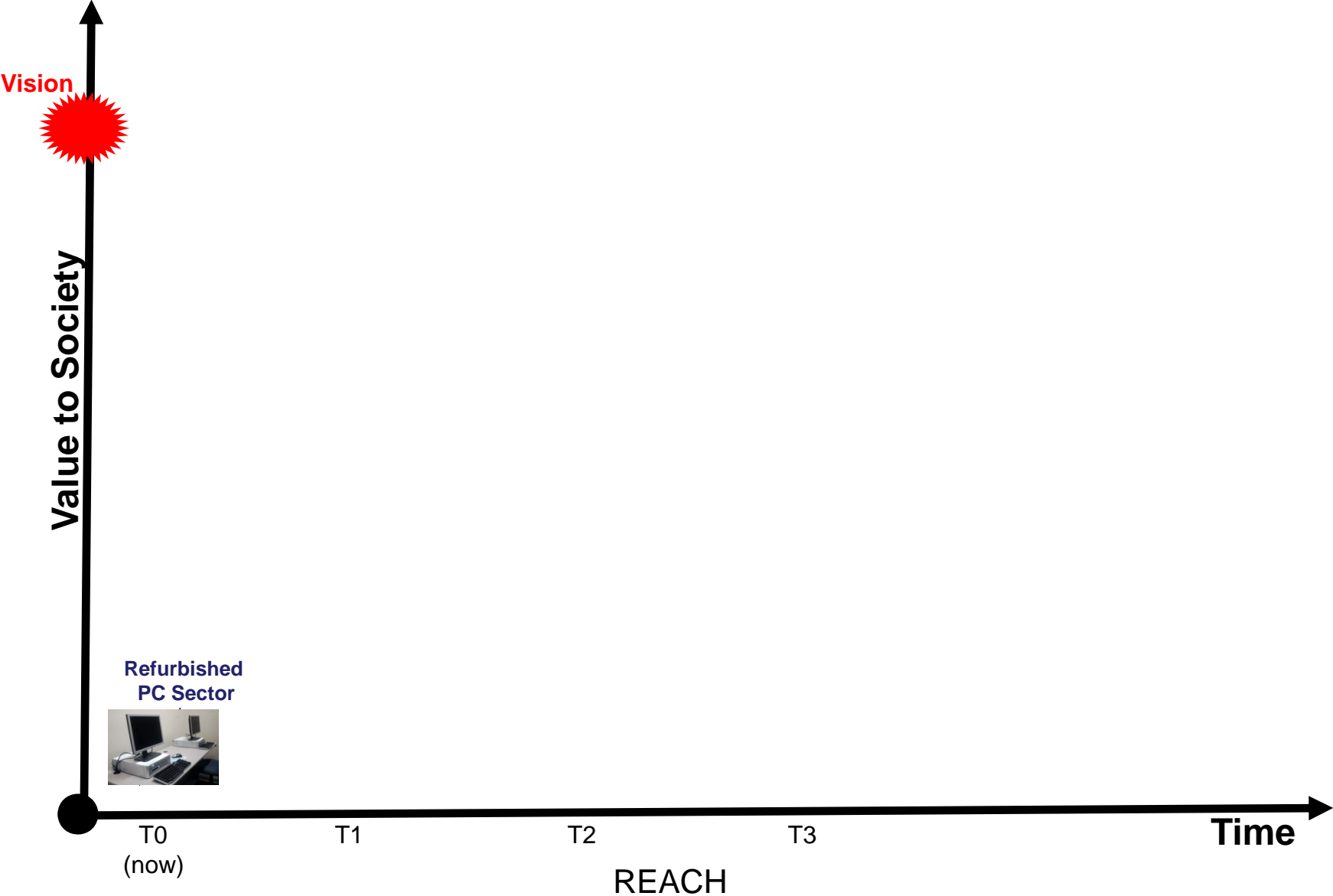
# National Innovation Ecosystem Model



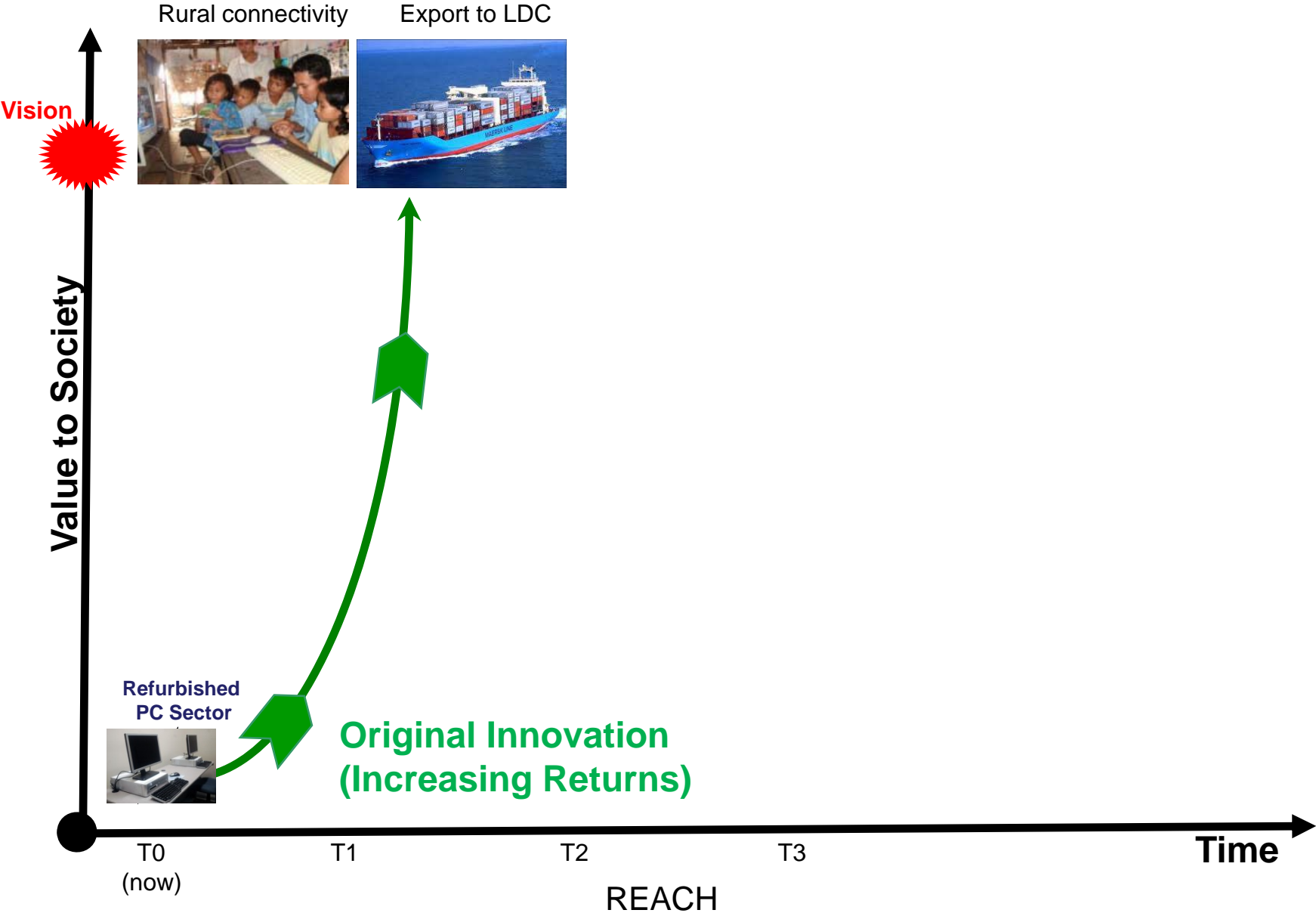
# National Innovation Ecosystem Model



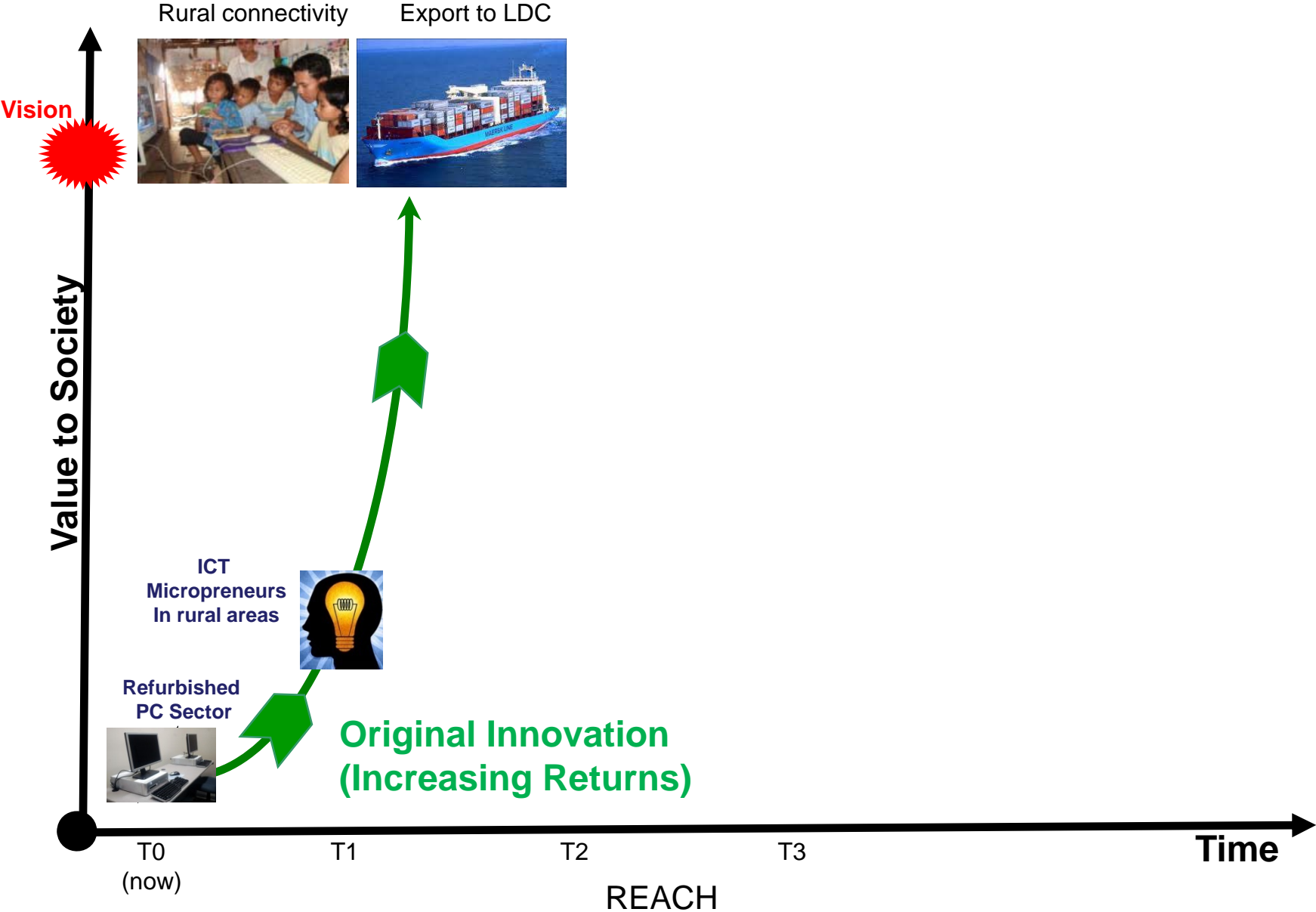
# National Innovation Ecosystem Model



# National Innovation Ecosystem Model

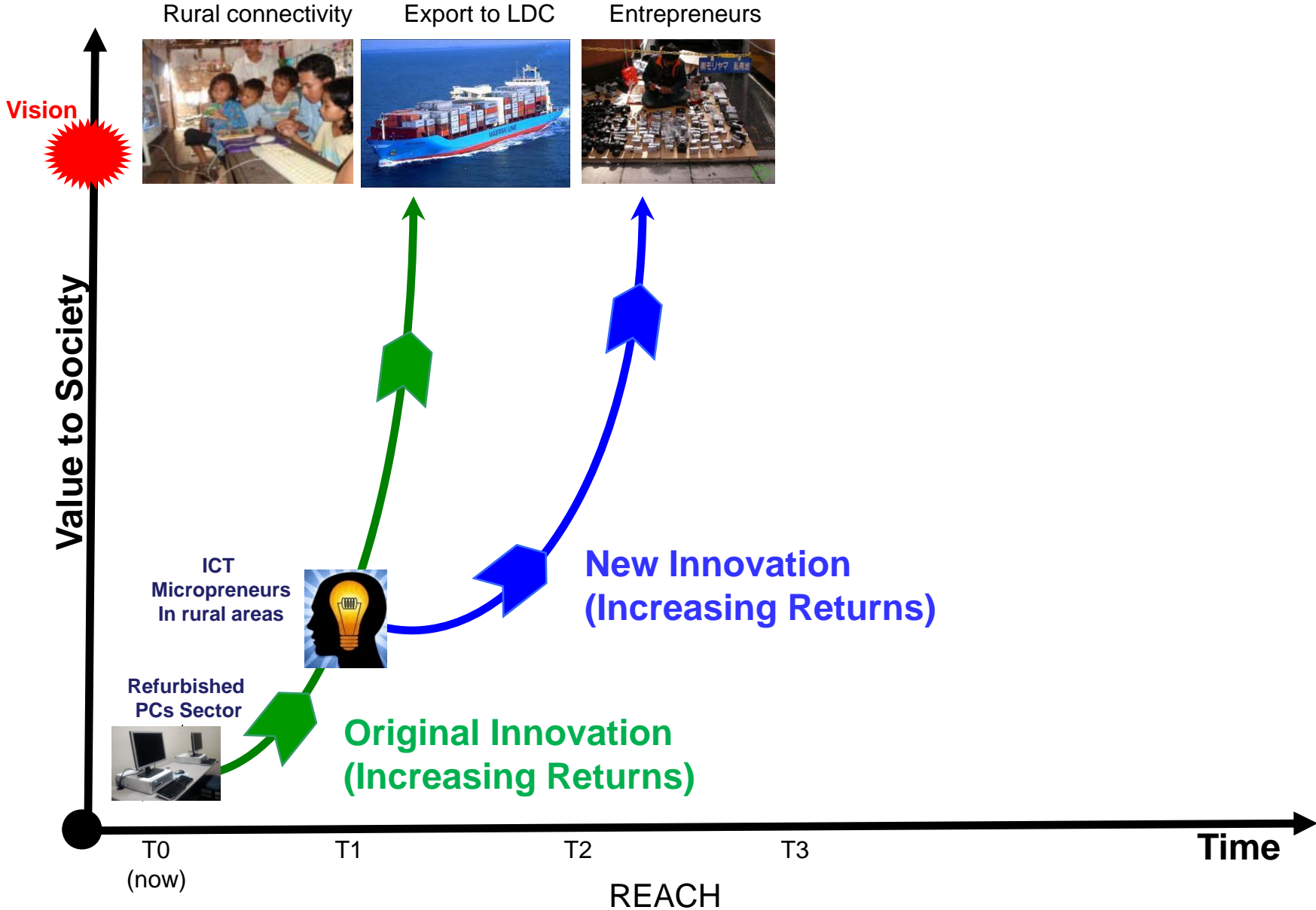


# National Innovation Ecosystem Model

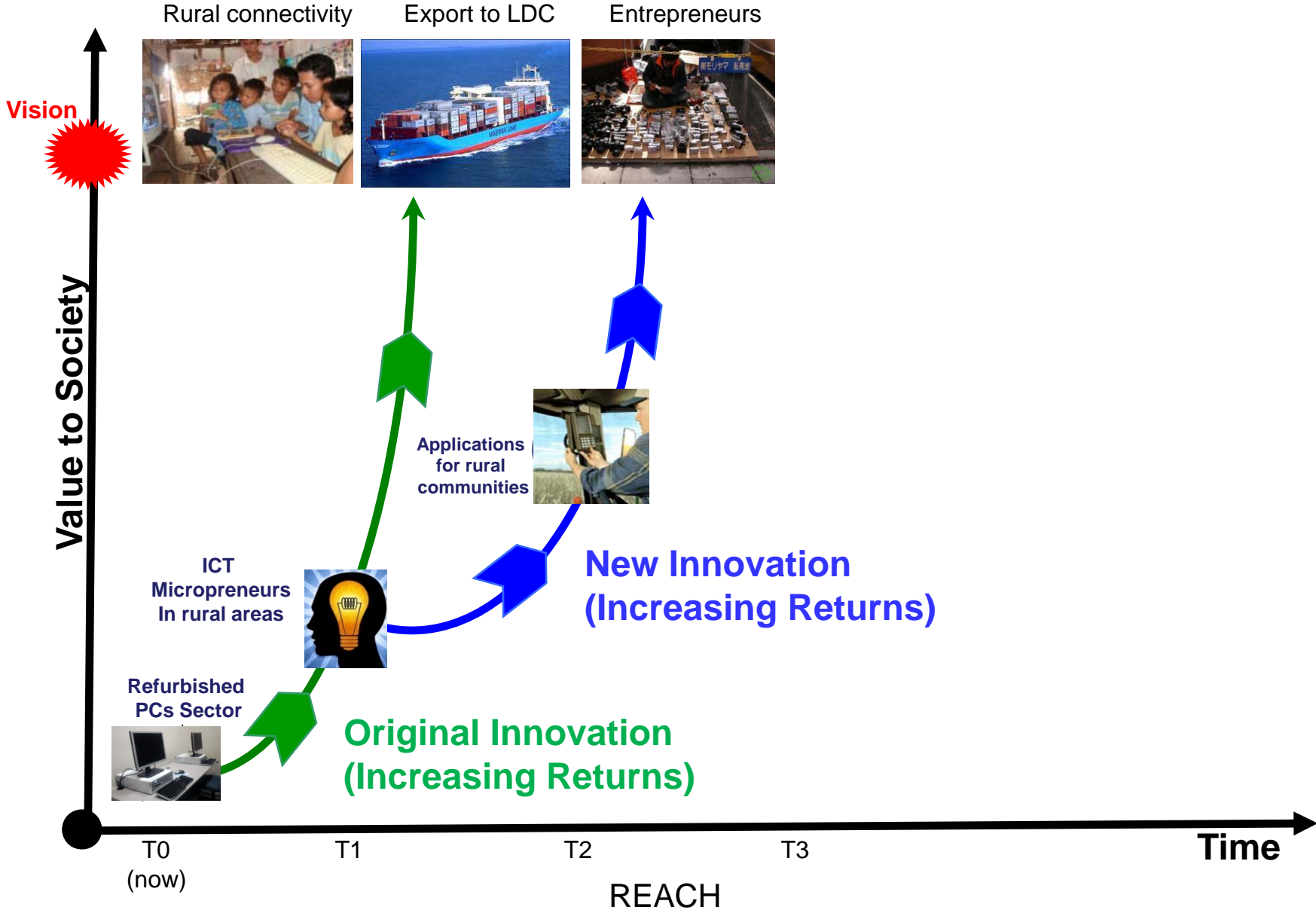




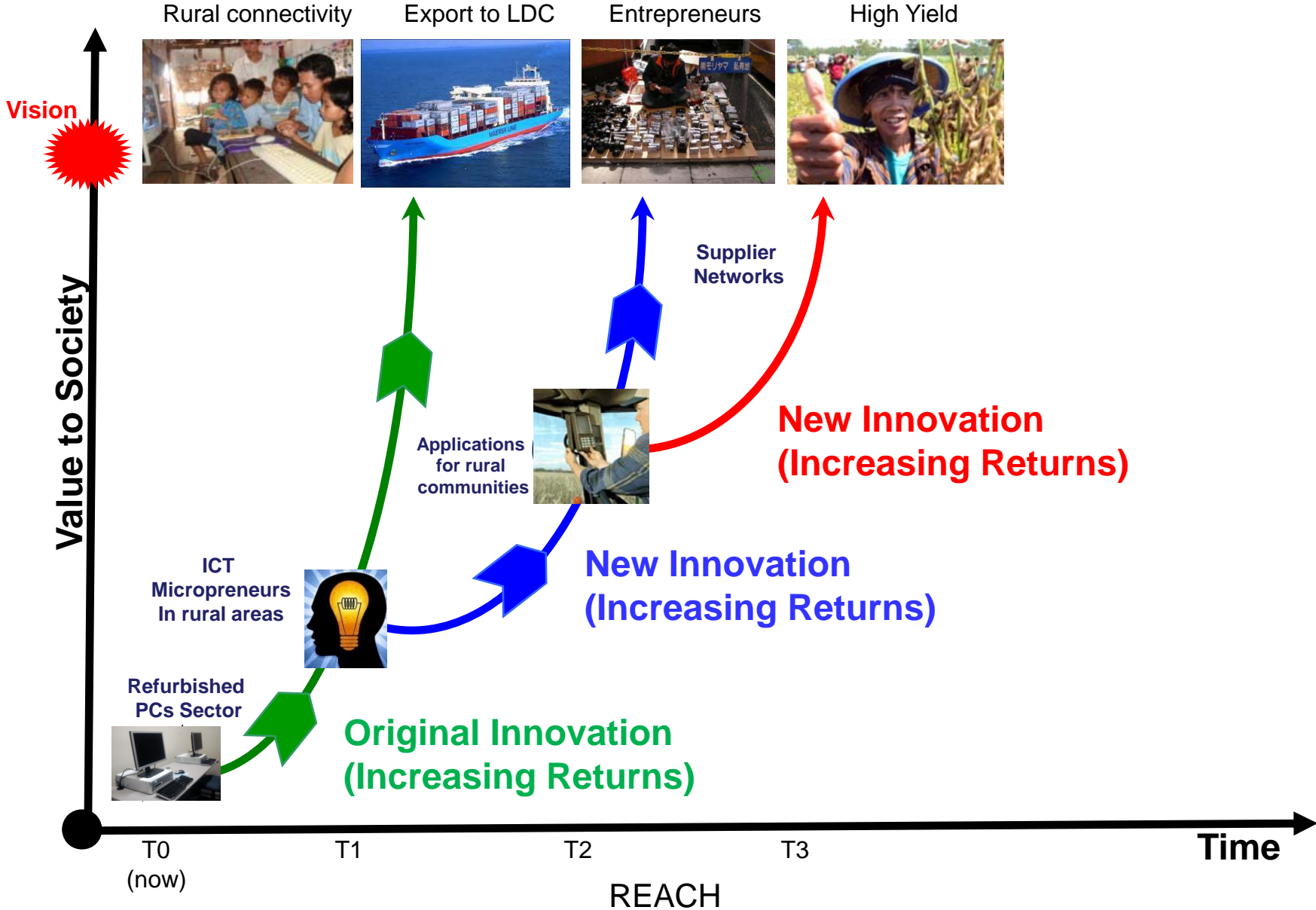
# National Innovation Ecosystem Model



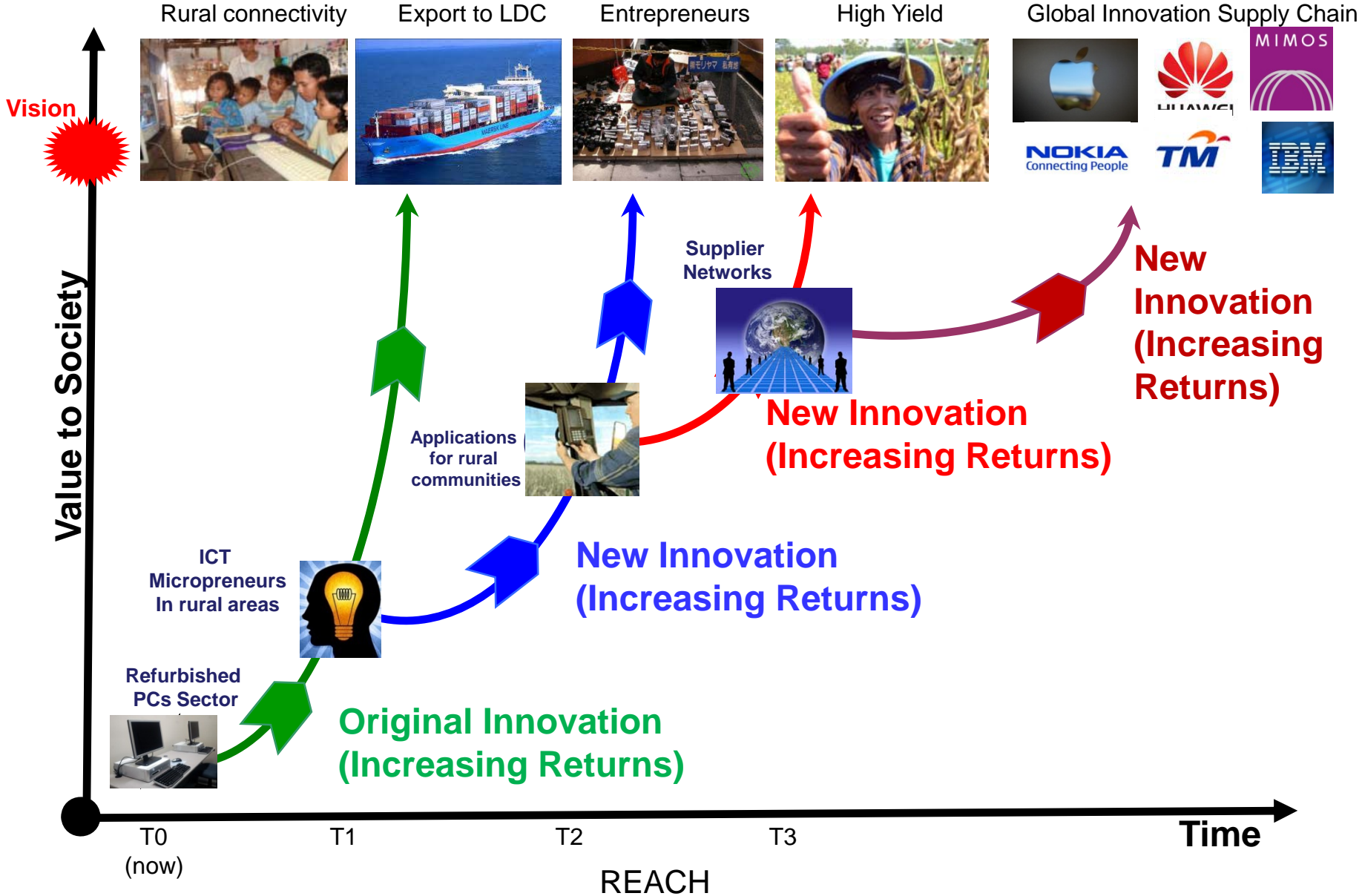
# National Innovation Ecosystem Model



# National Innovation Ecosystem Model

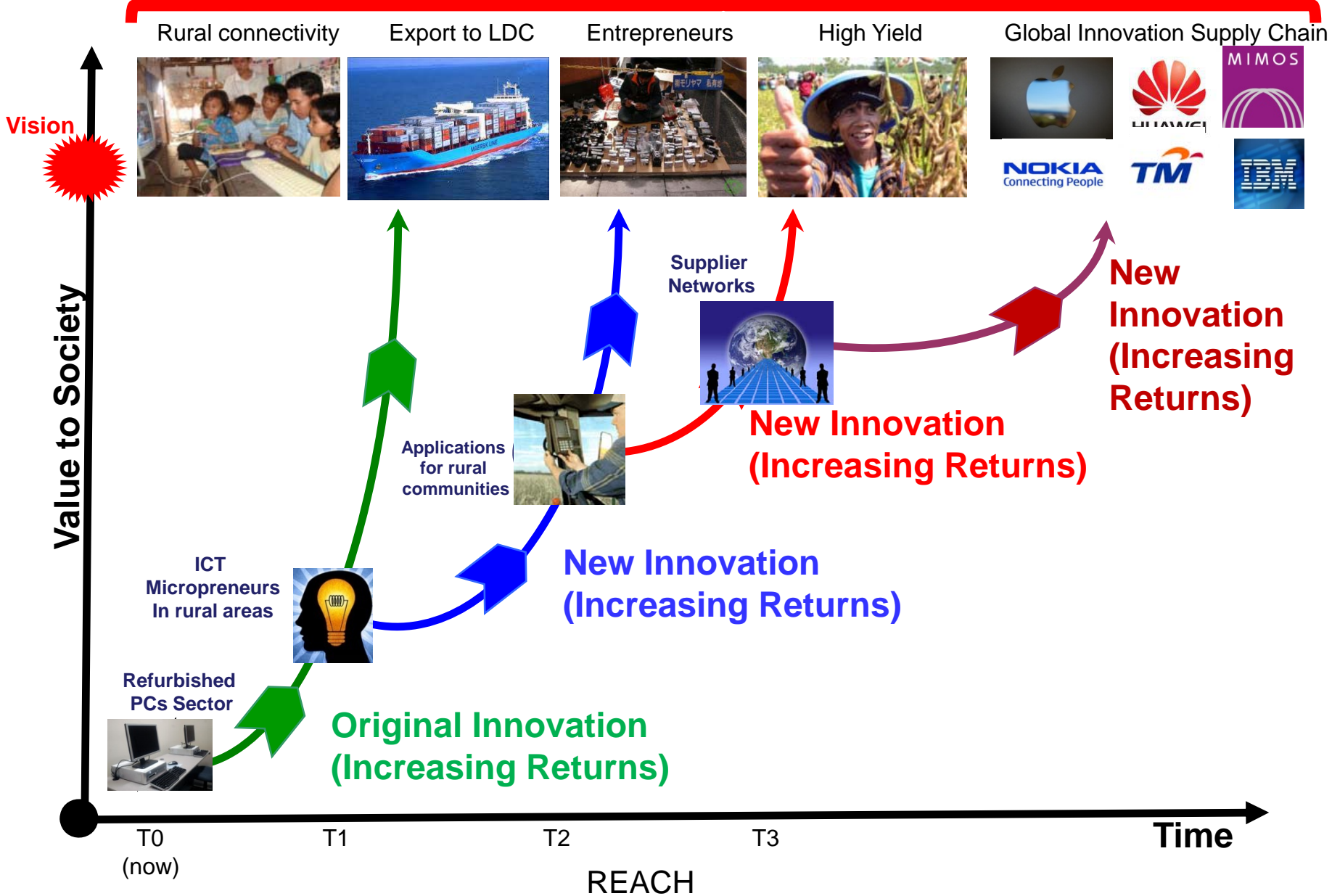


# National Innovation Ecosystem Model

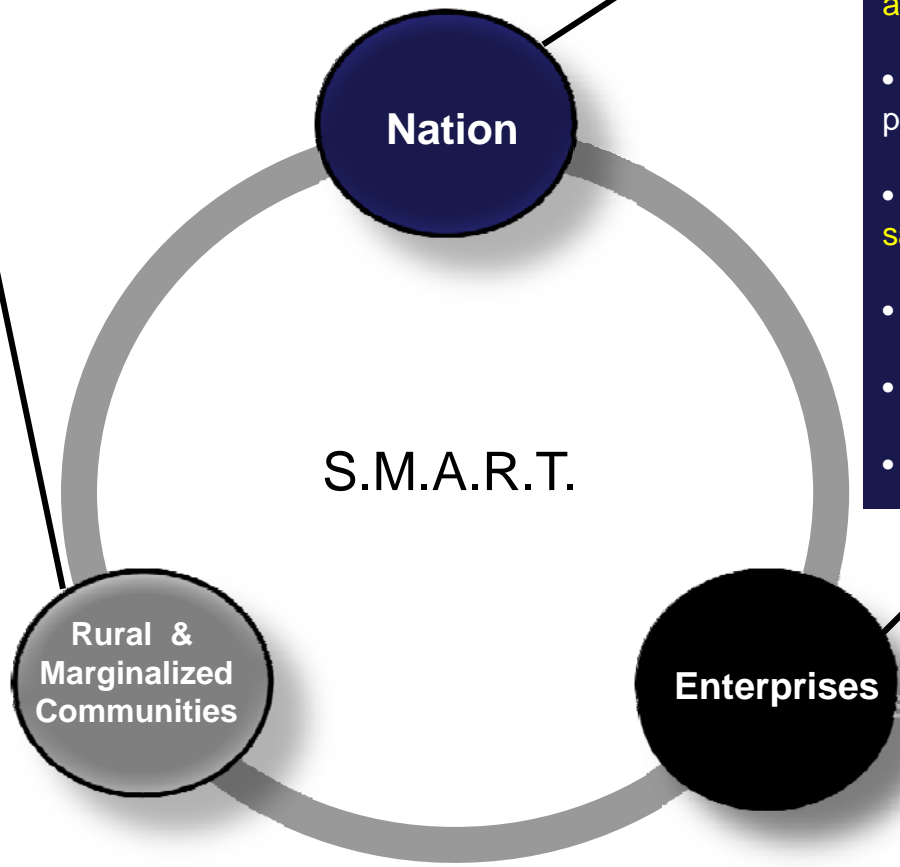


# National Innovation Ecosystem Model

S.M.A.R.T



# Multi-Stakeholder Benefits



- Access to good physical infrastructure
- Access to technology & information service
- Access to knowledge & transferable skills
- Minimize economic & financial risks
- Reduce market failures (intermediaries, moral-hazard & rent-seeking)
- Empowerment of rural & marginalized communities
- Increase social status
- Raise the hope and motivation
- Higher & stable income employment

- Sustained Rural Development
- Curb Brain-Drain from Rural areas
- Reduce rural migration (Urban-poor)
- Increase literacy & technology savvy population
- Raise labour competitiveness
- More diversified rural economy
- Reduce the wealth gap

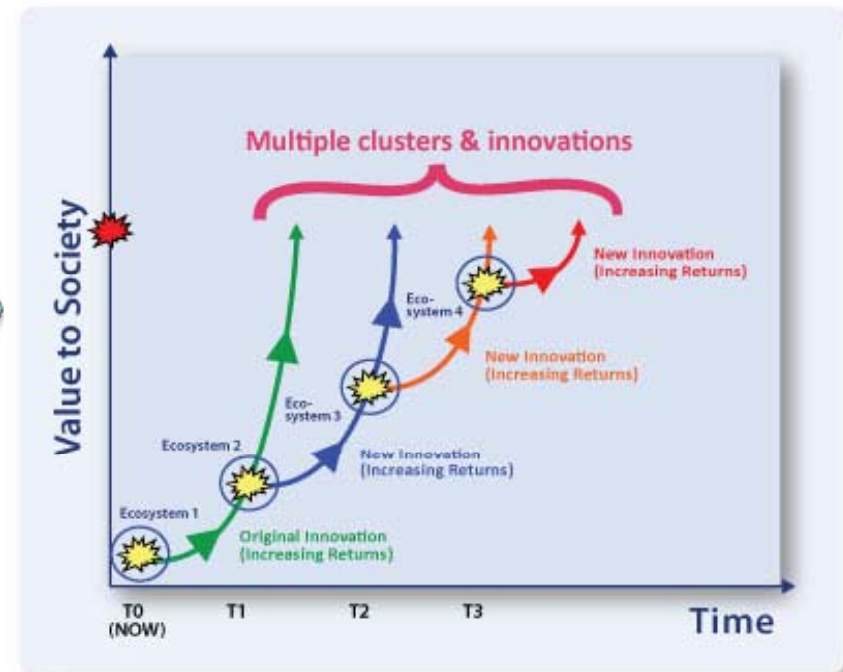
- Reduce cost of production
- Increase supply of dedicated k-workers
- Lower staff turn-over
- CSR Program
- Joint beneficiary of community based innovation projects (joint IPs & patents)
- Create internal demand for higher value products/services

# Old Economy



Input-output Model

# New Economy



Powered by Innovation

## 4. How have other countries leapfrogged to the new economy?

**Econometric Modelling using the 7i Framework – 2 stage estimation:**

Stage 1: Fuzzy Pattern Recognition Method

Stage 2: Impact model – random effects ordered probit model

**Data Sources:**

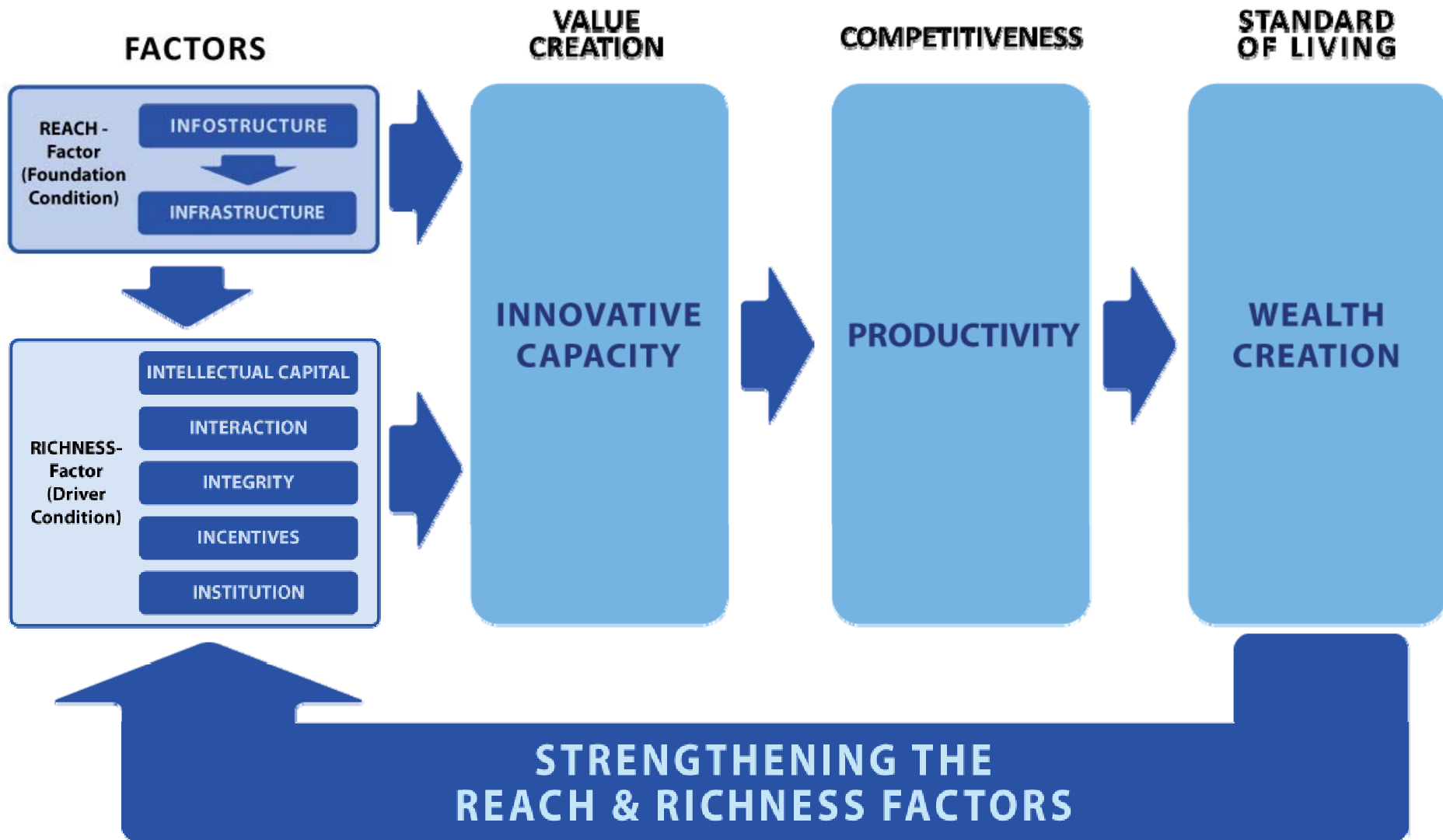
WDI, World Bank, IMF, WEF, IMD & Digital Planet & Various country Reports from EIU.

**Data Period:**

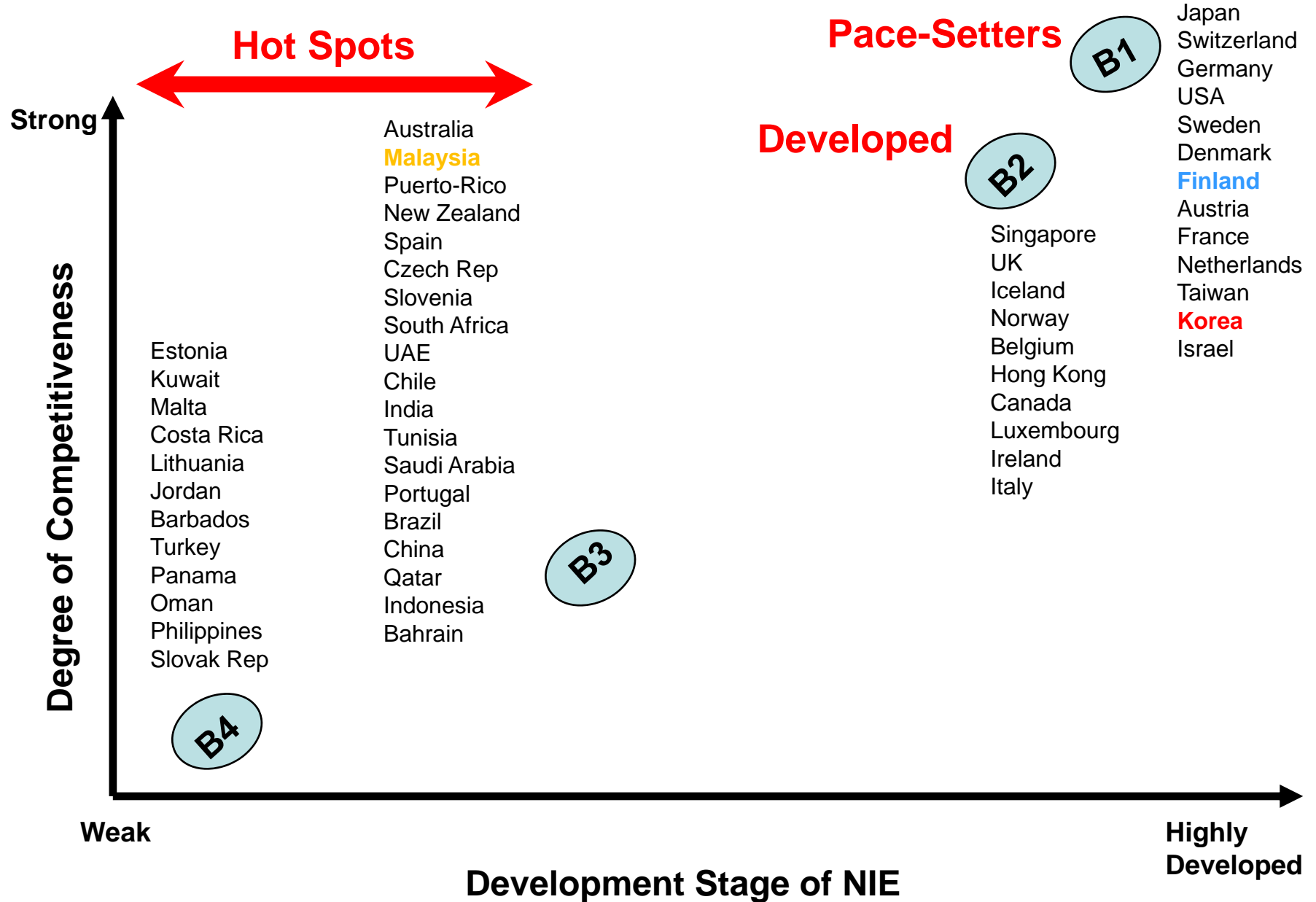
2007-2010



# 7i Framework

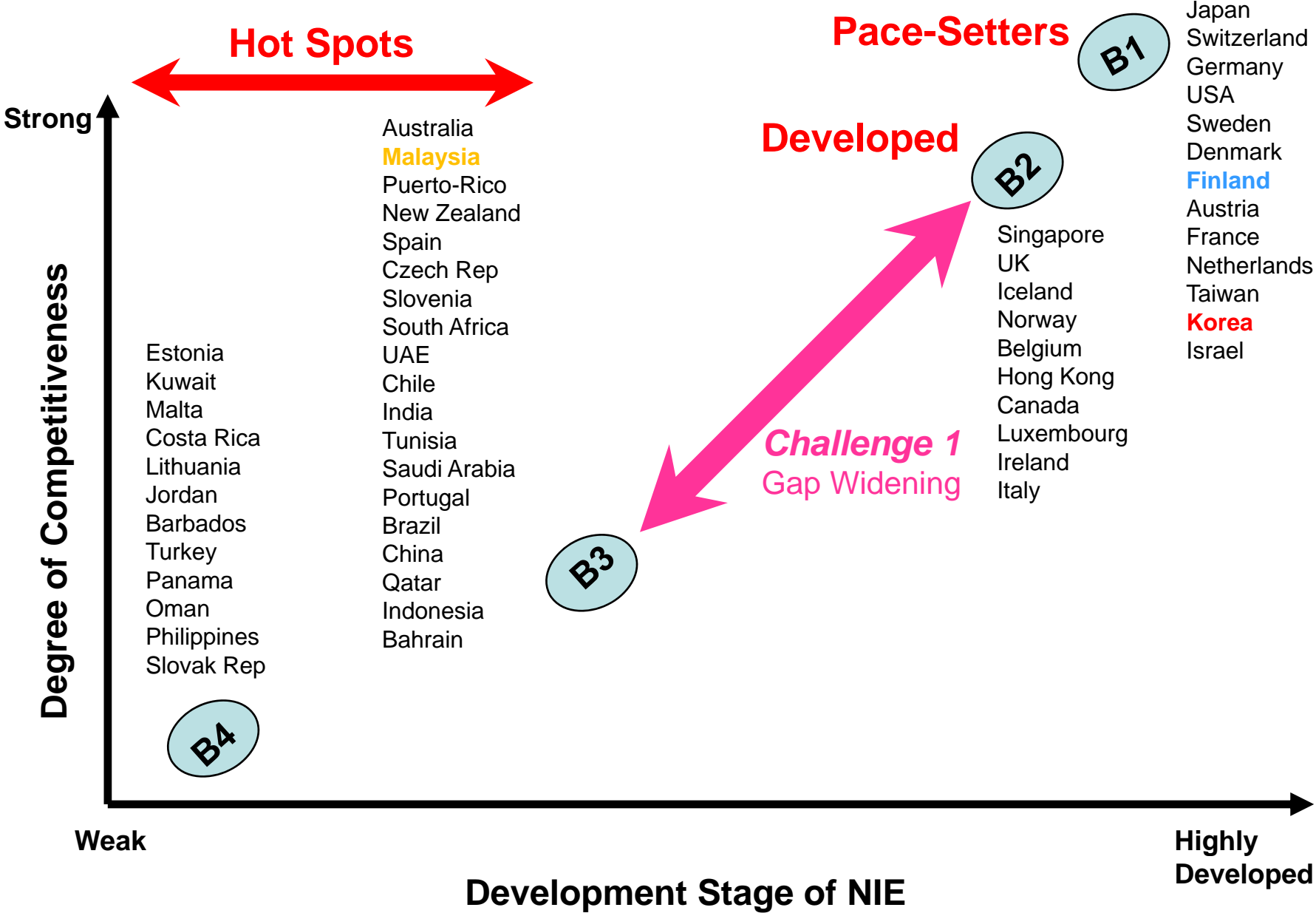


# Global Marathon Race in the new economy (2008/2009)

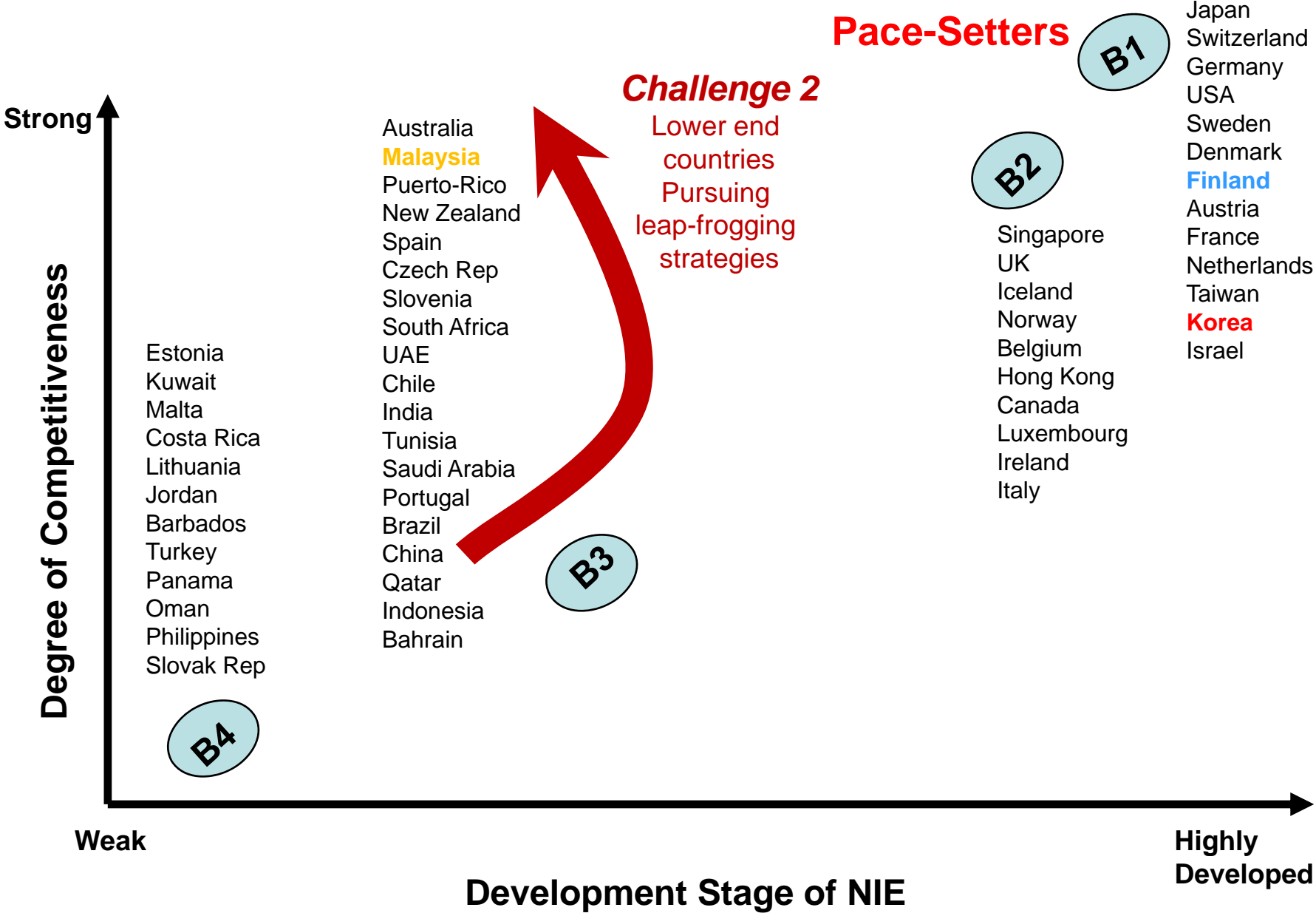


5. Can developing countries leap-frog  
to the innovation economy?  
Challenges & Drivers

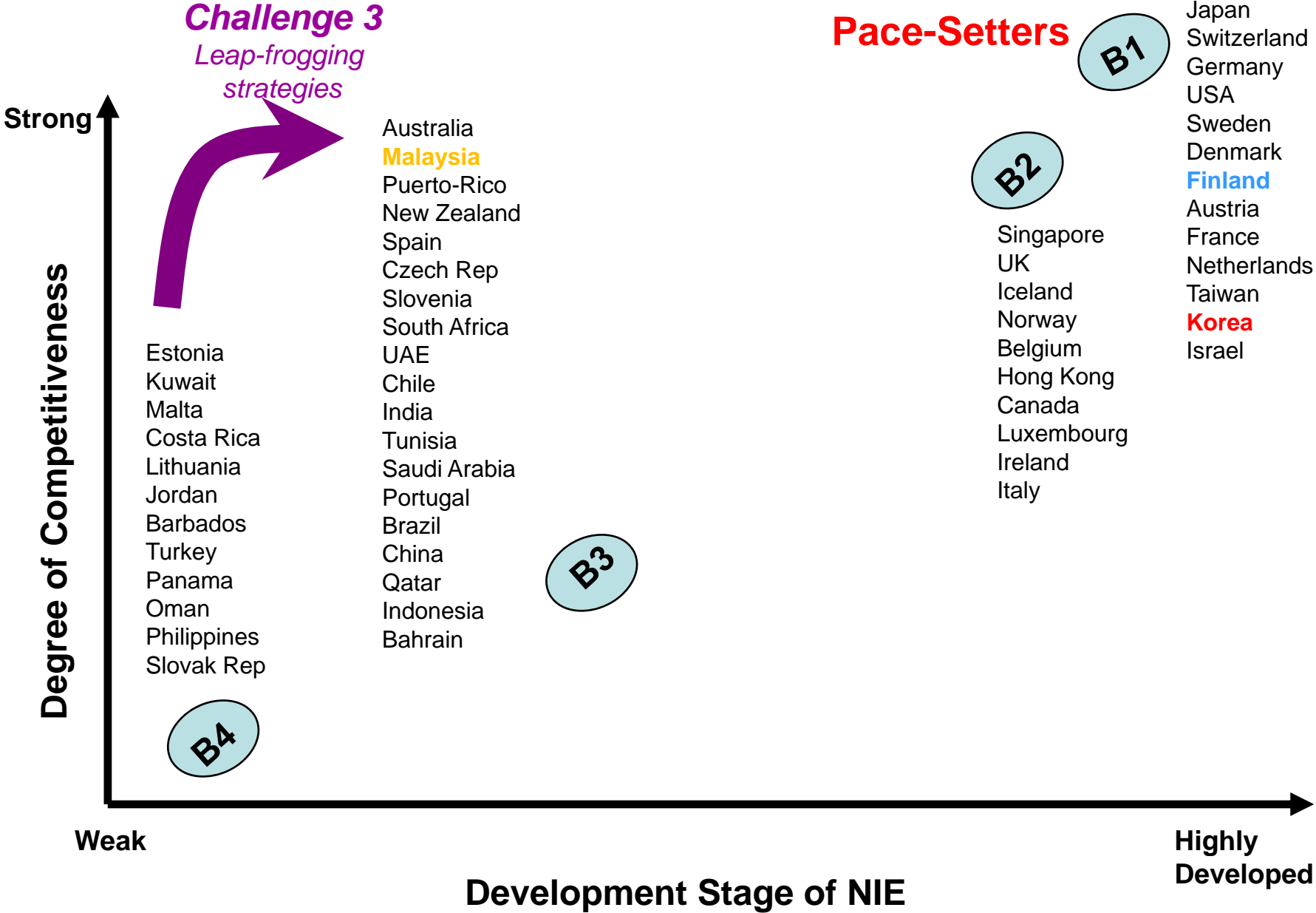
# Challenge 1



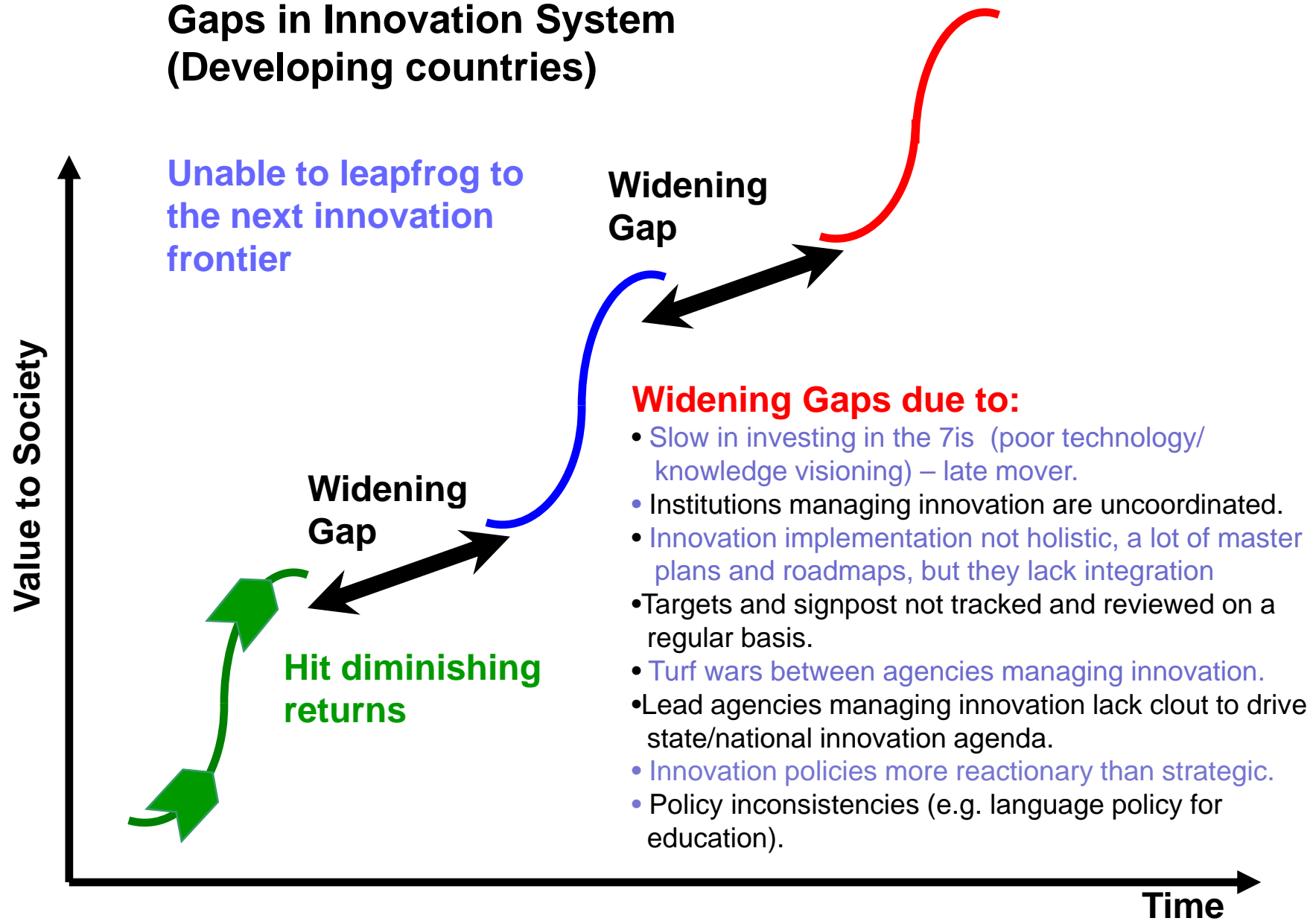
# Challenge 2



# Challenge 3



## Gaps in Innovation System (Developing countries)



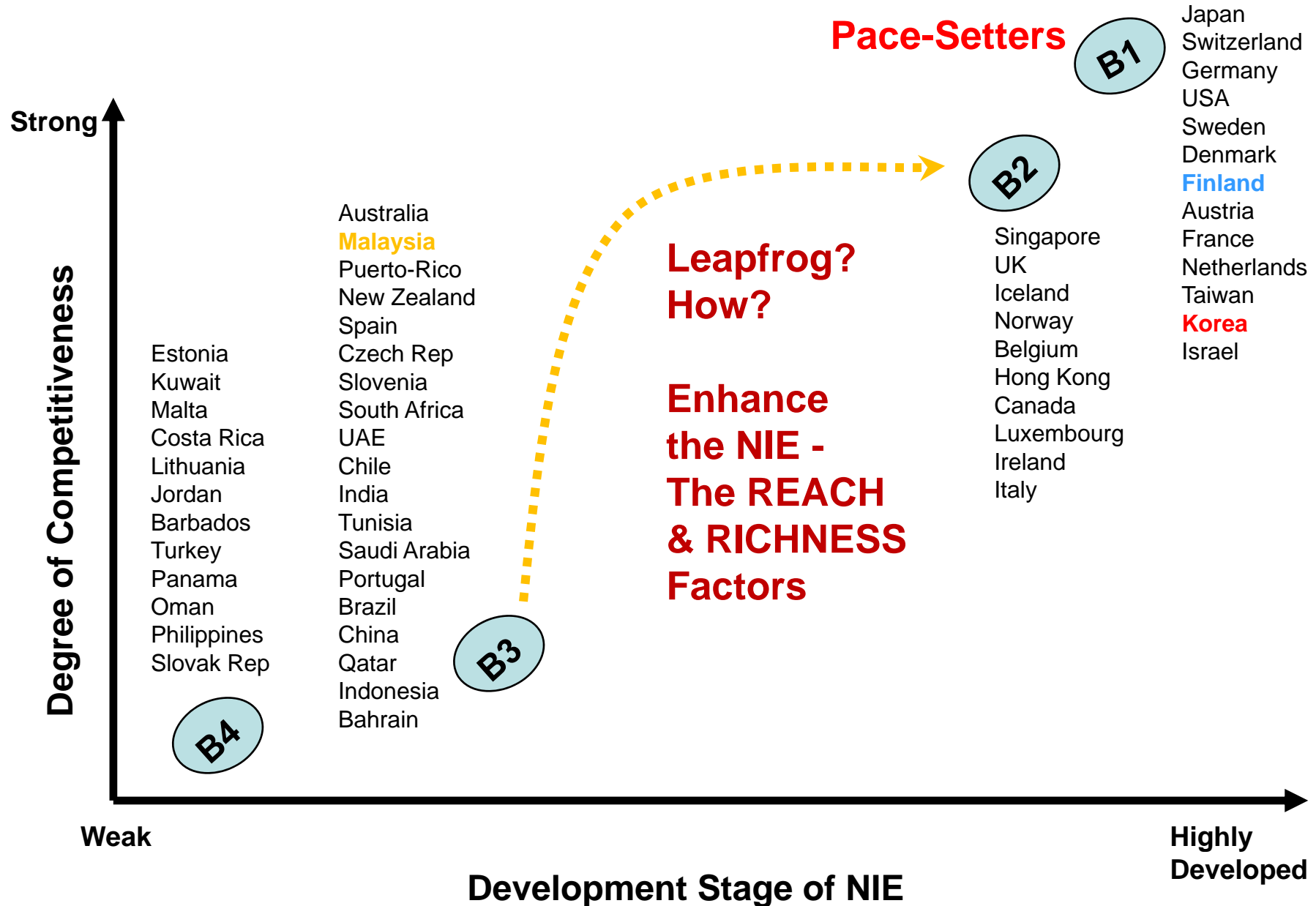
# Drivers: Strengths in Malaysia

- Political Will – under new PM
- Planning system is good.
- Emphasis on S&T – especially Mahathir's leadership (good foundation).
- High investment in education.
- Collaboration & Cooperation with regional economies (Korea and Japan)
- Gateway to ASEAN, Asia-Pacific and OIC

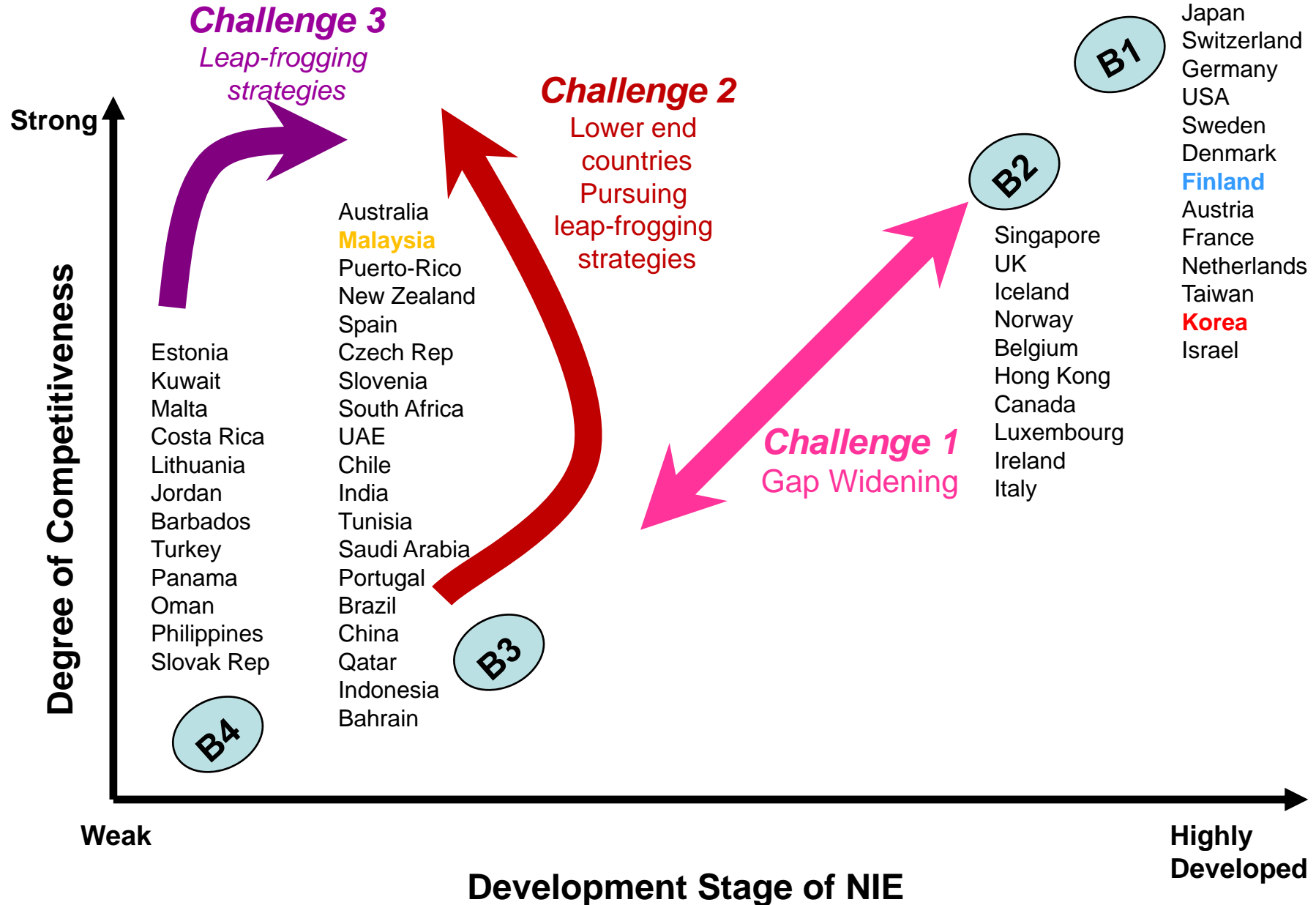


**6. What are the possible trajectories for a  
innovation driven economy?  
(Simulation Results)**

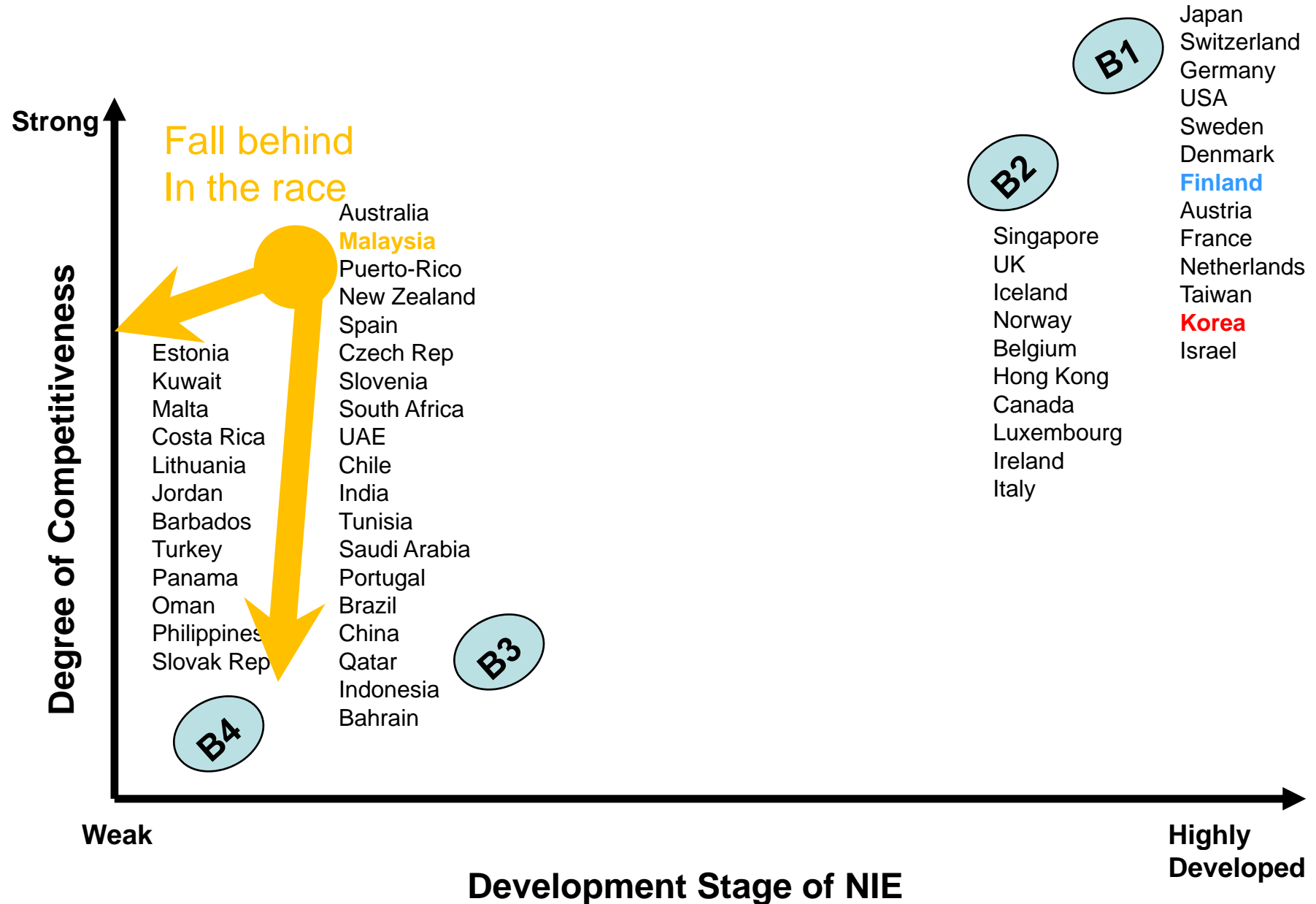
# How to move up the global innovation value chain?



# Competition from all Directions



# Trajectory 0 - Status Quo (2010-2015)



## 2008 - 2009

- 24. Australia
- 25. Malaysia
- 26. Puerto-Rico
- 27. New Zealand
- 28. Spain
- 29. Czech Rep
- 30. Slovenia
- 31. South Africa
- 32. UAE
- 33. Chile
- 34. India
- 35. Tunisia
- 36. Saudi Arabia
- 37. Portugal
- 38. Brazil
- 39. China
- 40. Qatar
- 41. Indonesia
- 42. Bahrain

**BAND 3**

**Hotspot**

Malaysia has fallen to 28th position (from 25th position) in Band 3 (as predicted) - others are moving at a faster pace.

New players moved from Band 4 to Band 3.

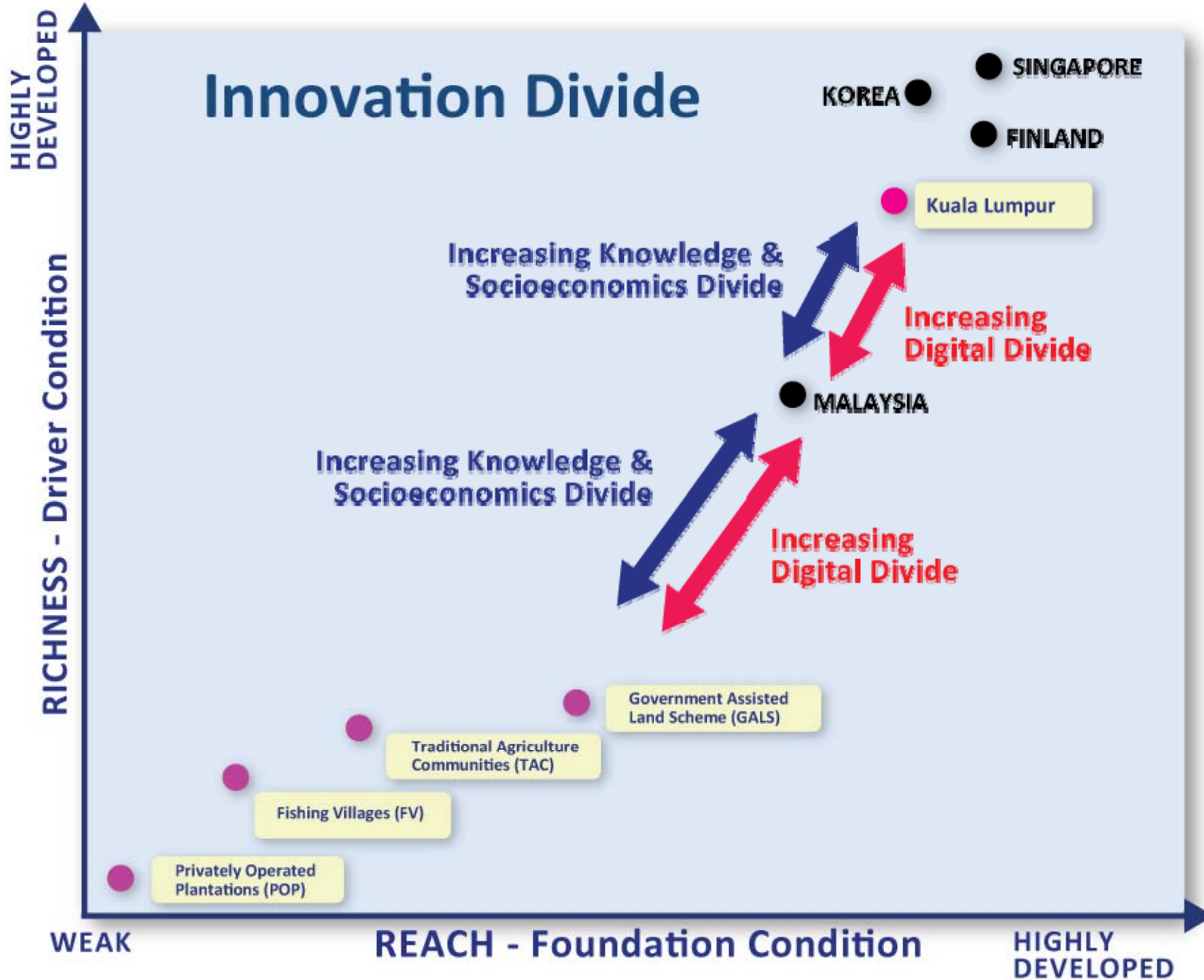
## 2009 - 2010

- 24. Australia
- 25. UAE
- 26. New Zealand
- 27. Czech Rep
- 28. Malaysia
- 29. Cyprus
- 30. Puerto-Rico
- 31. Slovenia
- 32. Spain
- 33. Saudi Arabia
- 34. South Africa
- 35. Brazil
- 36. Chile
- 37. China
- 38. India
- 39. Costa Rica
- 40. Sri Lanka
- 41. Indonesia

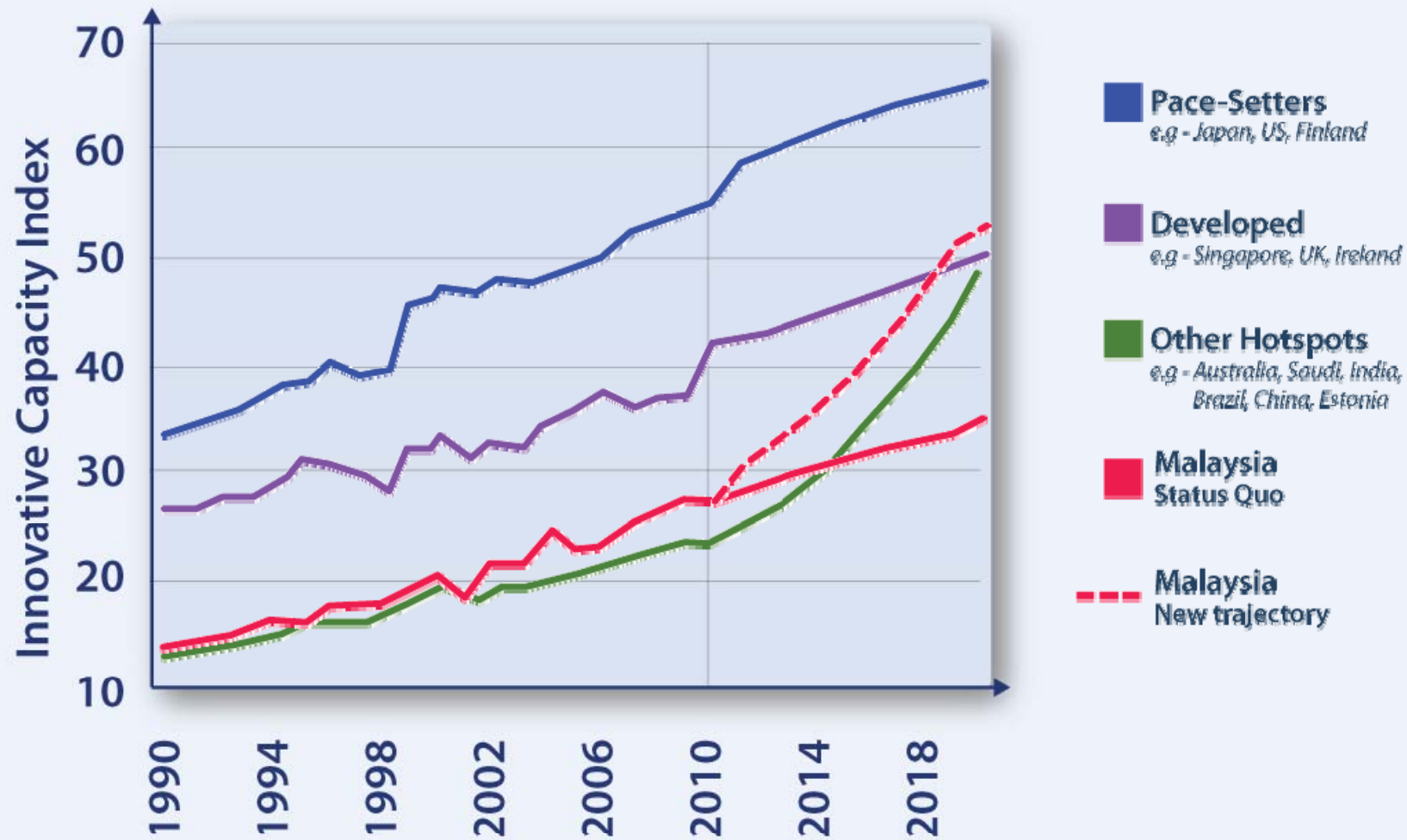
**BAND 3**

**Hotspot**

# Innovation Divide



# Innovative Capacity

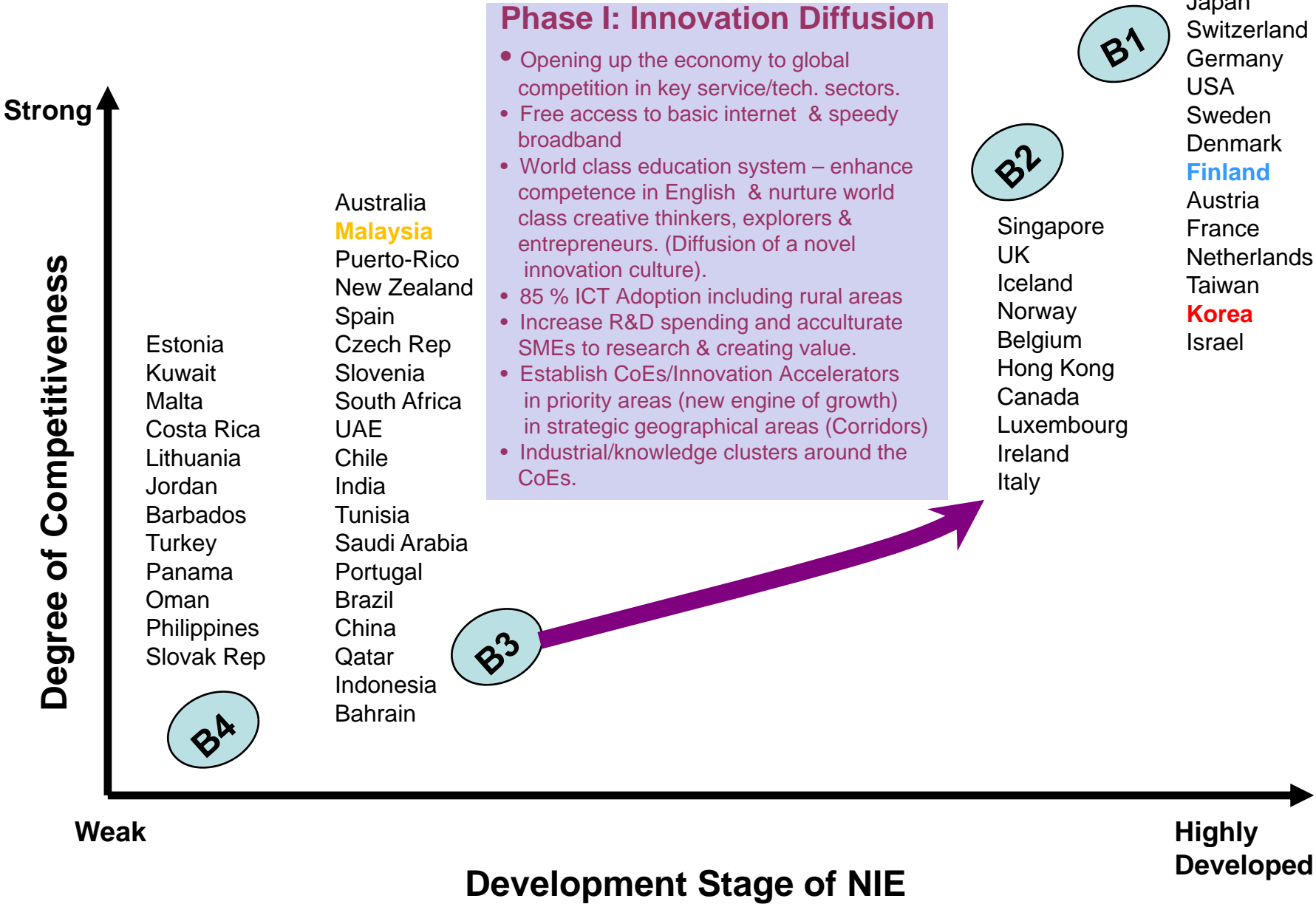


# Can Malaysia leapfrog to a new Innovation Trajectory?

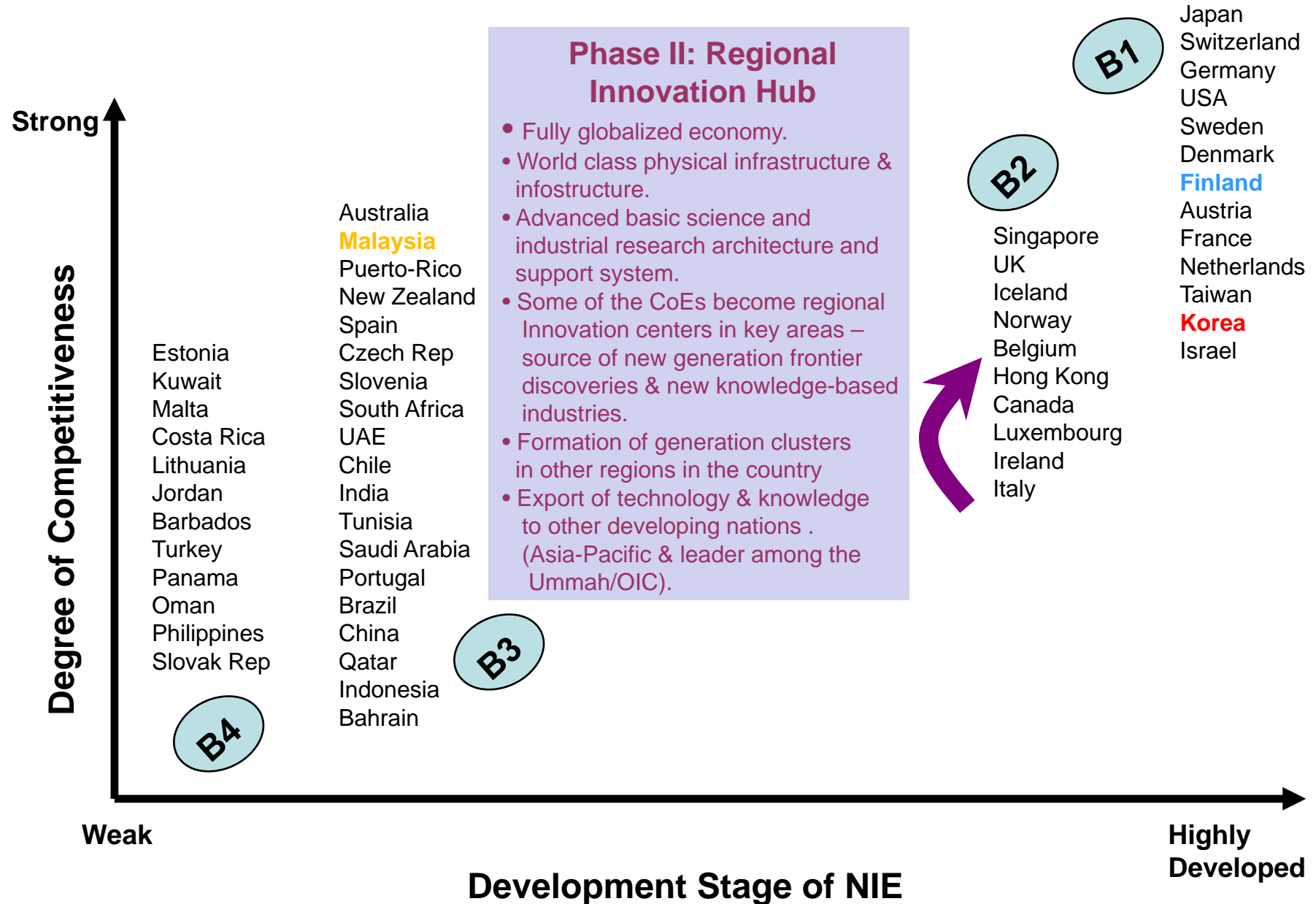




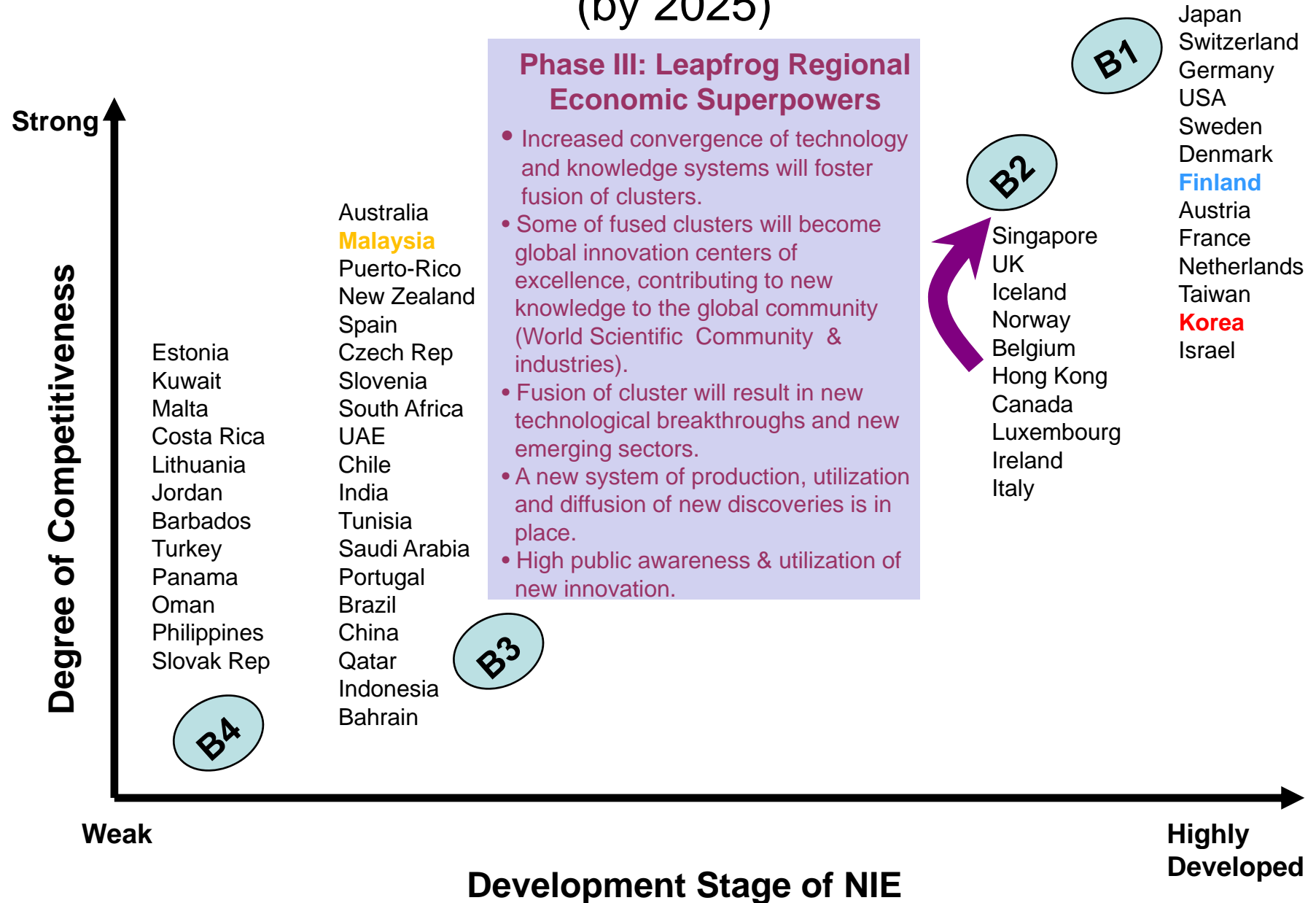
# Trajectory 1- Innovation Diffusion (2010-2015)



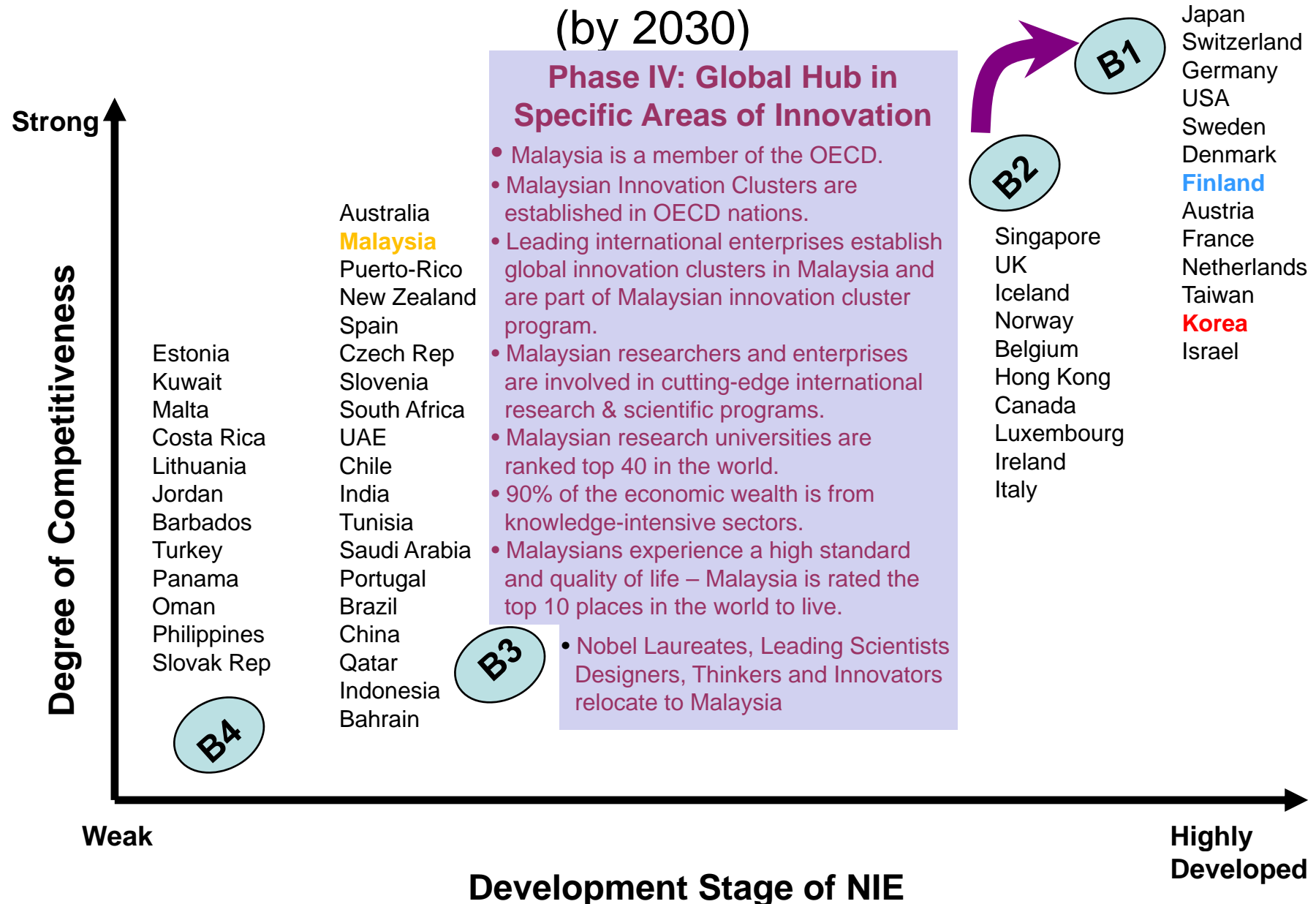
# Trajectory 2- Regional Innovation Hub (by 2020)



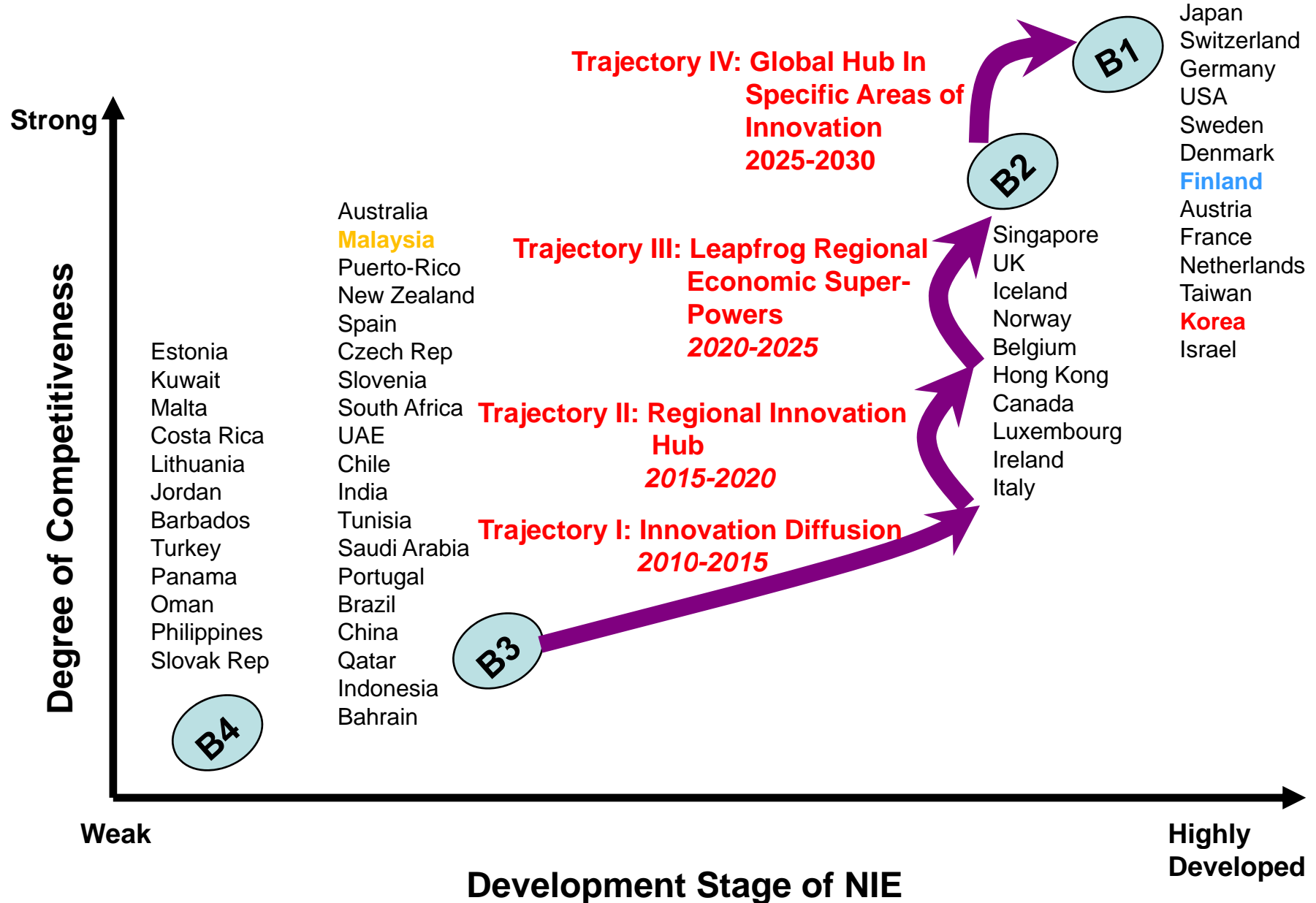
# Trajectory 3-Leapfrog regional economic super powers (by 2025)



# Trajectory 4- Global Leadership in key innovation areas (by 2030)



# Tracing the footprints to a Pace-Setter: A Staged Approach



# Summary from the Simulations

- Status Quo Trajectory (Average Per capita GDP Growth Rates)
  - 1990 to 2000: 5.0%
  - 2001 to 2010: 2.7%
  - 2011 to 2020: 2.2%

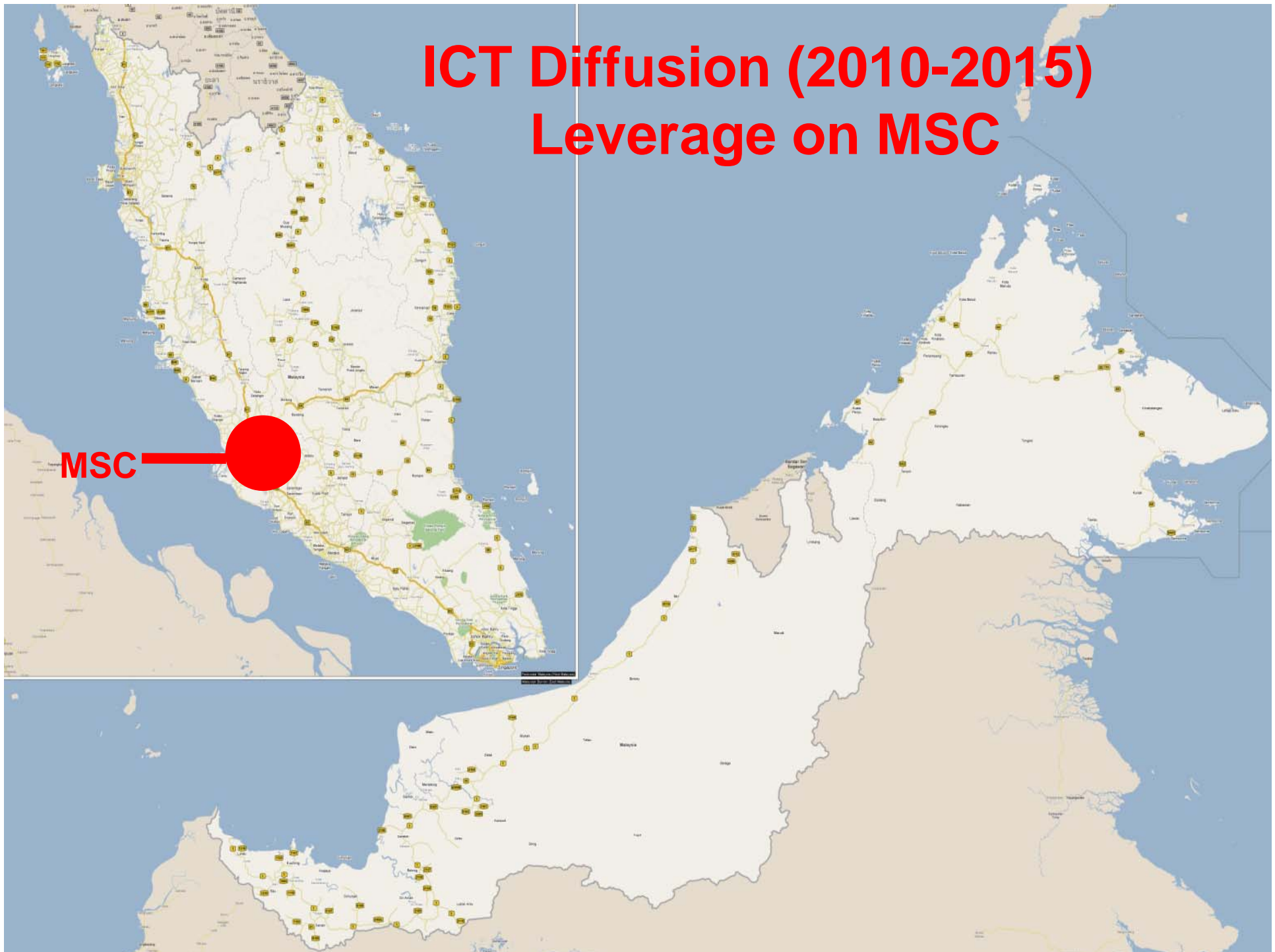
} Decreasing Returns to Scale  
} Decreasing Returns to Scale
- New (Innovation) Trajectory (Average Per capita GDP Growth Rates)
  - 1990 to 2000: 5.0%
  - 2001 to 2010: 2.7%
  - 2011 to 2020: 6.5%

} Decreasing Returns to Scale  
} Increasing Returns to Scale

*Ongoing research work on linking National Innovation Ecosystem & Quality Of Life and Economics of Happiness in Malaysia & other countries*

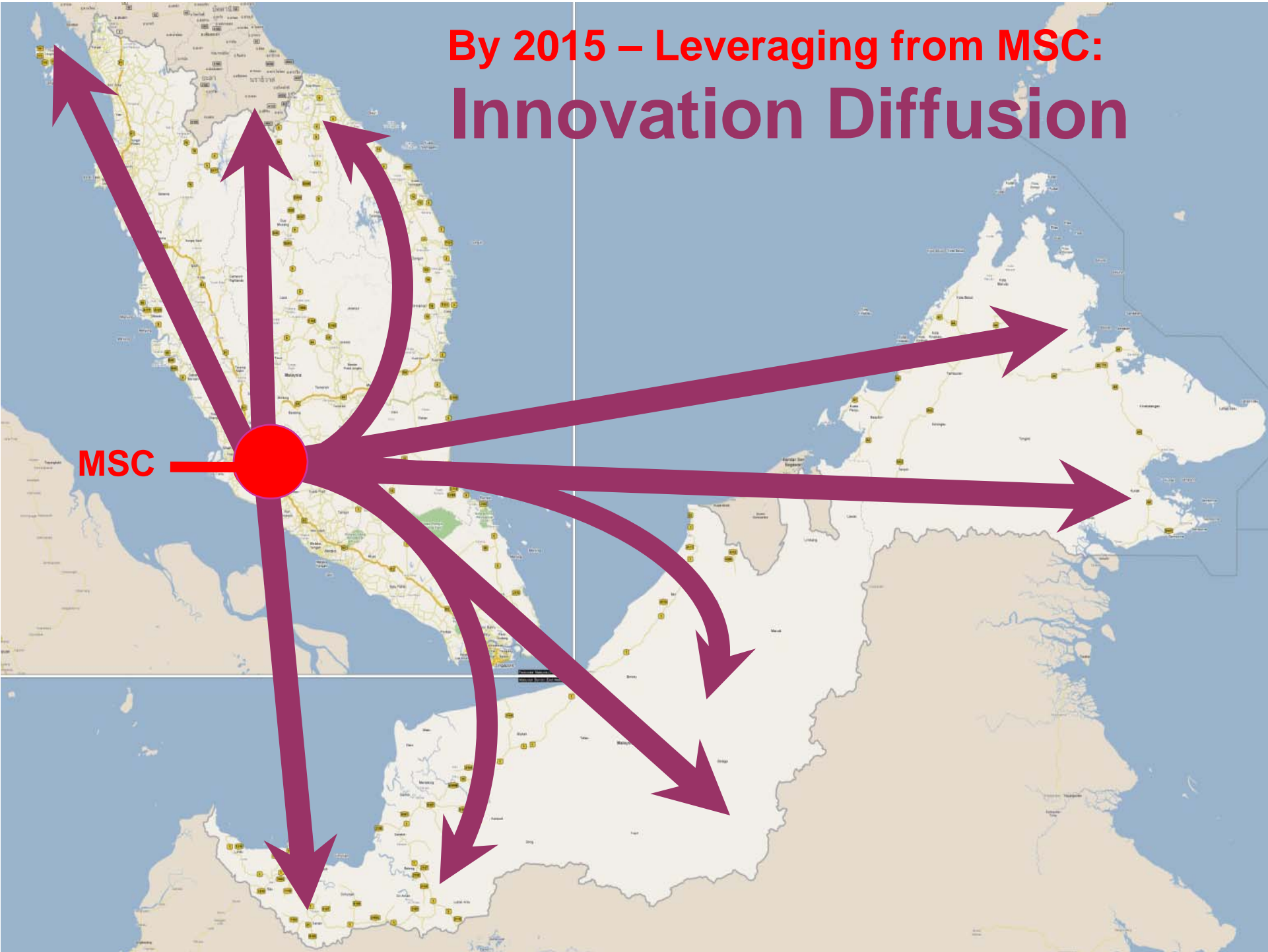
# Innovation Multiplier-Effect: A Staged Plan

# ICT Diffusion (2010-2015) Leverage on MSC

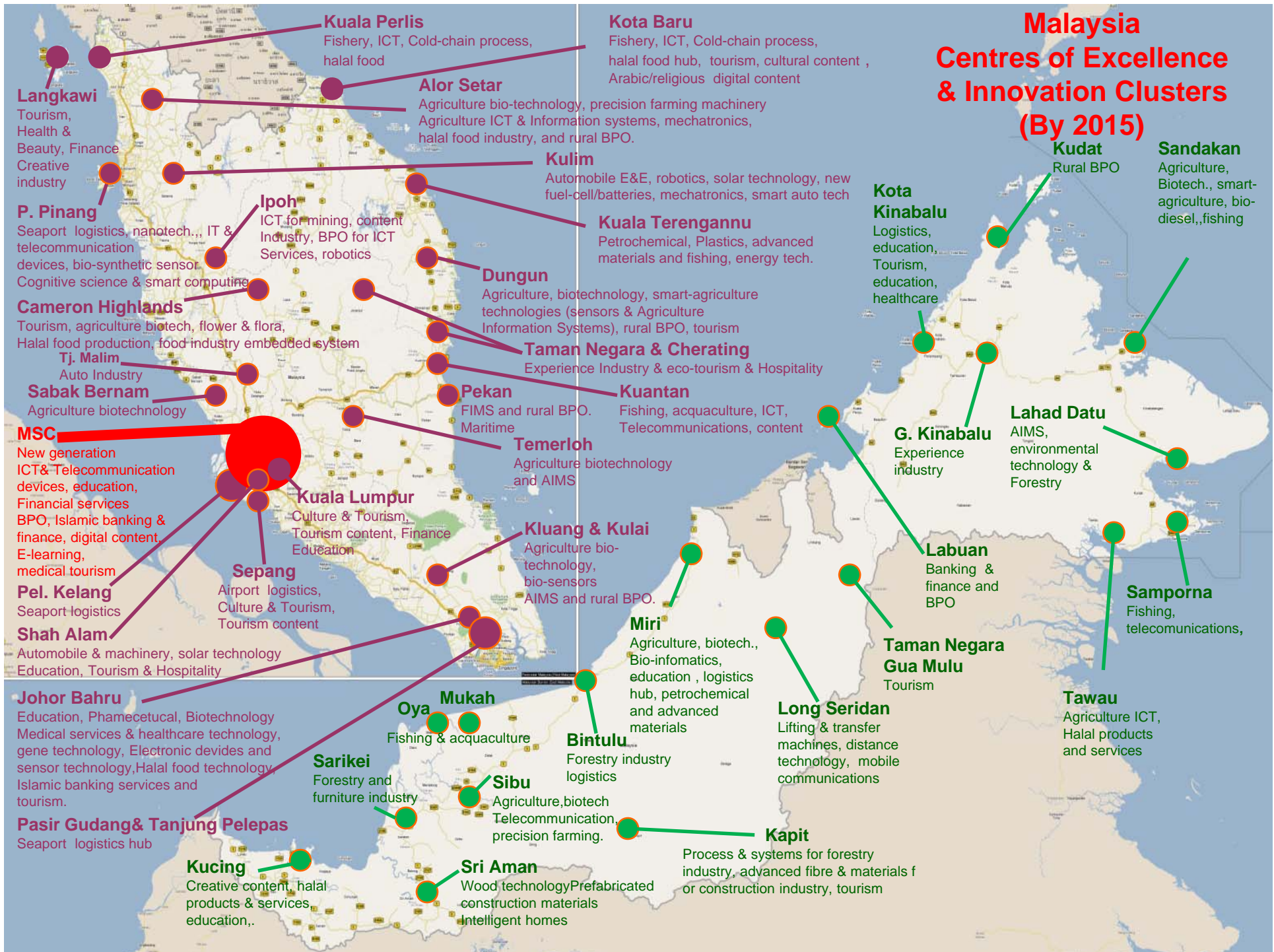


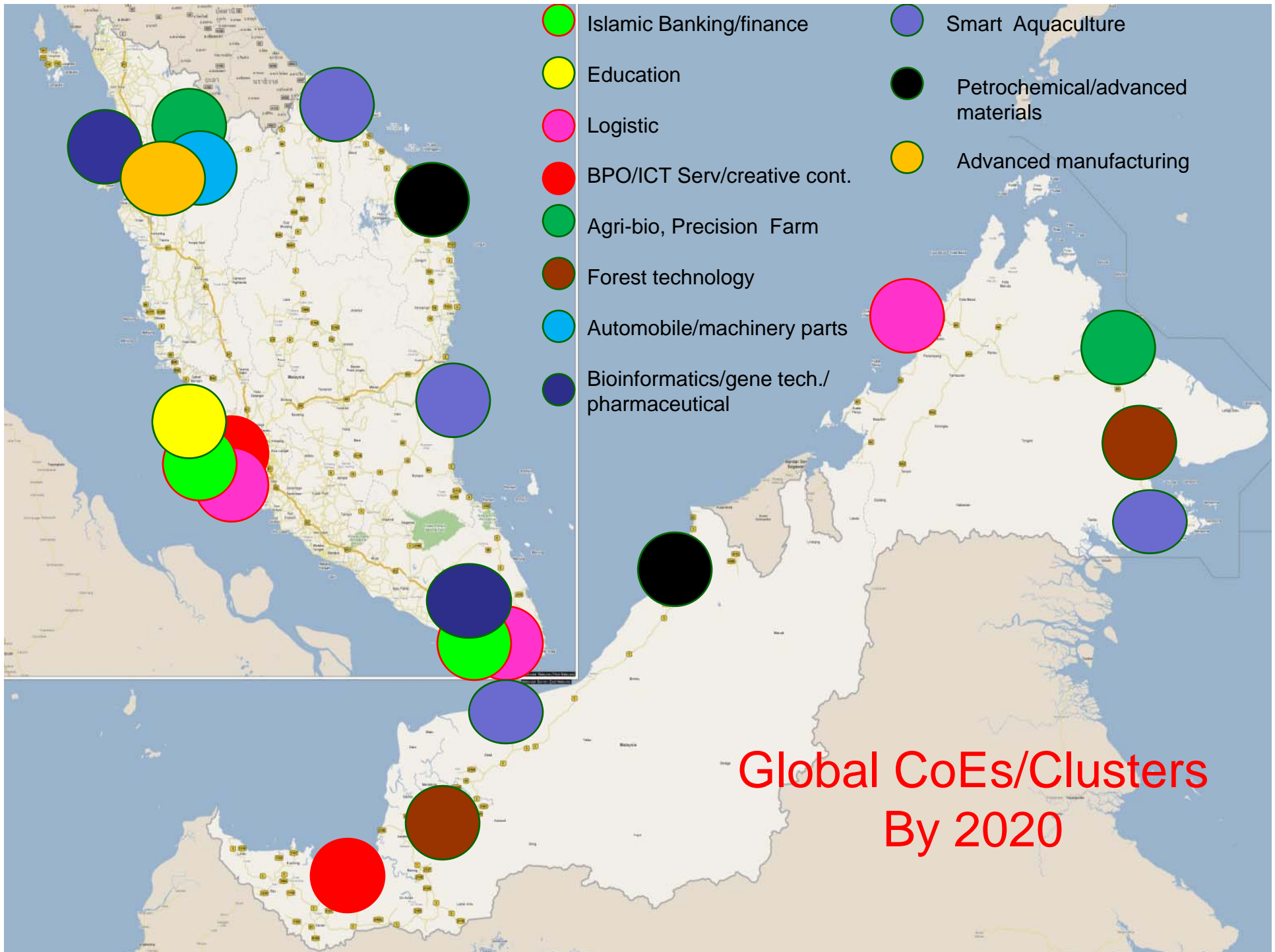


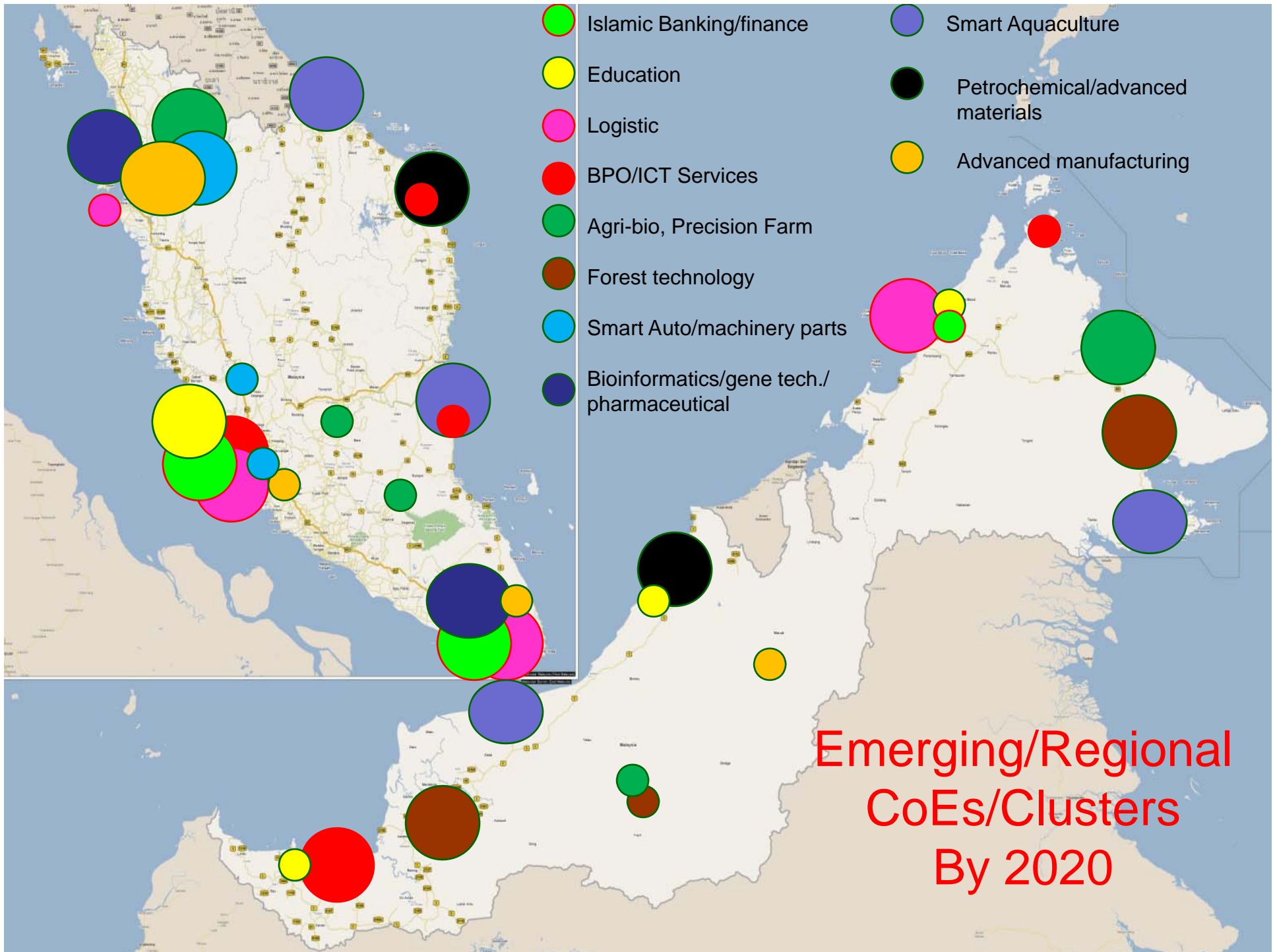
**By 2015 – Leveraging from MSC:  
Innovation Diffusion**

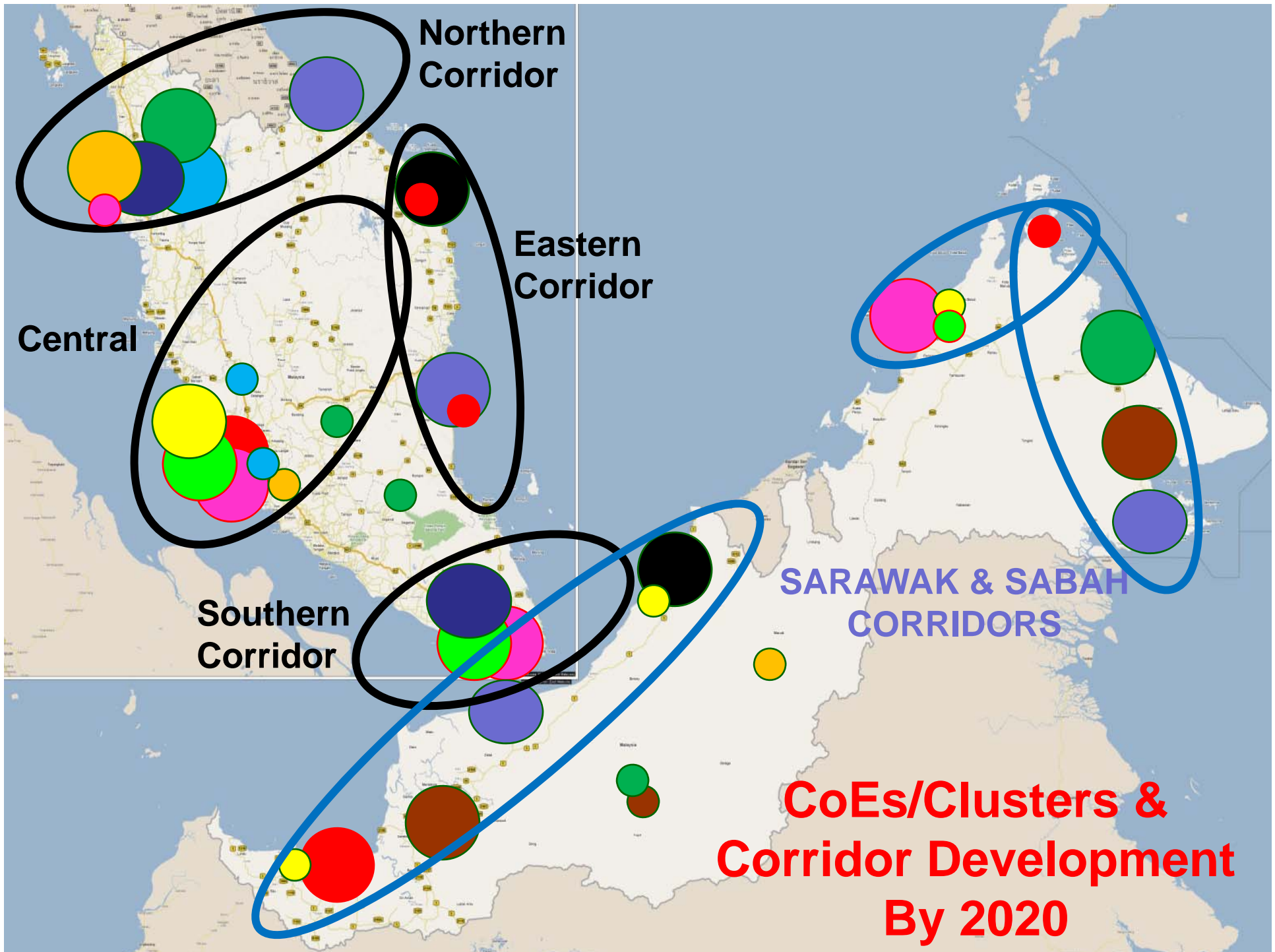


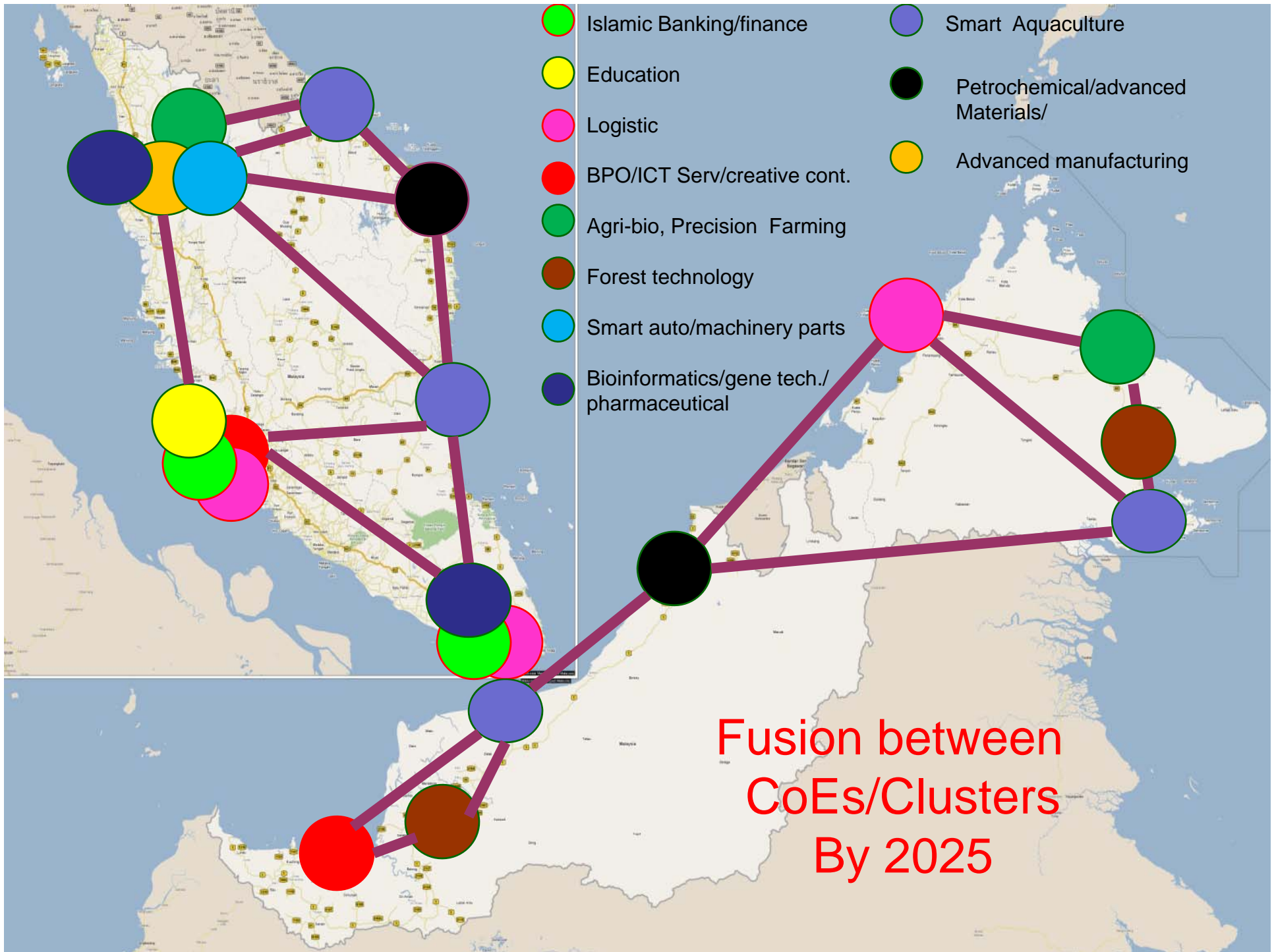
# Malaysia Centres of Excellence & Innovation Clusters (By 2015)

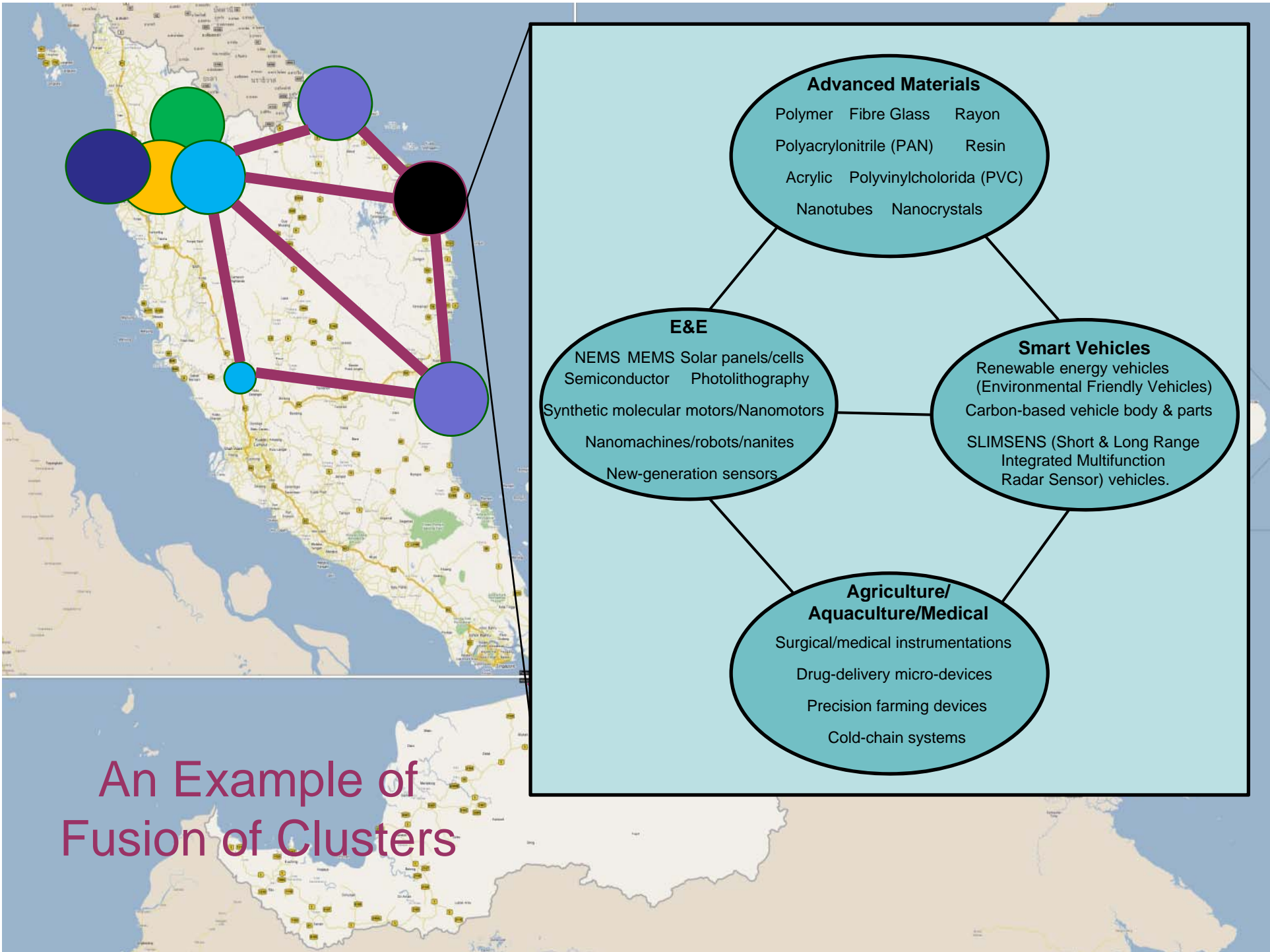




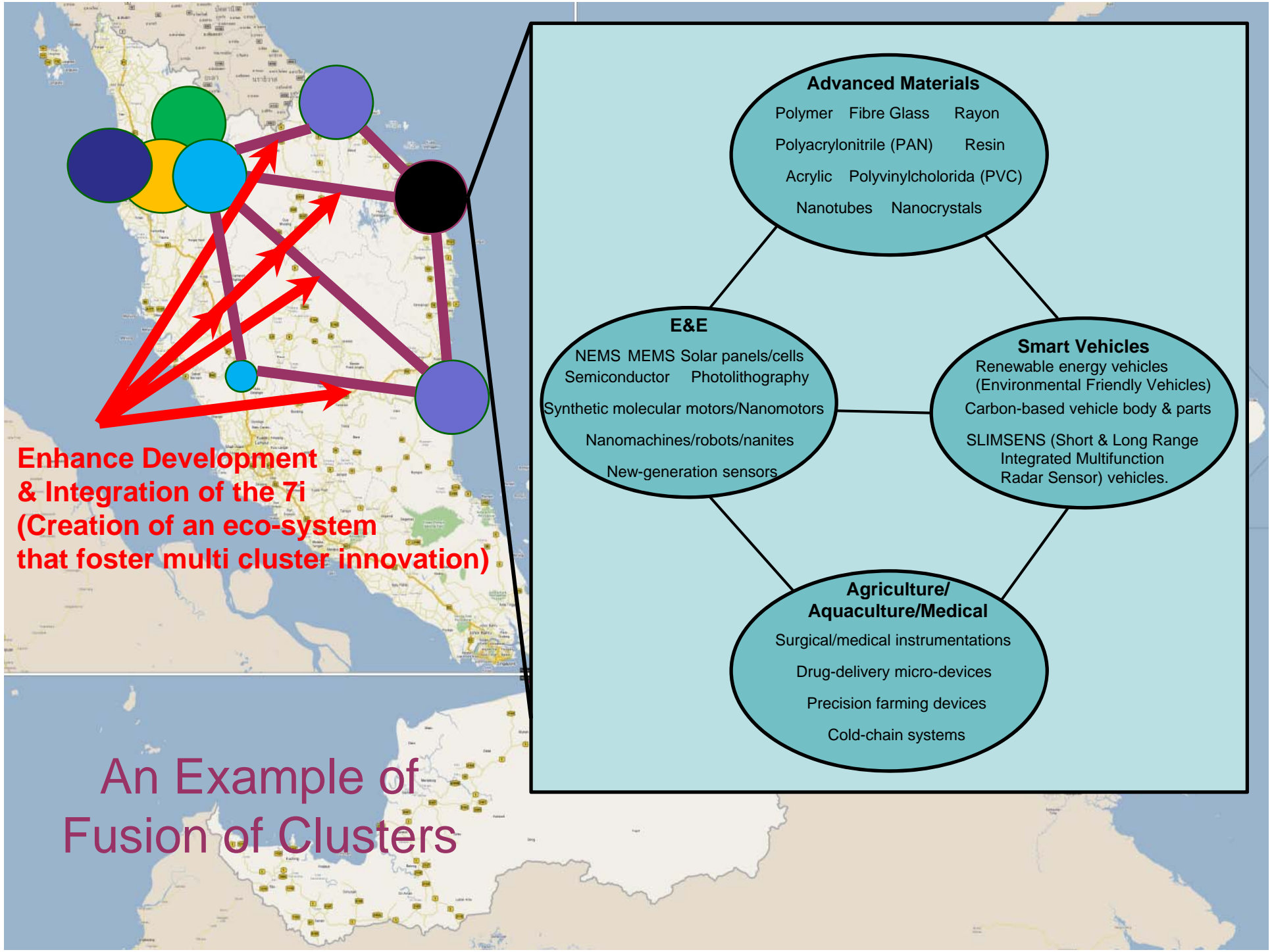








An Example of  
Fusion of Clusters



**Enhance Development & Integration of the 7i (Creation of an eco-system that foster multi cluster innovation)**

**An Example of Fusion of Clusters**

**Advanced Materials**  
Polymer Fibre Glass Rayon  
Polyacrylonitrile (PAN) Resin  
Acrylic Polyvinylchlorida (PVC)  
Nanotubes Nanocrystals

**E&E**  
NEMS MEMS Solar panels/cells  
Semiconductor Photolithography  
Synthetic molecular motors/Nanomotors  
Nanomachines/robots/nanites  
New-generation sensors

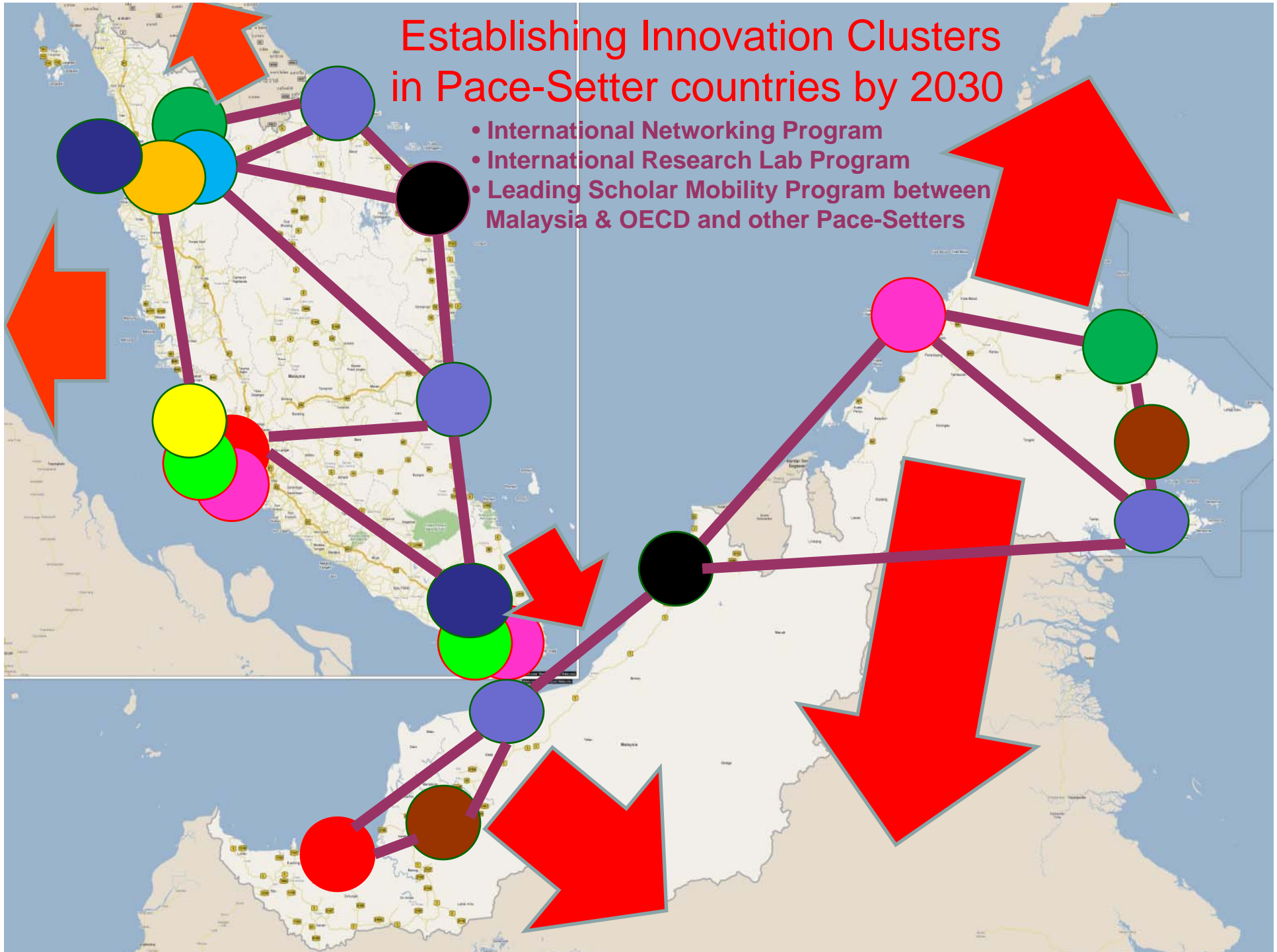
**Smart Vehicles**  
Renewable energy vehicles (Environmental Friendly Vehicles)  
Carbon-based vehicle body & parts  
SLIMSENS (Short & Long Range Integrated Multifunction Radar Sensor) vehicles.

**Agriculture/ Aquaculture/Medical**  
Surgical/medical instrumentations  
Drug-delivery micro-devices  
Precision farming devices  
Cold-chain systems



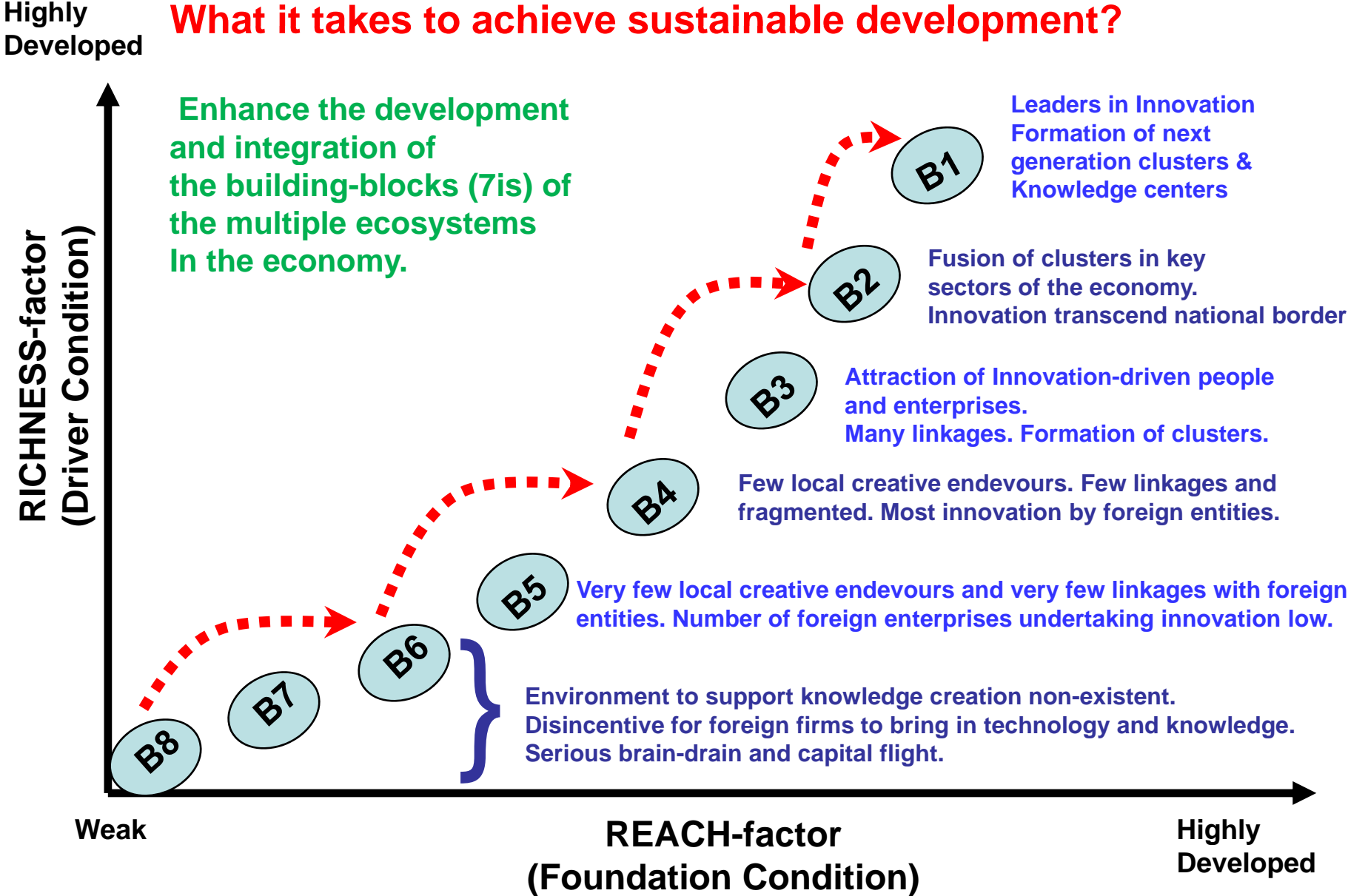
# Establishing Innovation Clusters in Pace-Setter countries by 2030

- International Networking Program
- International Research Lab Program
- Leading Scholar Mobility Program between Malaysia & OECD and other Pace-Setters



# Summary

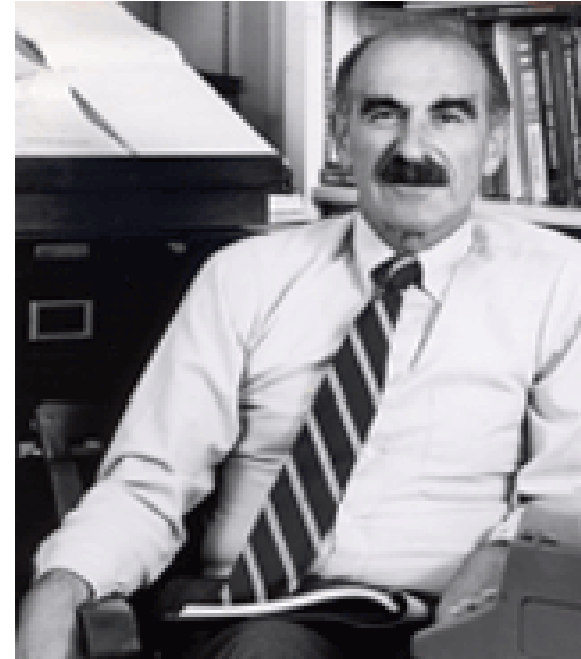
## What it takes to achieve sustainable development?



# Innovation Imprinted in our DNA

“Just as energy is the basis of life, and ideas source of *innovation*, so is innovation the vital spark of all human change, improvement and progress.”

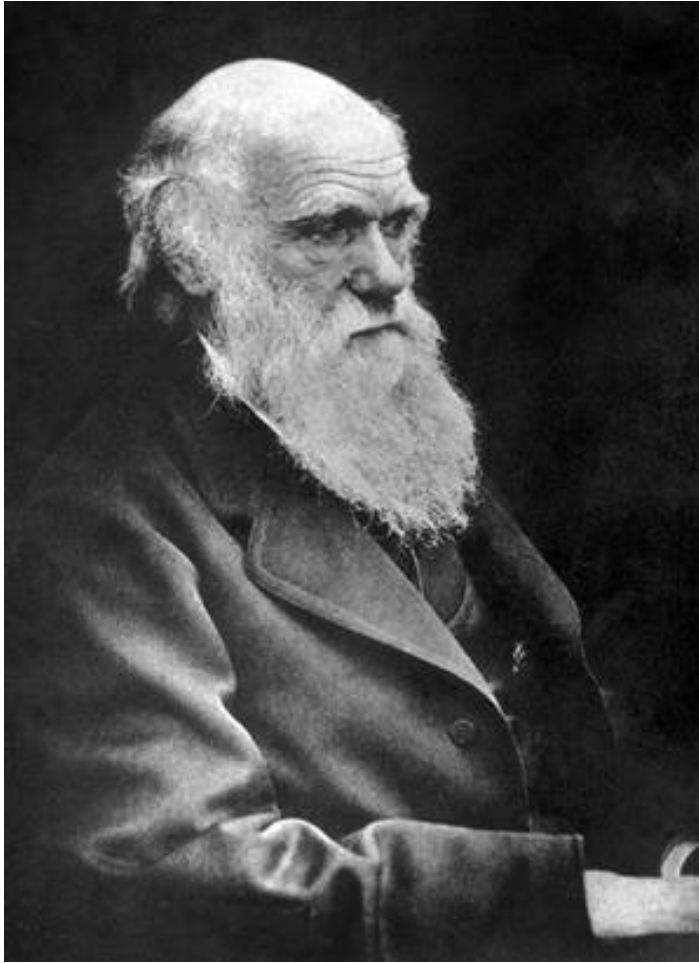
- Theodore Levitt



**Theodore Levitt**  
**1925–2006**

American Economist & the  
Harvard University Professor  
who coined the term 'Globalization'.

# Survival of the Fittest



“It is not the strongest of the species that survives, nor the most Intelligent that survives. It is the ones that is most adaptable to change”

- Charles Darwin

# 'True' Development

“Whenever you are in doubt ... Apply the first test. Recall the face of the poorest and the weakest man whom you have seen, and ask if the step you contemplate is going to be any use to him.

Will he gain anything from it?  
Will it restore him to a control over his own life and destiny?

**True development puts those first that society puts last”**

**- Mahatma Gandhi**



Thank You