Financing Cross-Border Joint R&D

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Contents

1. Context (R&D spending)

2. Participation in International S&T Projects, Funding, Impact

3. Beyond Science
   - Technology Life Cycles
   - Globalization, GVCs

Main Message

The discussion on international joint STI collaboration outdated.

- Incomplete data
- Deficient “situational awareness”

R&D Spending Trends

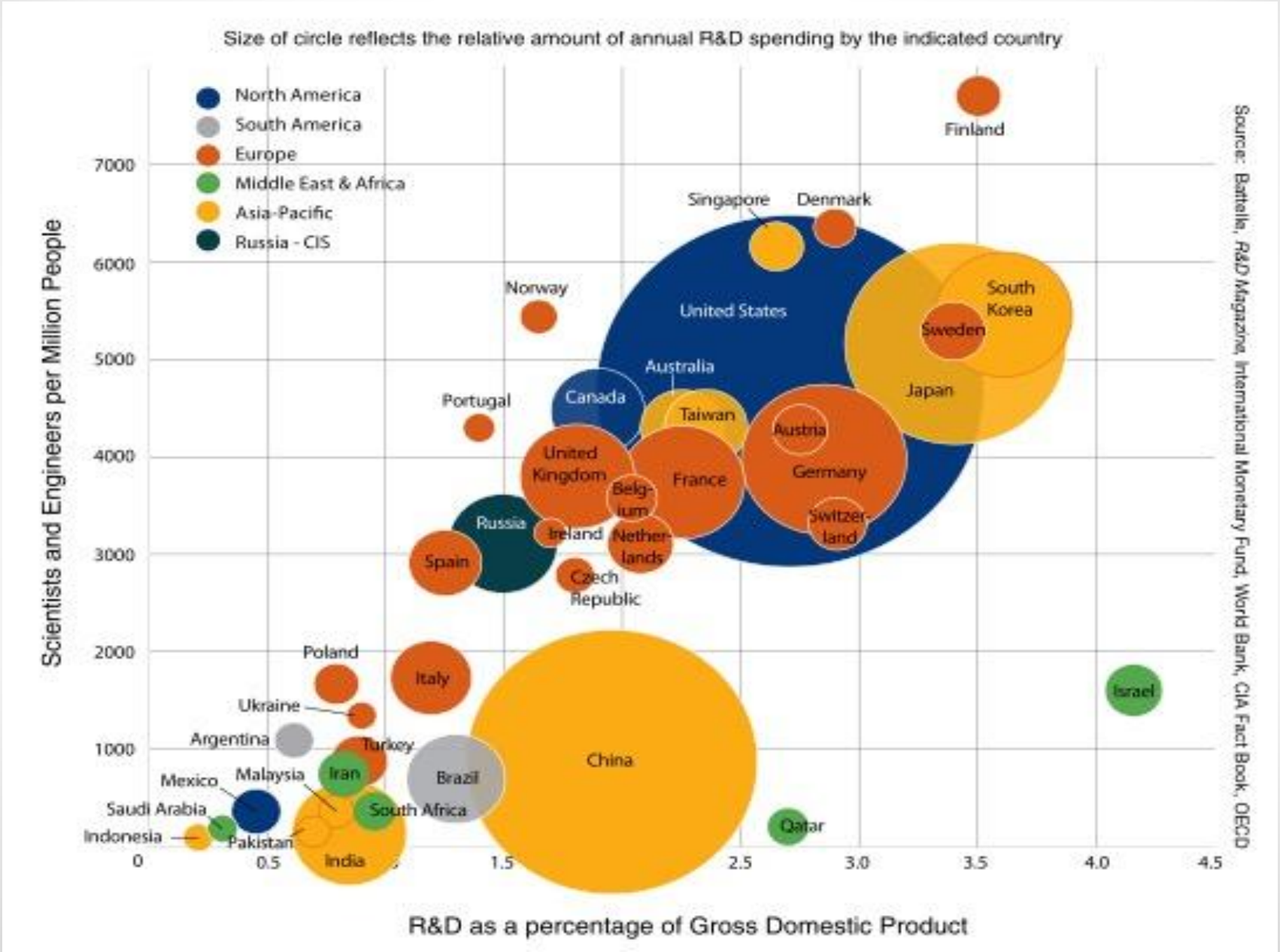
- The ranking of the top ten countries as measured by R&D spending did not change in 2014, with the U.S. retaining its role as the dominant force in global research across numerous industries and China closing the gap rapidly.

- The growth in China's R&D budgets far outpaces those of the U.S. At the current rates of growth and investment, China's total funding of R&D is expected to surpass that of the U.S. by about 2022. [???]

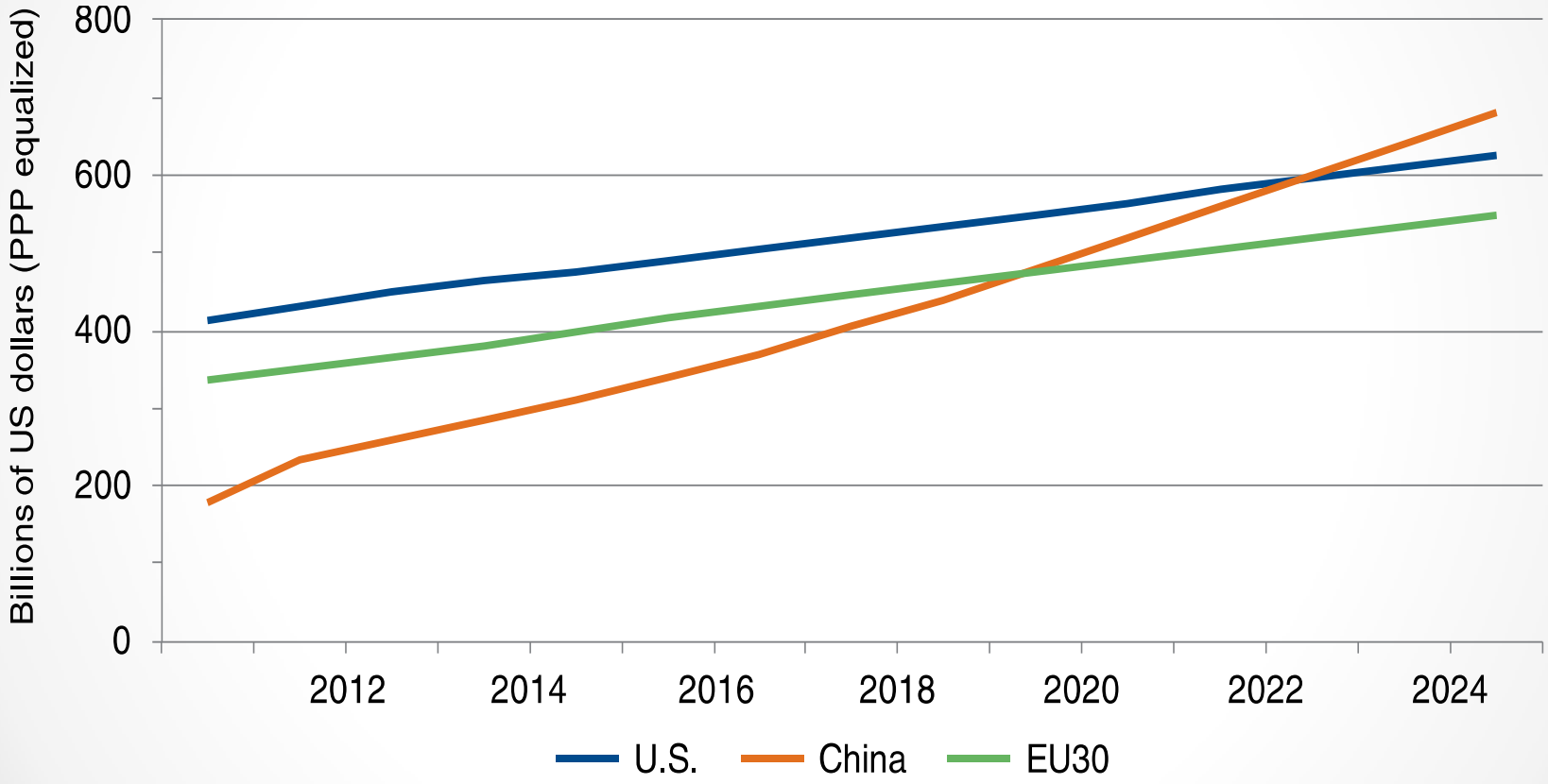
- In 2014, ten countries spent about 4/5 of the total $1.6 trillion global investment in R&D. The combined investments by the top three – U.S., China, Japan – accounted for more than half of the total.

- Together, the U.S., China, Japan and European Union accounted for more than ¾ of the global investment in R&D.

R&D Effort


Size of circle reflects the relative amount of annual R&D spending by the indicated country
North America
South America
Europe
Middle East & Africa
Asia-Pacific
Russia - CIS
Scientists and Engineers per Million People
R&D as a percentage of Gross Domestic Product
Source: Battelle, R&D Magazine, International Monetary Fund, World Bank, CIA Fact Book, OECD
Finland
Singapore
Denmark
Norway
United States
South Korea
Sweden
Australia
Japan
Portugal
Canada
Taiwan
Austria
United Kingdom
France
Germany
Belg-ium
Switzer-land
Russia
Ireland
Nether-lands
Spain
Czech Republic
Poland
Italy
Israel
Ukraine
Argentina
Turkey
China
Mexico
Malaysia
Iran
Brazil
Saudi Arabia
South Africa
Qatar
Indonesia
Pakistan
India
0
0.5
1.5
2.5
3.0
3.5
4.0
4.5
1000
2000
3000
4000
5000
6000
7000

Evolution R&D Spending



Data Challenge

- Besides EU publications about the Framework Programmes, the data on cross-border STI projects very unsystematic and scarce.

- Two output indicators – bibliometrics (joint cross-border publications) and patents (cross-border co-inventions) – are the only bright spots.

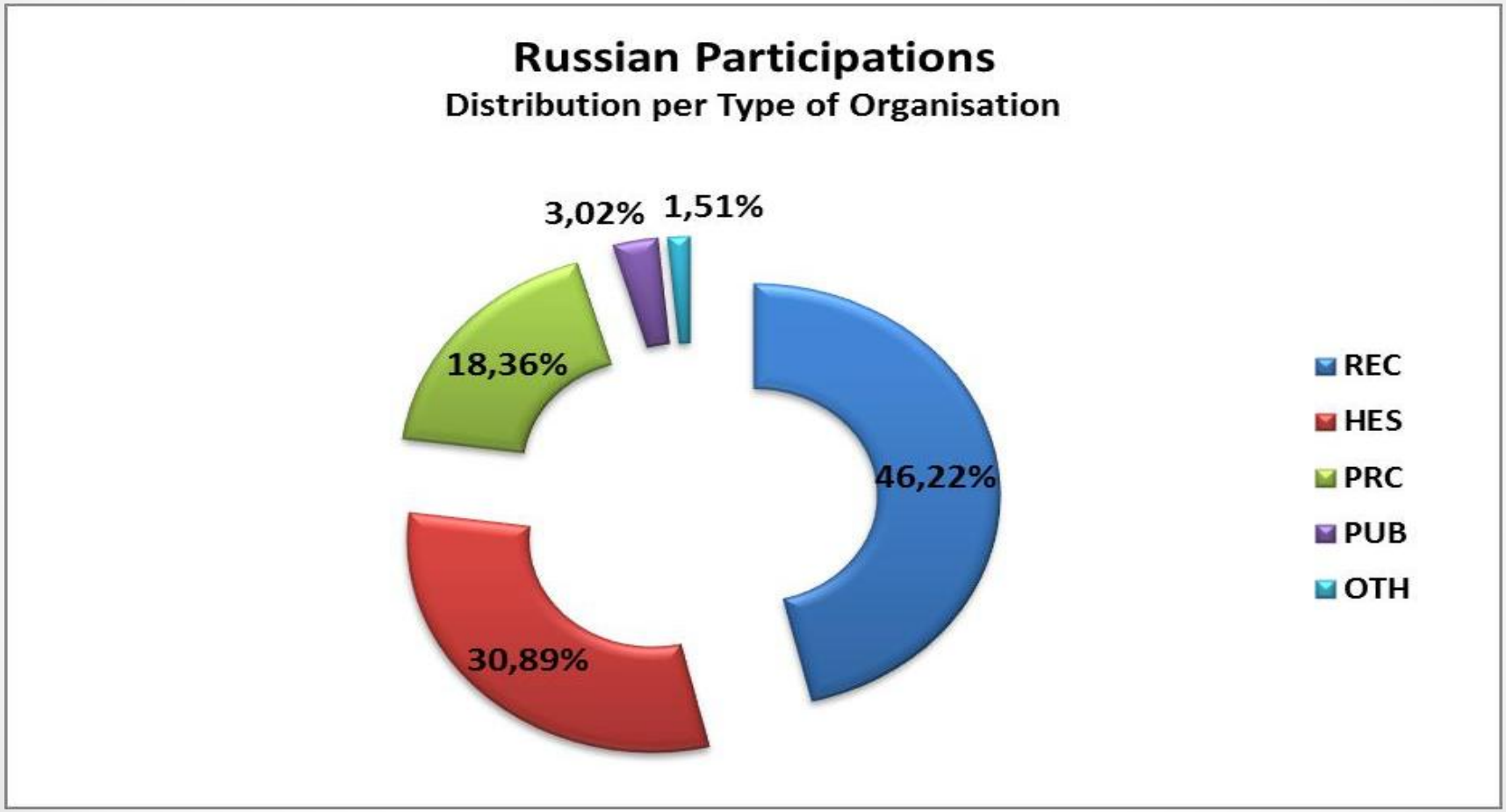
- However, they tell a very partial story. They may also be biasing attention towards what "is measured" rather than on what "should be measured". Too much attention on science (Universities, PROs).

Collaboration Patterns

Collaboration Patterns Among Companies and Institutions							
		Collaboration Partner					
		Academia	Research Institute	Govern-ment	Domestic Corporation	Multinat-ional Corp.	None
U.S.	Academia	91%	40%	42%	23%	25%	4%
	Domestic Corp.	56%	26%	32%	44%	36%	6%
	Multinational Corp.	71%	31%	33%	35%	56%	13%
	Government	87%	53%	67%	53%	33%	0%
	Research Institute	96%	61%	48%	30%	26%	0%
	U.S. Total	**86%**	**39%**	**41%**	**28%**	**30%**	**5%**
Non-U.S.	Academia	87%	55%	21%	32%	30%	3%
	Domestic Corp.	67%	48%	38%	52%	38%	0%
	Multinational Corp.	73%	47%	19%	29%	56%	10%
	Government	77%	55%	55%	32%	14%	9%
	Research Institute	74%	60%	25%	32%	30%	6%
	Non-U.S. total	**80%**	**55%**	**25%**	**32%**	**33%**	**5%**
All Respondents total		**82%**	**46%**	**32%**	**30%**	**32%**	**5%**

Battelle, 2014

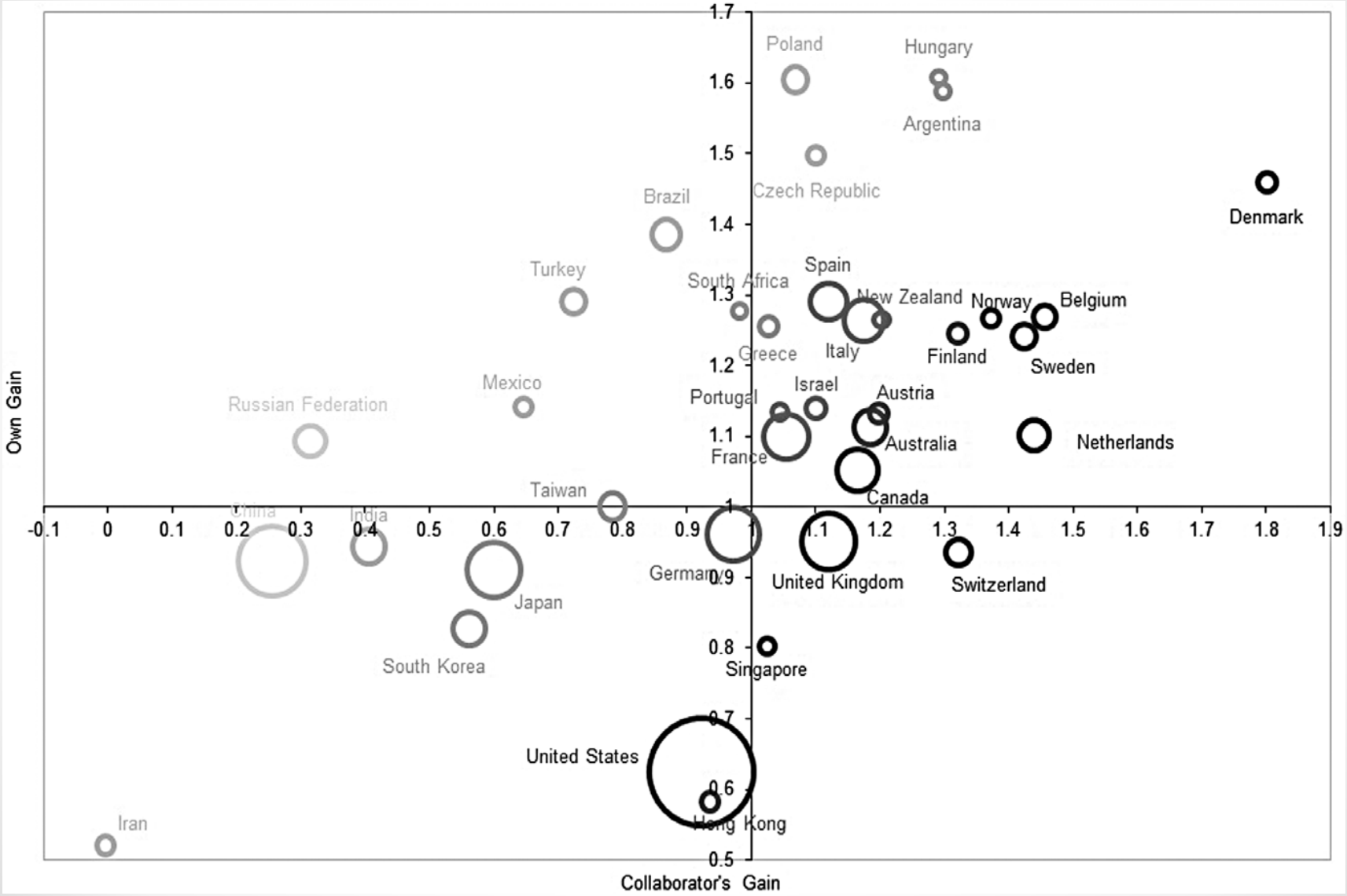
FP7 Participation of Russian Organizations



*REC – Research organisations; HES- Higher or secondary education; PRC - Private for profit (excluding education); PUB -Public body (excluding research and education); OTH – other

EU Commission, 2013

Benefits from Science Collaboration

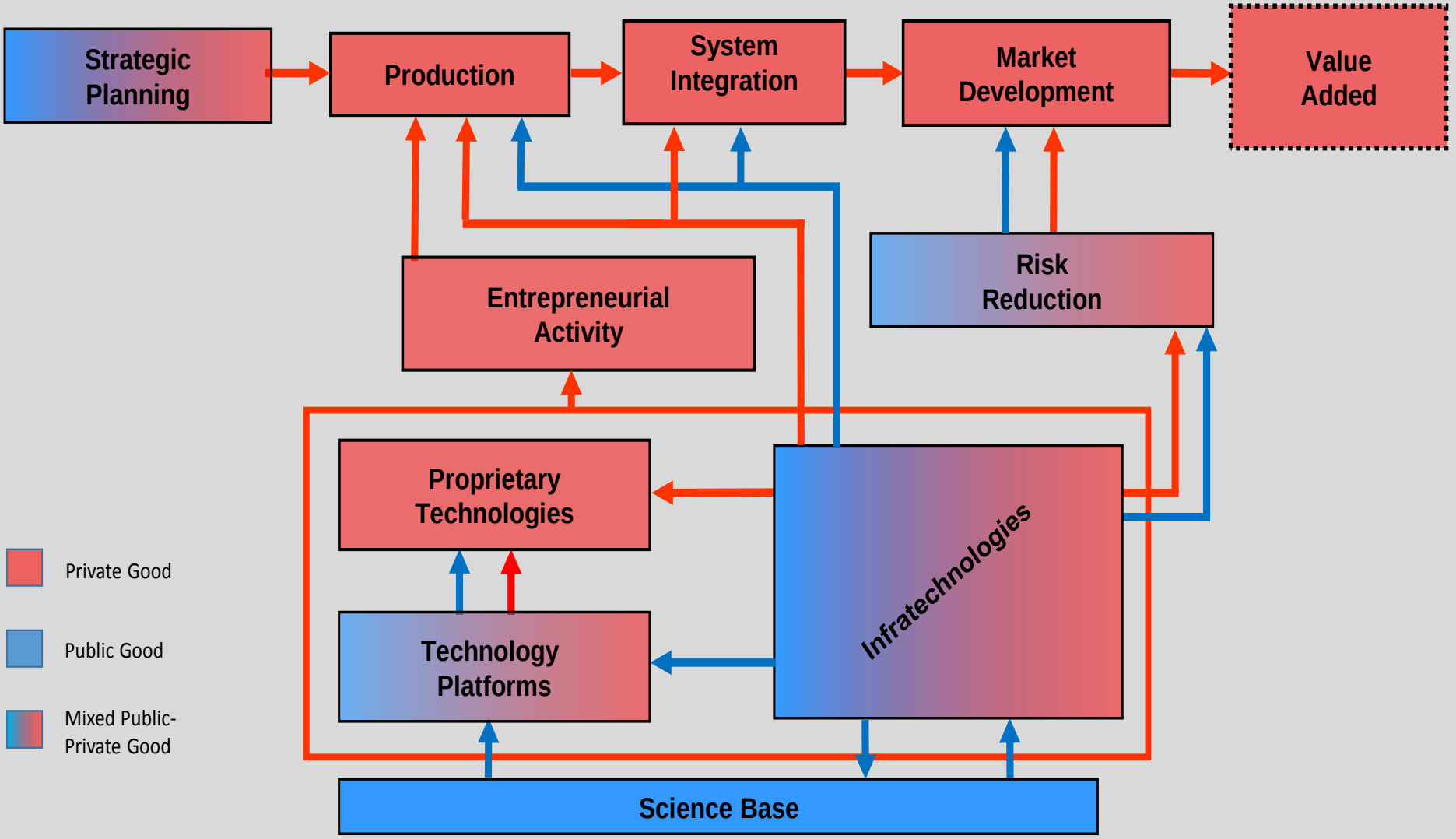


Bote et al., 2012

Beyond Science:

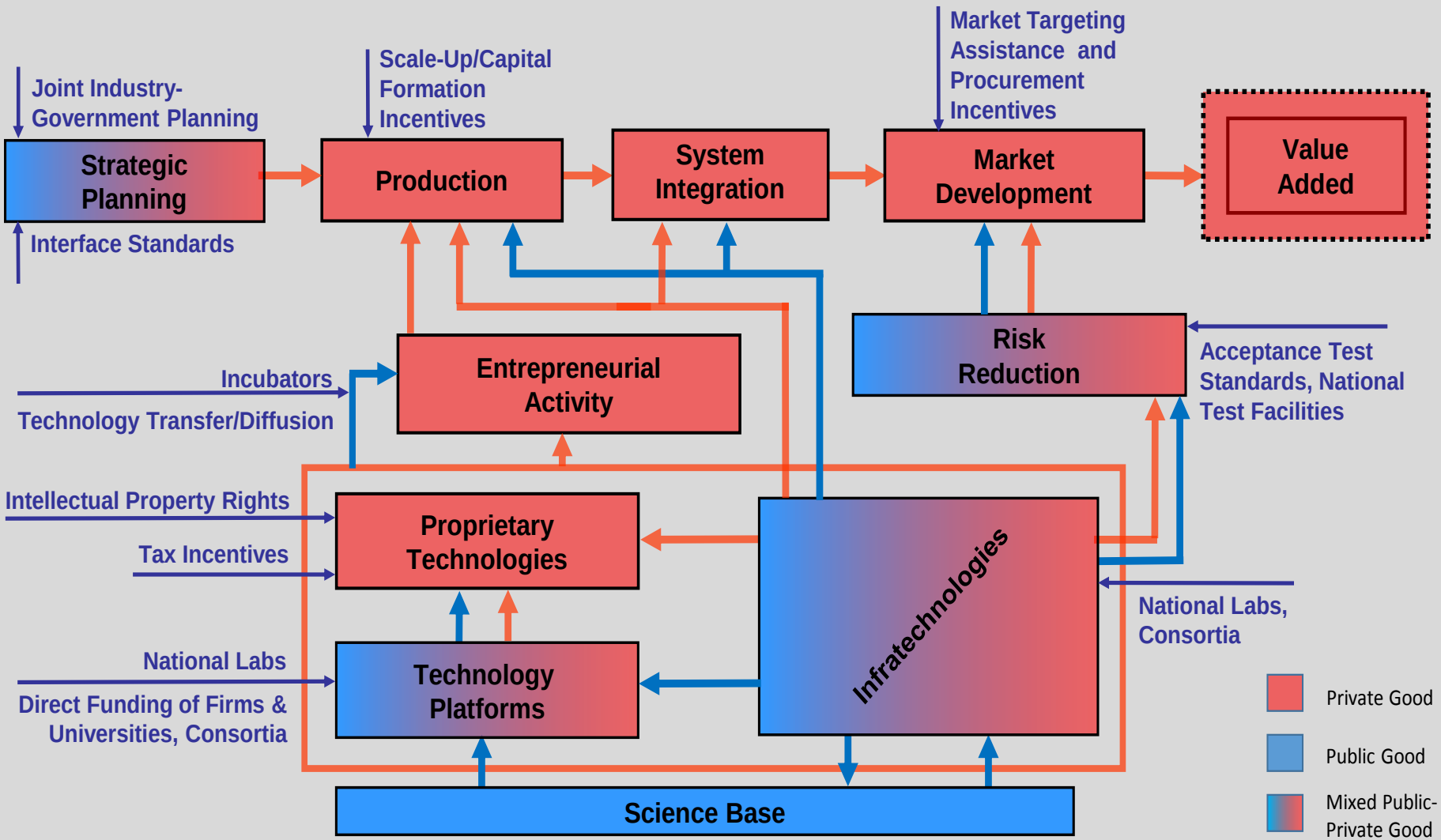
I. Technology Life Cycles

Elements of the Modern Industrial Technology



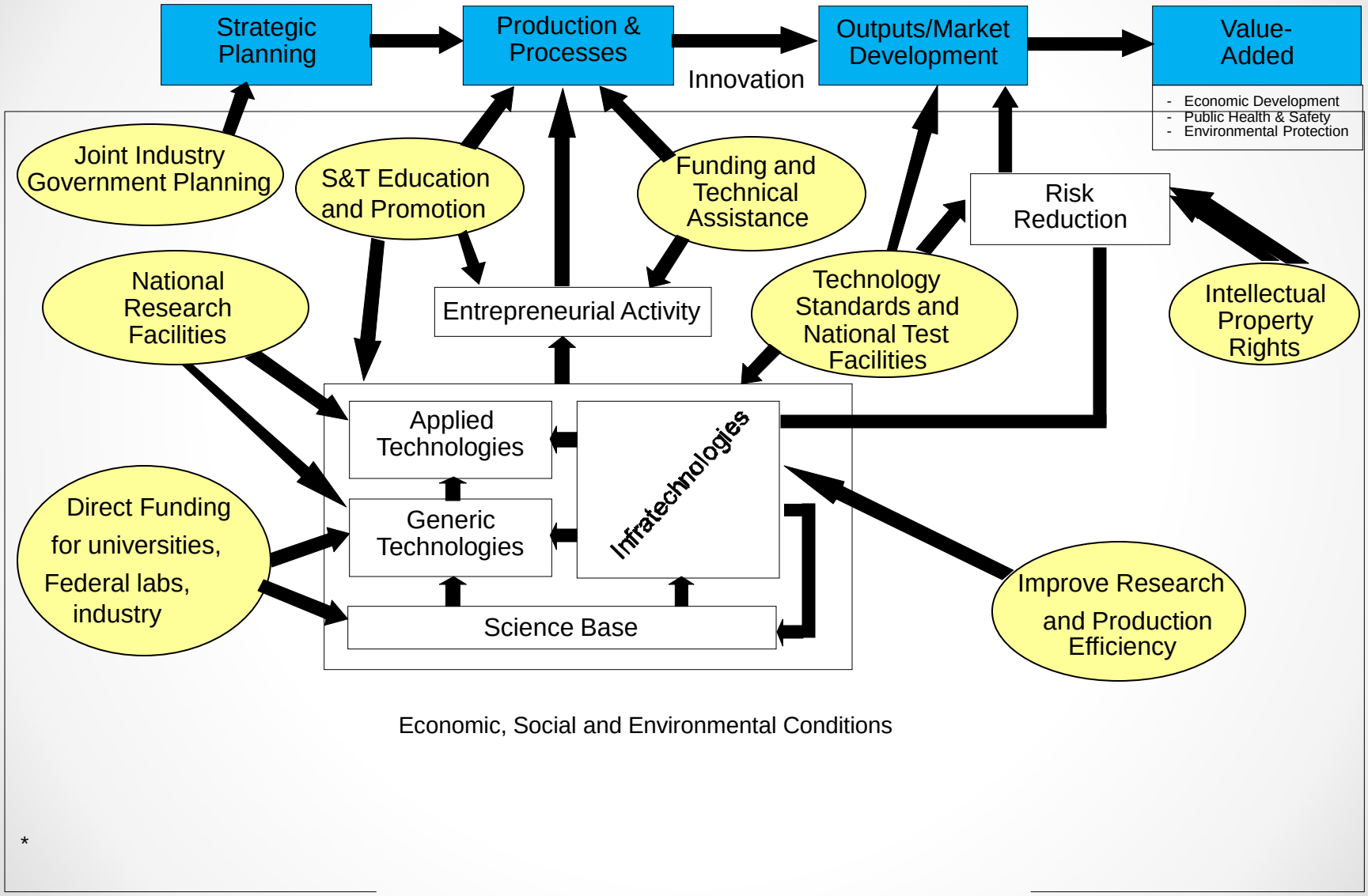
- Greg Tassey, presentation NASA, 30/3/2015

Managing the Entire Technology Life Cycle: Policy Roles in Response to Market Failures



Greg Tassey, presentation NASA, 30/3/2015

Policy Interventions in the Innovation System



G. Jordan, 2007 (Derived from G. Tassey, NIST, 1991)

Beyond Science:

II. Globalization - GVCs

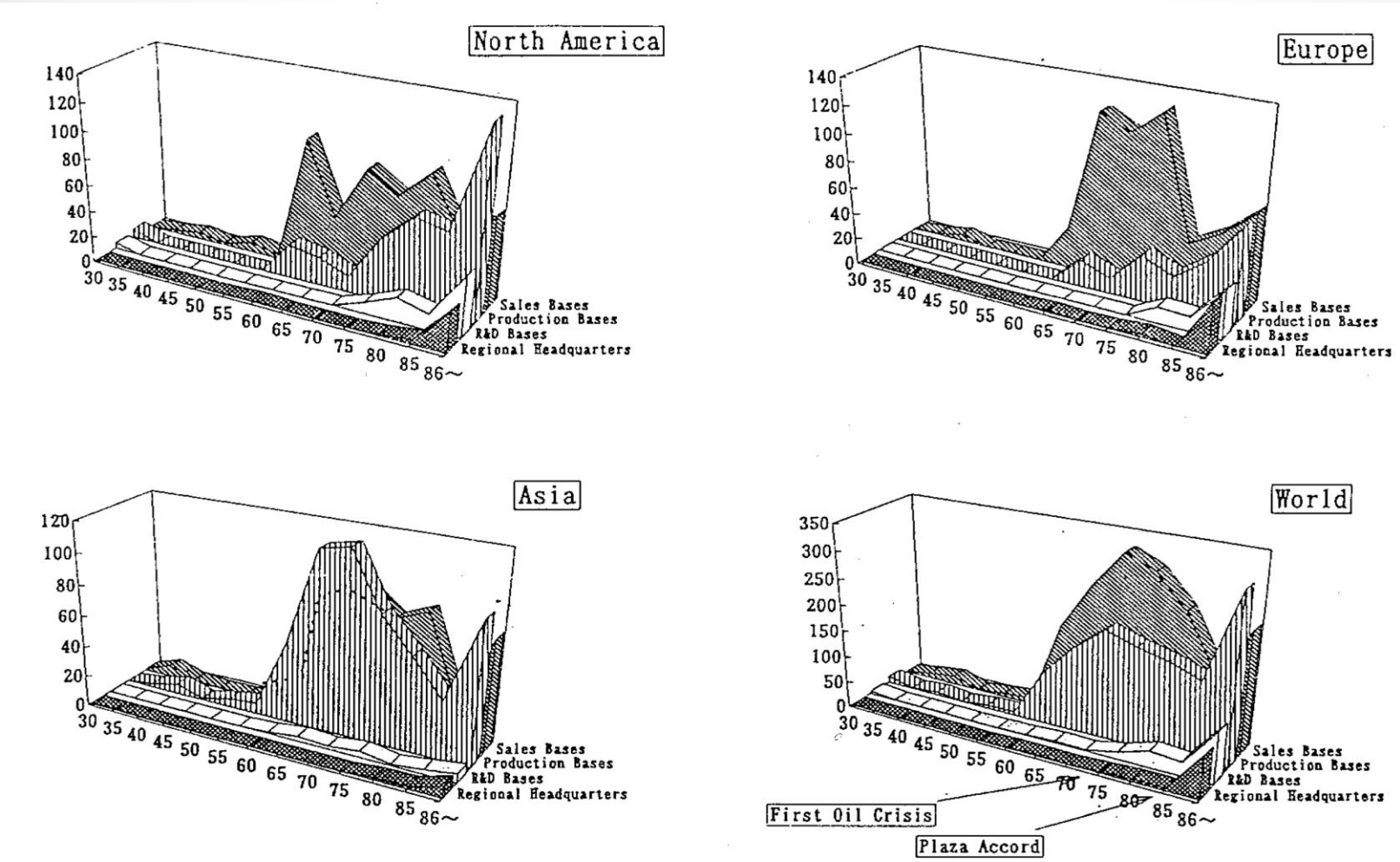
Globalization Unleashed

- Globalization of R&D has accelerated in the past decade through a combination of R&D funding growth in emerging economies, off-shoring and outsourcing of a portion of MNC R&D, improved communications, and the need for larger-scale, interdisciplinary collaboration on major scientific challenges.

- R&D capabilities follow markets for technology-enabled products.

EVs are a good illustration of a globally distributed long-term R&D effort with domains of coordinated collaboration, complemented by independent efforts that leverage loosely coupled global connectivity through publications, licensing, recruitment of experienced scientists and engineers and other forms of knowledge transfer.

Globalization of Japanese Companies



Compiled by AIST, Technology Research and Information Division based on "Study Report on the Advancement of Globalization and Industrial Technology" (Mitsubishi Research Institute) [1992].

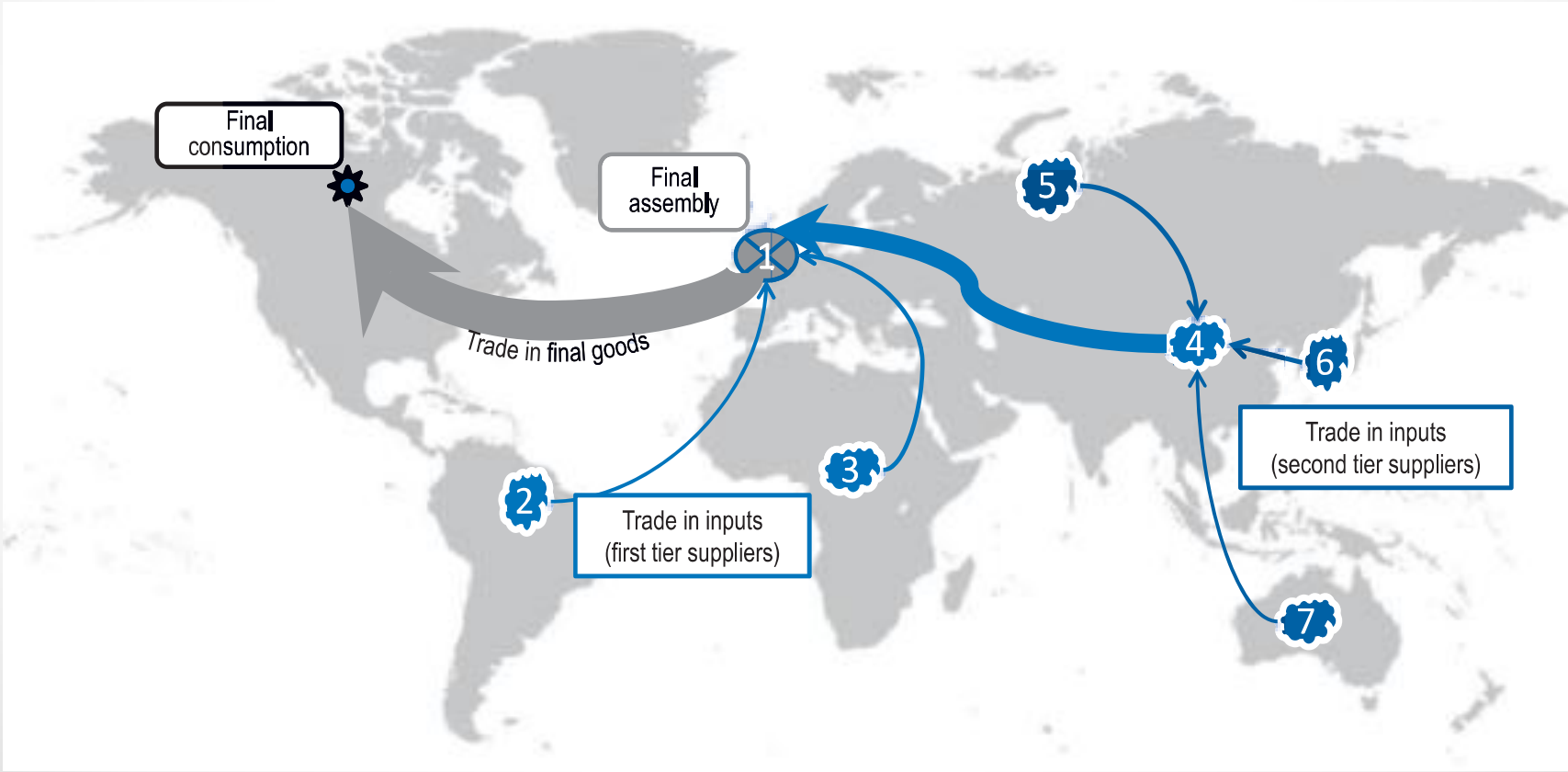
GVC

- A value chain includes the full range of firm activities such as design, production, marketing, distribution and consumer support. The activities in a value chain can be undertaken by a single company or be divided among several (supplier) firms. They cover goods as well as services and can be concentrated at one location or be spread out over different locations.

- The term Global Value Chain (GVC) captures the strong trend for dispersion of value chain activities across the world.

- Production, trade and investment increasingly take place as part of GVCs.

Simplified Representation of a GVC



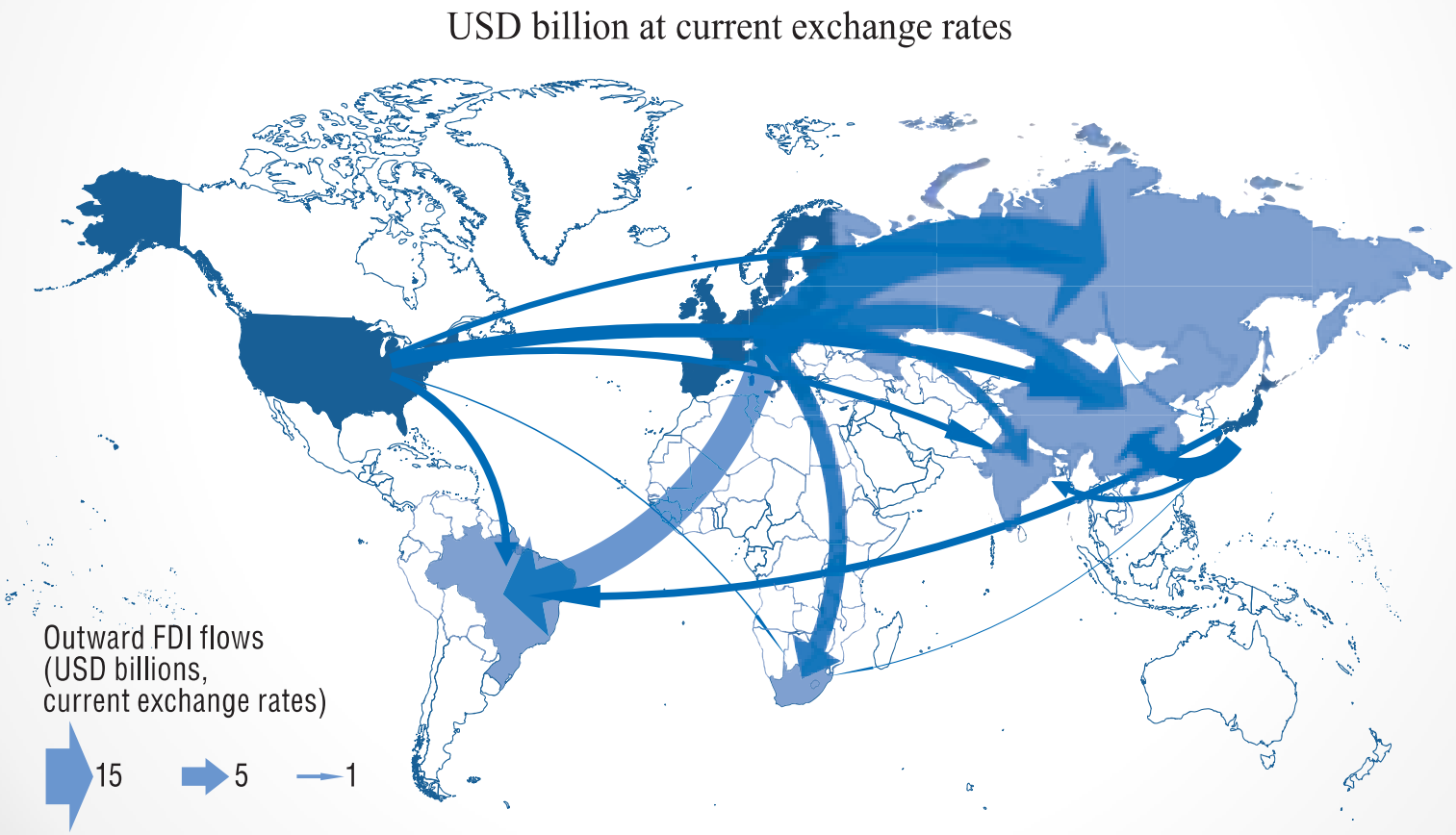
Rise of GVCs

- *GVCs have grown larger and more pervasive*. In recent years they have also been changing their nature in reflection to changes in the international investment landscape with emerging economies like countries such as China and India becoming major new outward investors.

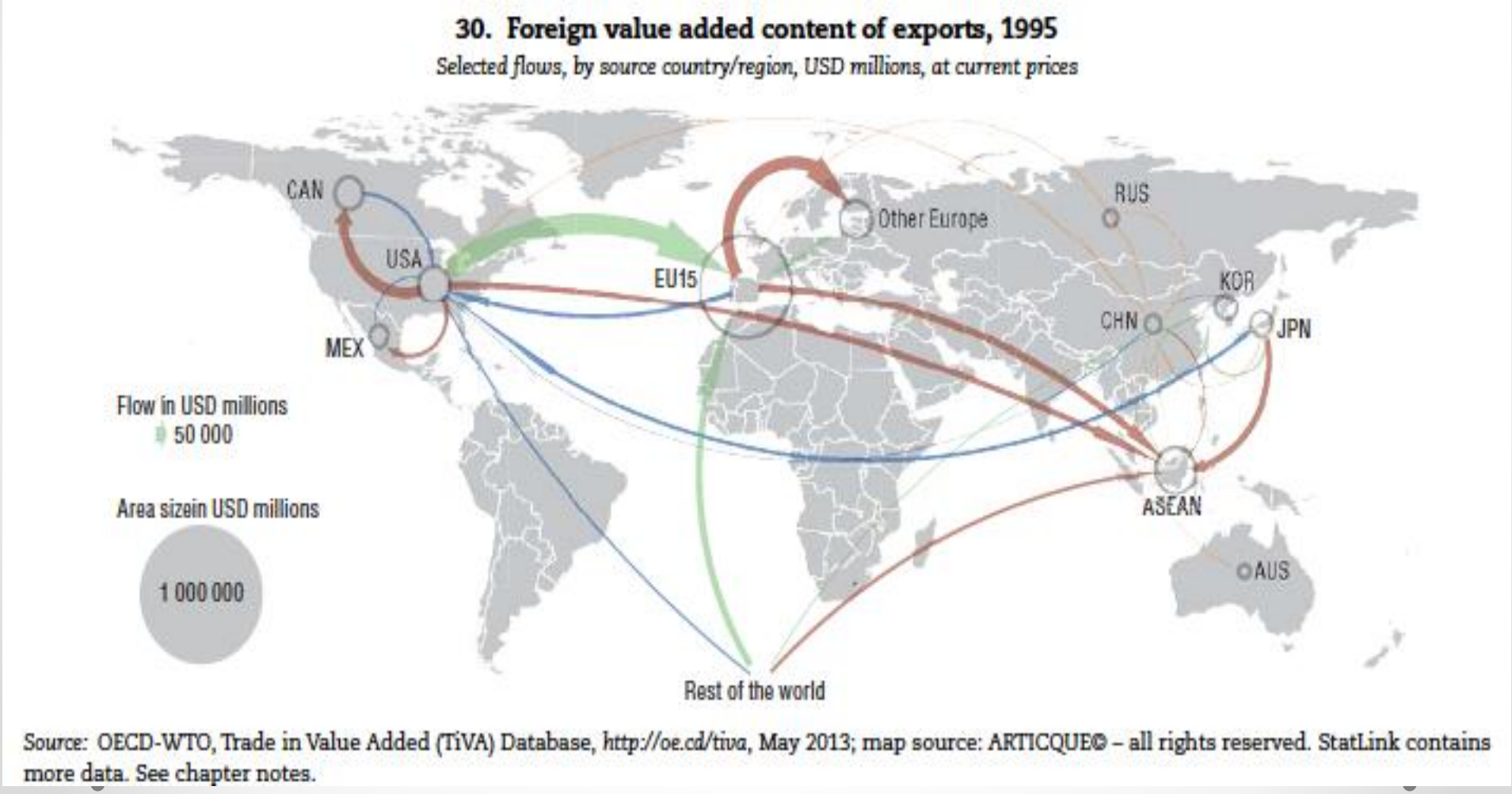
- In addition, *MNCs have rationalized their international architecture* through outsourcing and off-shoring.

- *Vertical disintegration of MNCs*, redefining core competencies to focus on innovation and product strategy, marketing, and the highest value-added segments of manufacturing and services, while reducing their direct ownership over “non-core” functions.

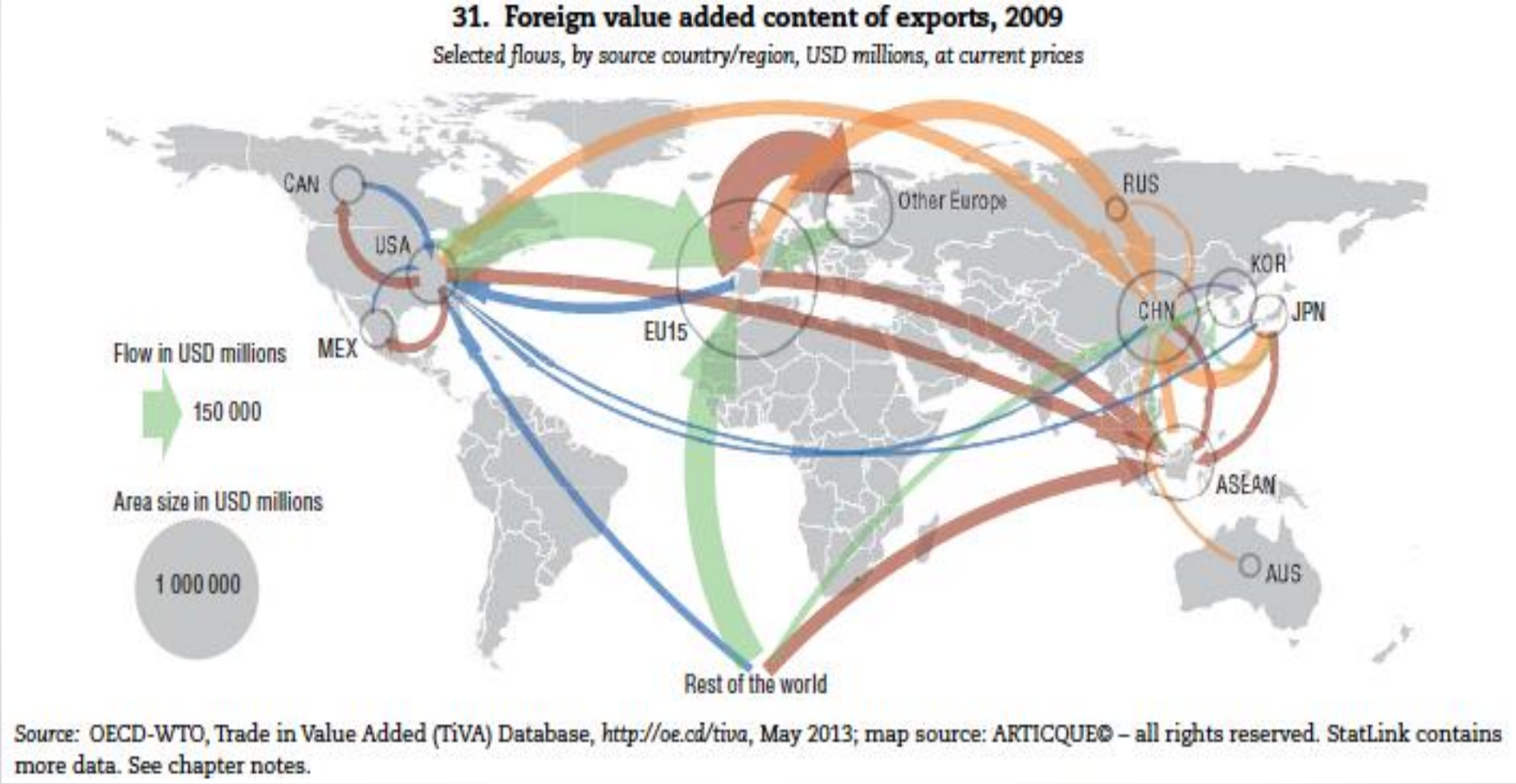
Outward FDI Flows US, EU, Japan to BRICS



Foreign Value Added of Exports:1995



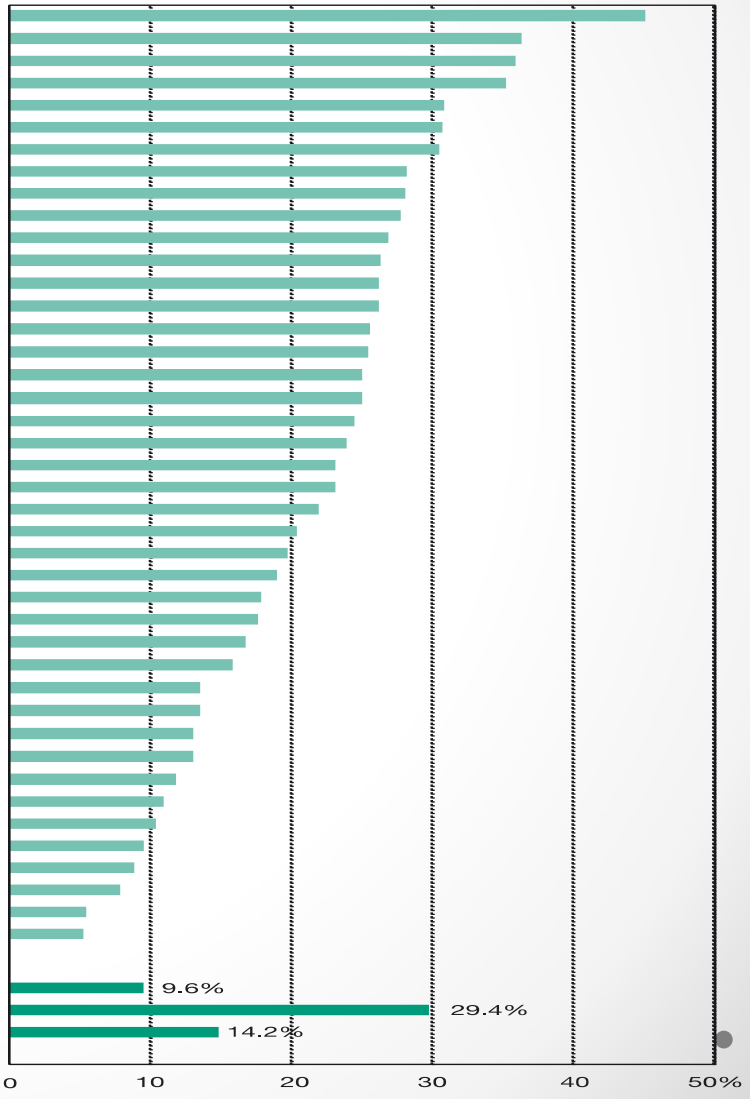
Foreign Value Added of Exports: 2009



Share of Foreign Value Added in Exports, 2010

1 Manufacture of office, accounting and computing machinery
2 Manufacture of motor vehicles, trailers and semi-trailers
3 Manufacture of radio, television and communication equipment
4 Coke, petroleum products and nuclear fuel
5 Manufacture of man-made fibres, plastics and synthetic rubber
6 Manufacture of other electrical machinery and apparatus
7 Manufacture of other transport equipment
8 Rubber and plastic products
9 Manufacture of basic chemicals
10 Metal and metal products
11 Manufacture of textiles
12 Manufacture of paints, varnishes and similar coatings, etc
13 Other chemical products
14 Machinery and equipment
15 Other manufacturing
16 Manufacture of wearing apparel; dressing and dyeing of fur
17 Wood and wood products
18 Precision instruments
19 Tanning of leather; manufacture of luggage, handbags, saddlery
20 Transport and storage
21 Manufactures of fertilizers, pesticides, other agro-chemical products
22 Manufacture of detergents, cleaning preparations, toiletries
23 Food, beverages and tobacco
24 Publishing, printing and reproduction of recorded media
25 Non-metallic mineral products
26 Manufacture of pharmaceuticals, medicinal chemicals
27 Construction
28 Research and deelopment
29 Recycling
30 Electricity, gas and water
31 Post and telecommunications
32 Hotels and restaurants
33 Computer and related activities
34 Mining and quarryiing
35 Other business activities
36 Retail trade, repair of personal and household goods
37 Agriculture and related service activities
38 Finance
39 Wholesale trade and commission trade
40 Rental activities
41 Real estate activities
42 Petroleum

Memorandum item:
Primary sector
Sectondary sector
Tertiary sector



Thank you!

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