International Round Table on Materials Criticality

Critical assessments and stable procurement of mineral resources in the field of policy applications in Japan

EcoBalance Tokyo, 09:45 – 10:00 , October 9, 2018
Room 112
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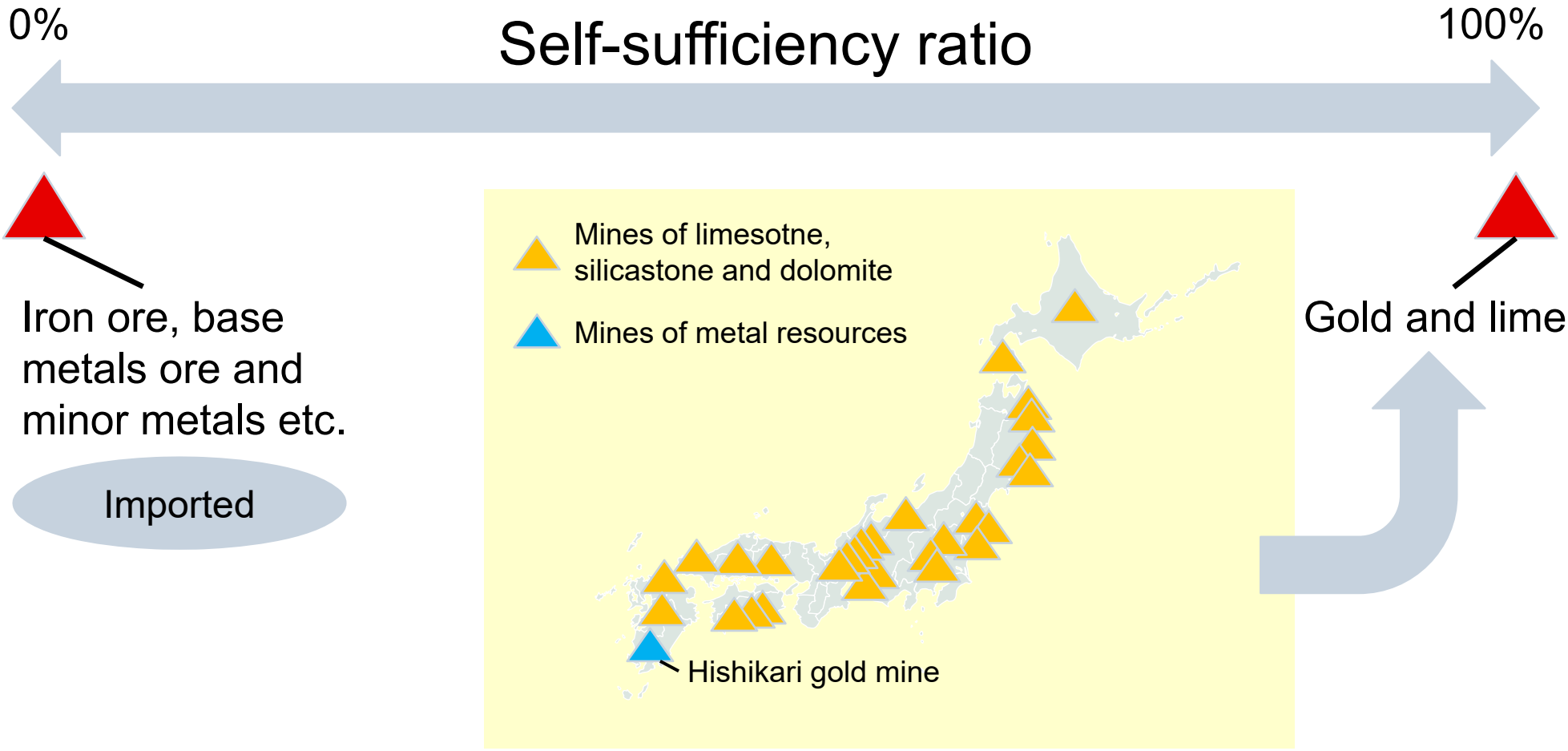
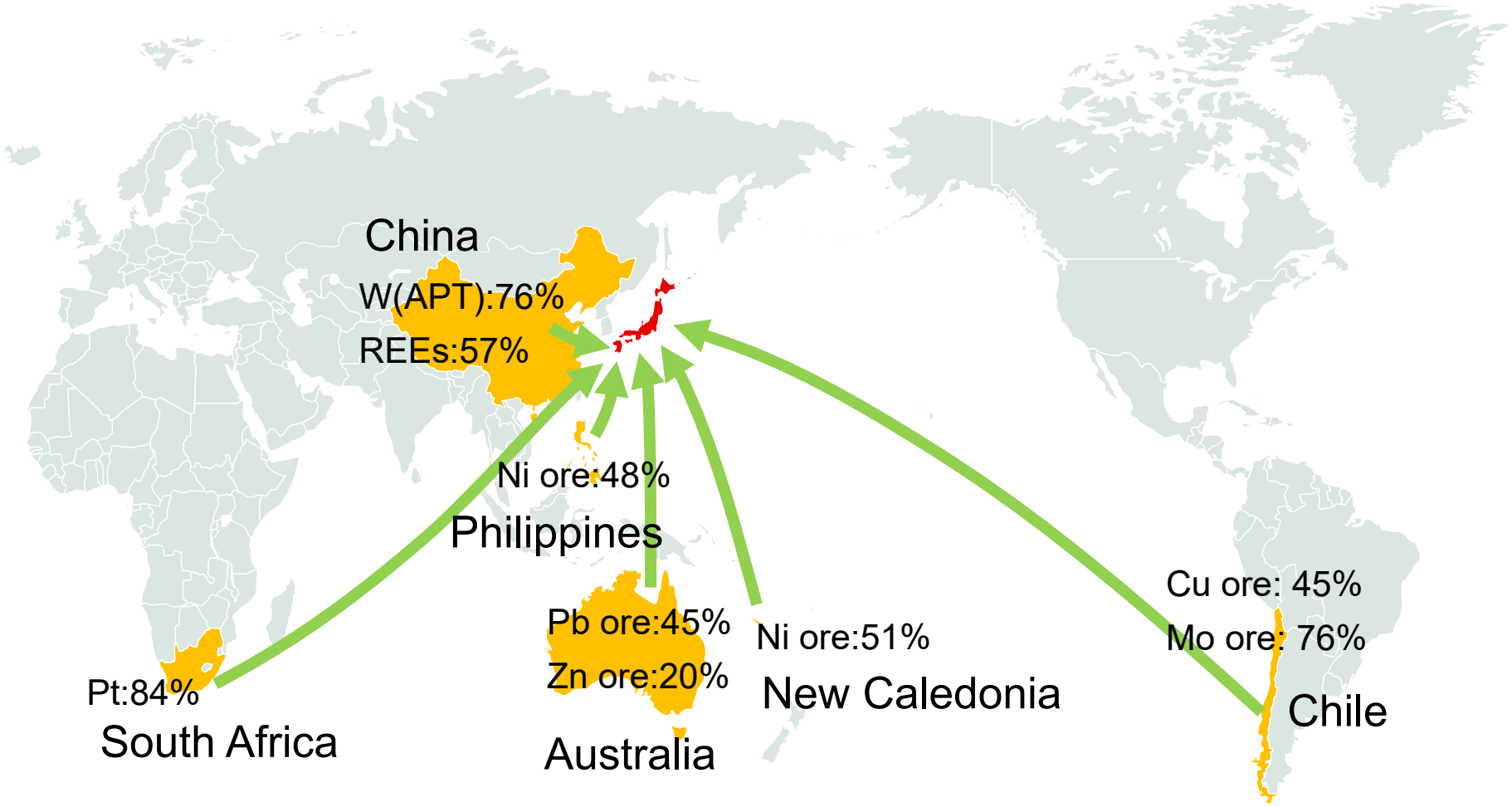
Self-sufficiency of mineral resouces in Japan

- Most of mineral resources consumed in Japan are imported from foreign countries except lime and gold.



Source: Limestone Association of Japan, Sumitomo Metal Mining Co., Ltd.

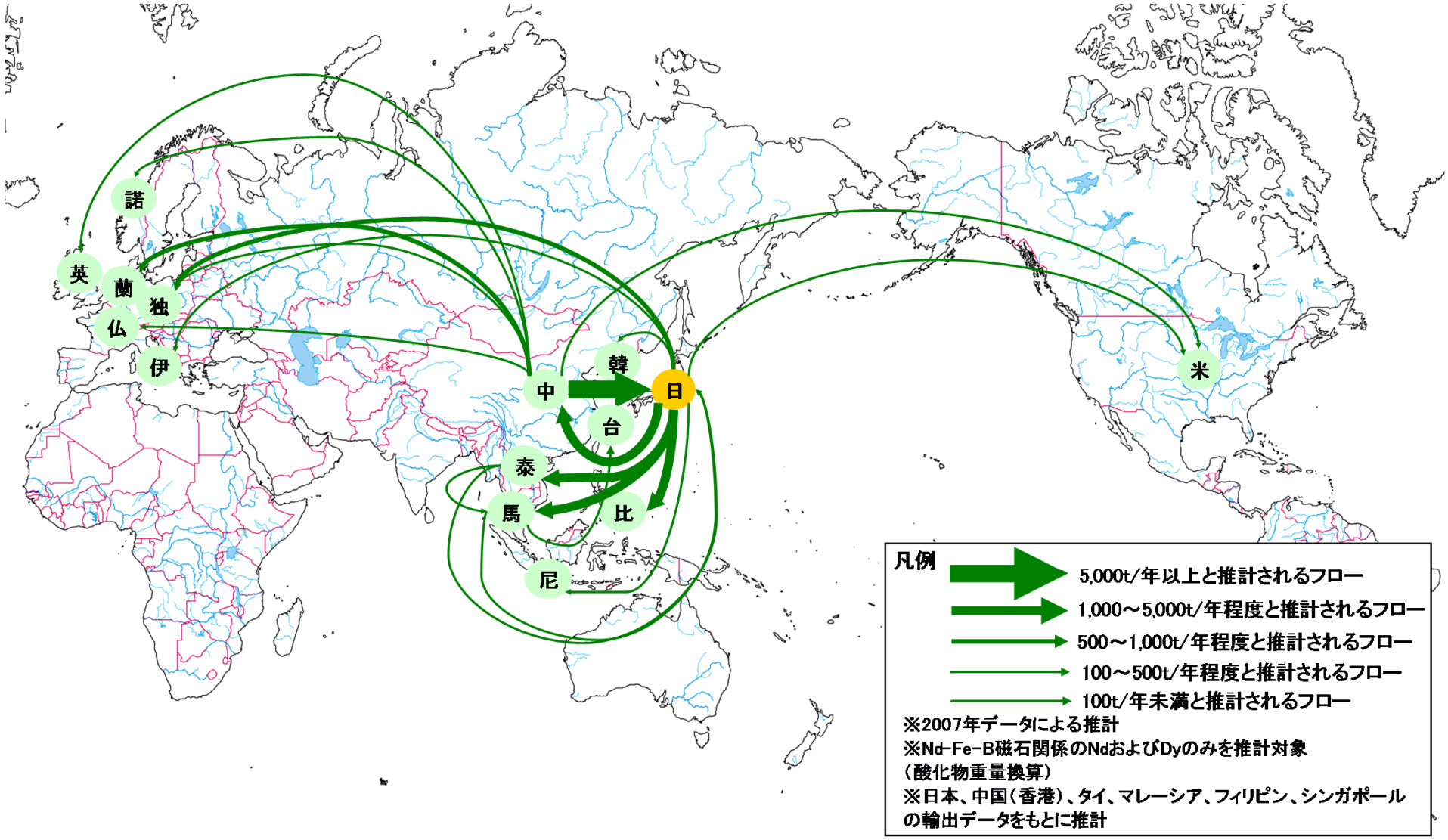
Countries of origin of imported mineral resources



Note : Data as at 2016

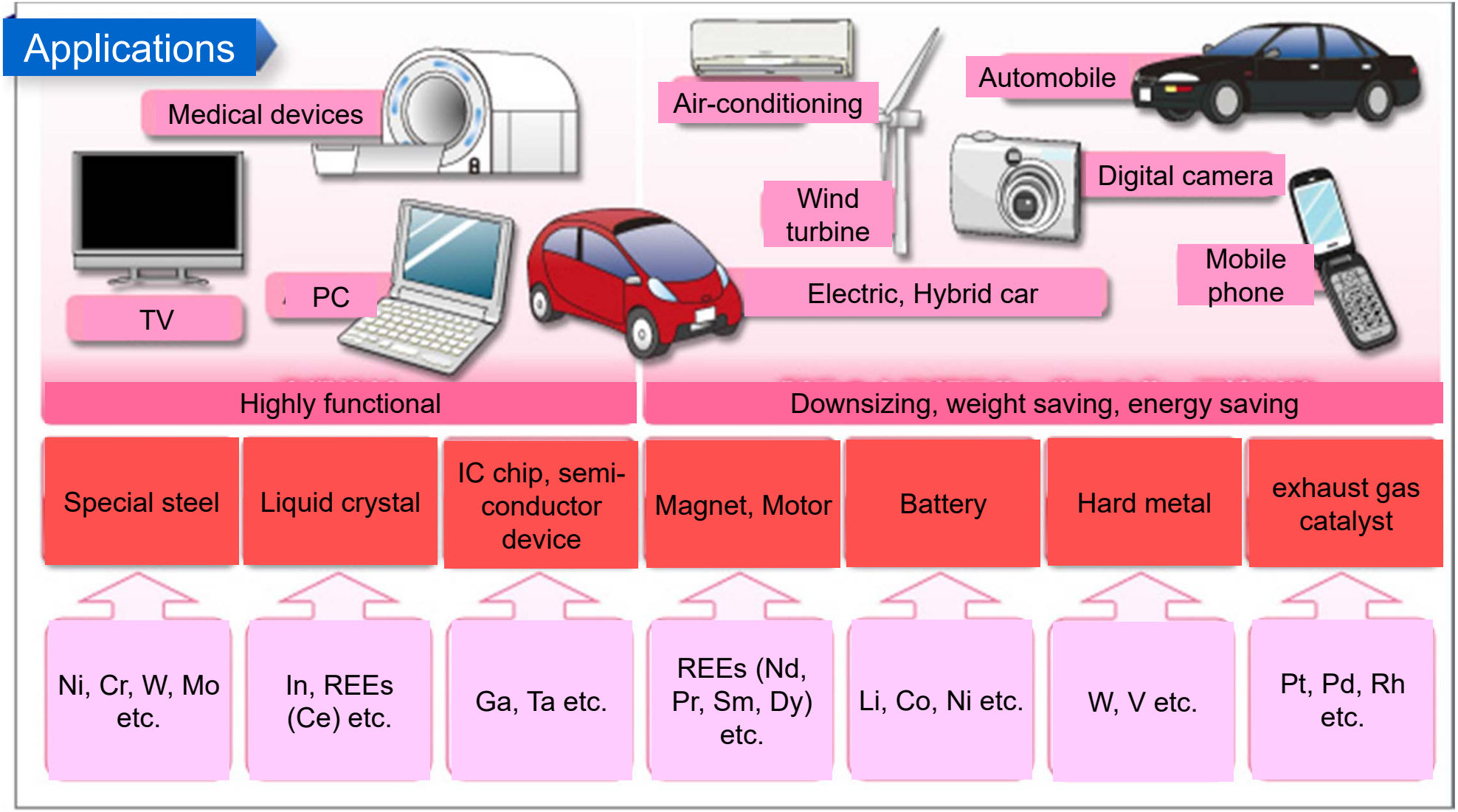
Source: Ministry of Finance, Japan “Trade statistics of Japan”

Supply chain of rare earths from China for magnet



Source: Kotaro Shimizu (2009) in Japanese

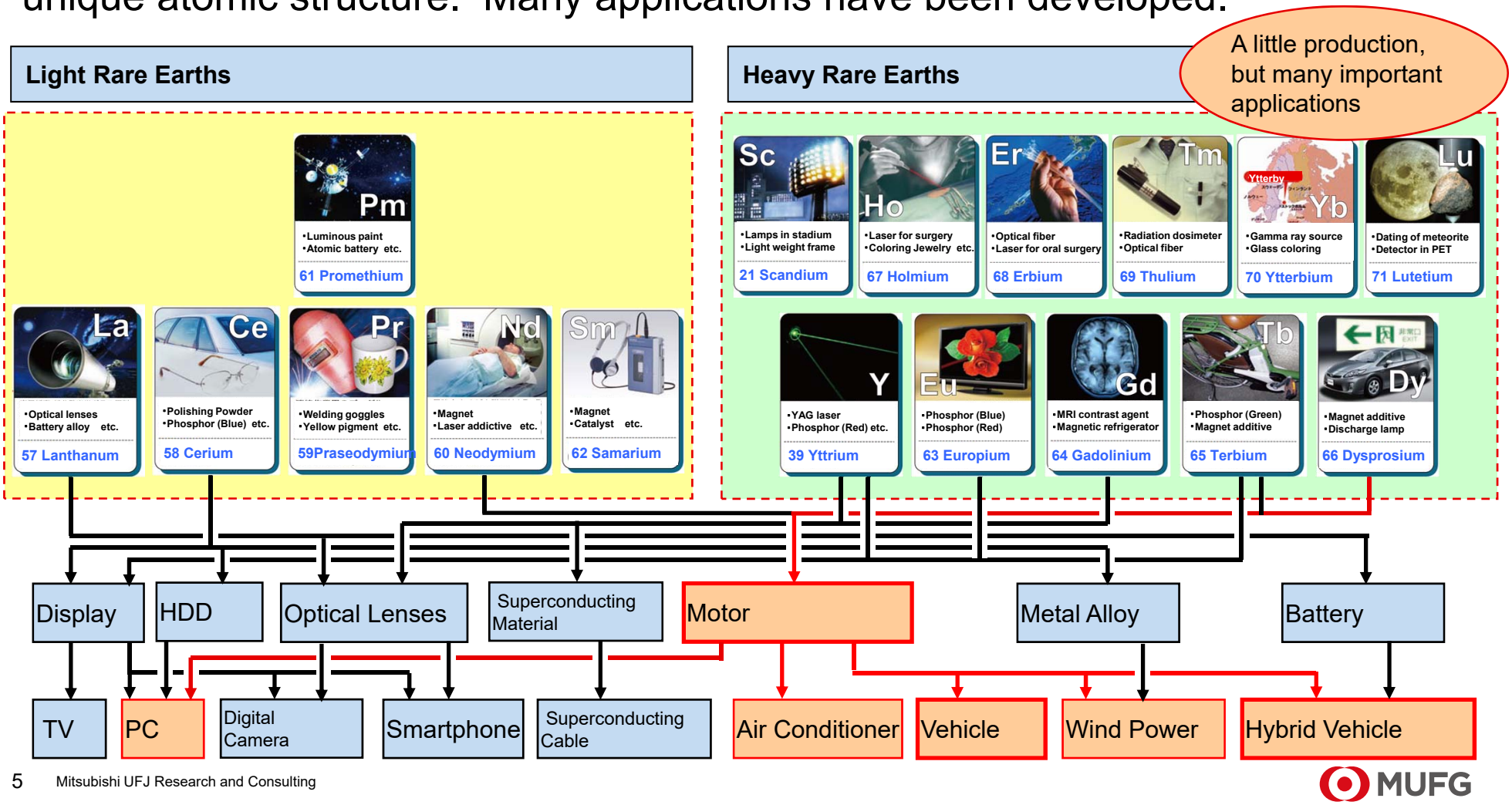
Applications of Rare Metals in Japan



Source: Ministry of Foreign Affairs

Applications of Rare Metals in Japan

Rare Earths have excellent optical functionality (e.g. fluorescence, laser) , magnetic functionality (e.g. special permanent magnet) etc. derived from their unique atomic structure. Many applications have been developed.



China controls the production and export of REE

- The Chinese government promotes the control of domestic production and export of Rare Earths after 1990s that the Chinese share of Rare Earths production was rapidly expanded

The predawn of Rare Earths Industry | **The rapid expanding of Chinese share** | **The introduction of the control of domestic production and export quotas by China** | **Backlash against China and the rise of the new mines of Rare Earths**

1940s **1990s** **2000s** **2010s**

The Chinese share of Rare Earths production: 30% → 85% → 97% → ***The appearance of another supplier of Rare Earths***

Zhou Enlai

The Chinese government emphasizes the technology of Rare Earths

The Middle East has oil, China has Rare Earths !

Deng Xiaoping

2003 The publication of the White Paper on Chinese Resource

2010 The embargo of Rare Earths against Japan

Designating of Rare Earths as “the National Protective Minerals”

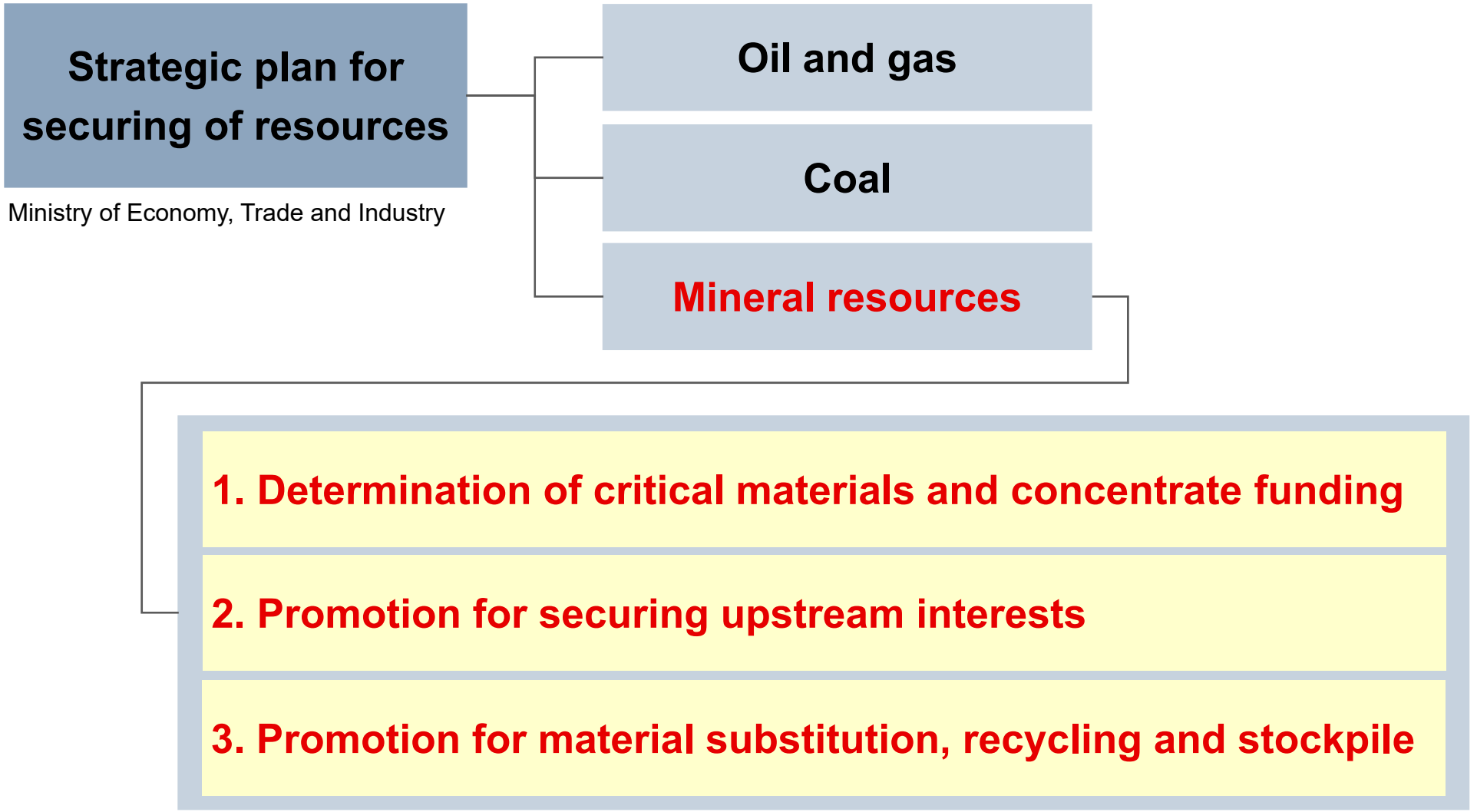
The control of export quotas of Rare Earths

WTO lost litigation (2015)

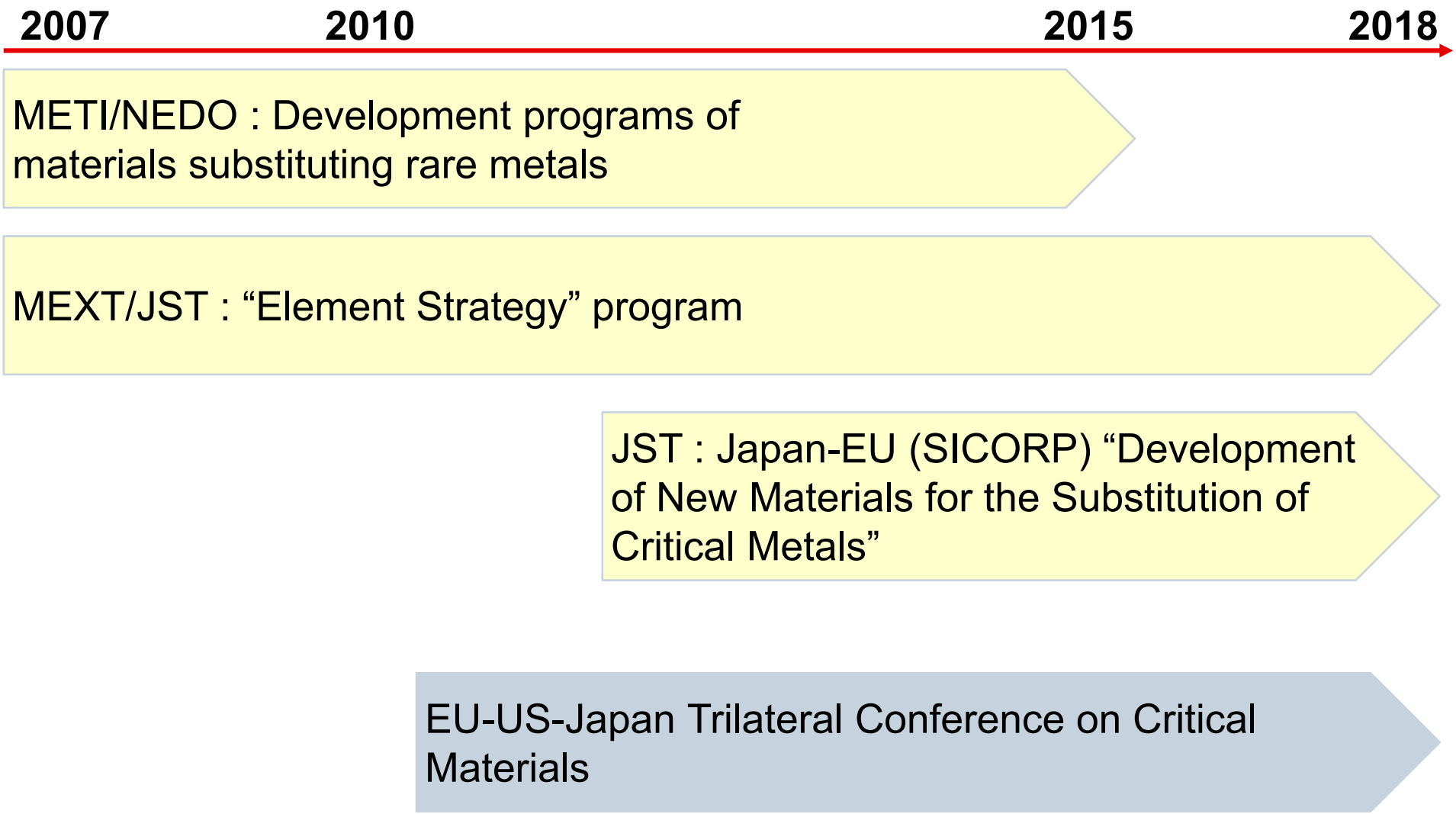
The bringing in the export customs duty on Rare Earths

The control of domestic production of Rare Earths

Strategic plan for securing of resources (2012)



Research and development programs

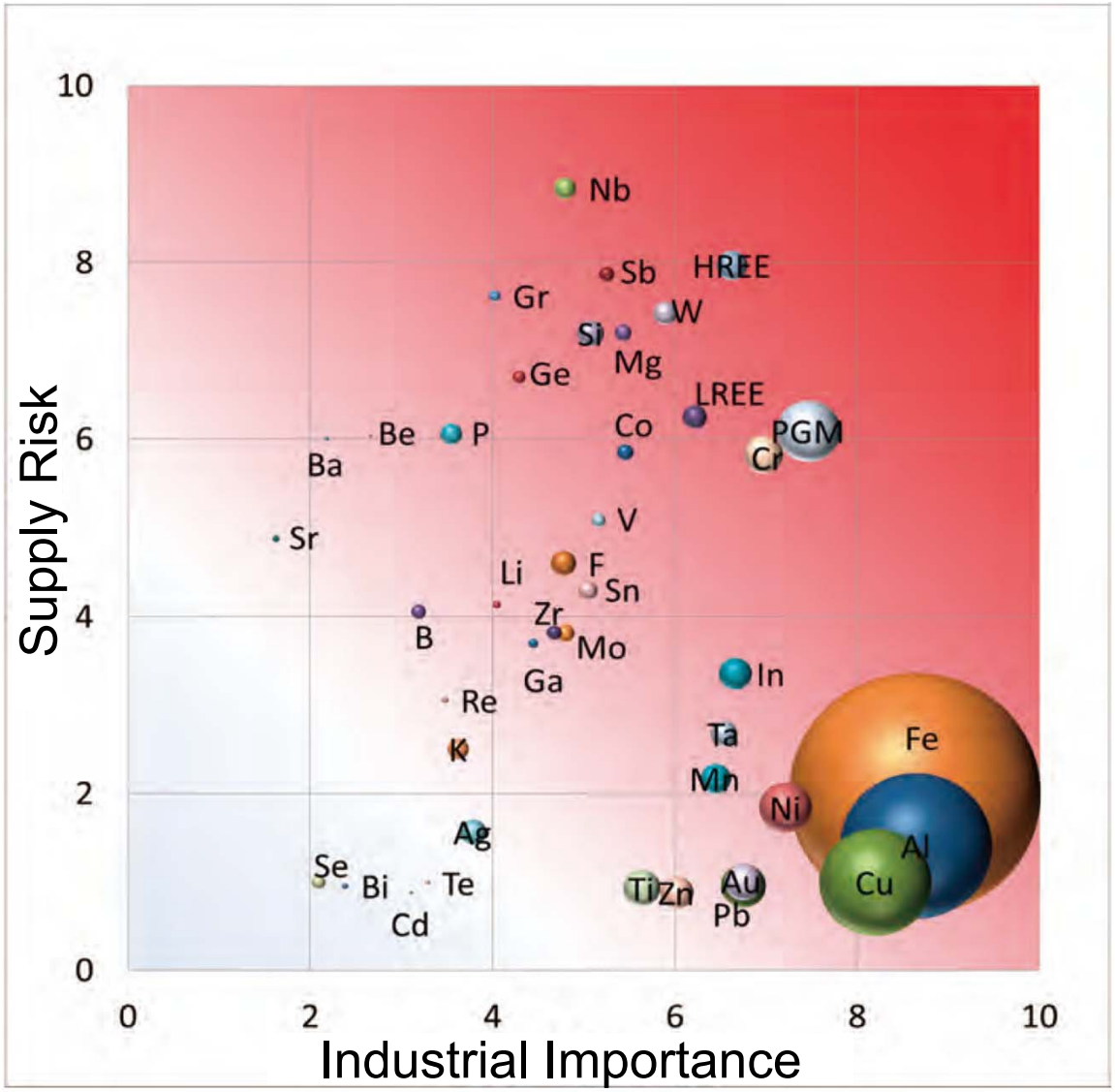


Critical assessments in Japan

	Supply Risk	Vulnerability	Environmental Impact
MMIJ		Economic impact analysis of supply disruption of Cu, Co and Ta (MMIJ, 2002)	
NEDO (METI)	Development programs of materials substituting rare metals (NEDO, 2007 -)		
JOGMEC	Ariga (2015)		
Some manufactures	Some manufactures' internal analysis (~2011 -)		Some manufactures' CSR report

Note : MMIJ: Mining and Materials Processing Institute of Japan, NEDO: New Energy and Industrial Technology Development Organization, JOGMEC: Japan Oil, Gas and Metals National Corporation

Case 1: Ariga (2015)



Note : Ariga (2015) in Japanese

Case 2: A manufacture (by MURC)

Method of calculating procurement risk (criticalness index)

(This index is a simple aggregate indicator. Note the difference in the nature of the problems between a material assigned a high index due to high potential impact and one assigned a high index due to high risk of supply disruption.)

Criticalness Index = $\left(\log_{10} \text{Impact Index}^2 + \text{Risk of supply disruption}^2 \right)^{1/2} \times$ **Risk of price hike**

- Impact Index: ■ Volume consumed per product
- Risk of supply disruption: ■ The higher this figure, the greater the risk of supply disruption posed by geopolitical factors
- Risk of price hike: ■ The higher this figure, the greater the risk of steep price increases due to disparities in the balance between supply and demand

Method of assessing risk of supply disruption

Risk of supply disruption = Σ (**①Unevenness of resource distribution** × **②Extent of market oligopoly in the resource-producing nation** × **③Stability of the resource-producing nation**)

- Risk of supply disruption: ■ Sum total of products ①,②, and ③ for the resource-producing nation
- Risk of supply disruption: ■ The higher this figure, the greater the risk of supply disruptions.
- ①Unevenness of resource distribution: ■ This is the square of the global market share of the resource-producing nation.
- ②Extent of market oligopoly in the resource-producing nation: ■ This is the square sum of the domestic market share of businesses located in the resource-producing nation.
- ③Stability of the resource-producing nation: ■ This is the governance coefficient of the resource-producing nation.

Method of assessing risk of price hike

Risk of price hike = **Potential global demand volume assuming current market prices (2013)** ÷ **Potential global supply volume assuming current market prices (2013)**

- Risk of price hike: ■ The higher this figure, the greater the risk of steep price increases.
- Potential global demand volume assuming current market prices (2013): ■ Forecast based on various data
- Potential global supply volume assuming current market prices (2013): ■ Forecast based on various data

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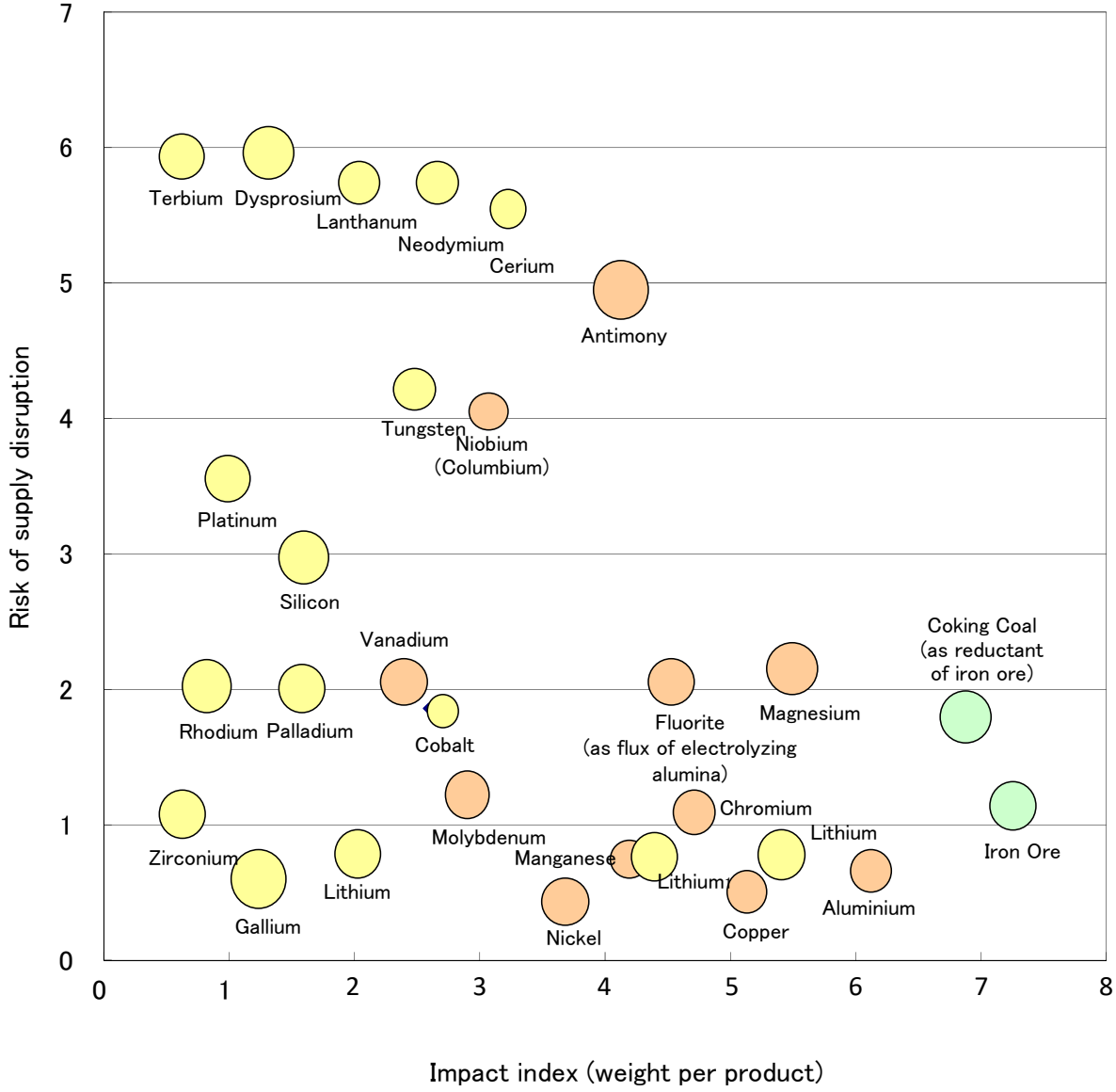
Case 2: A manufacture (by MURC)



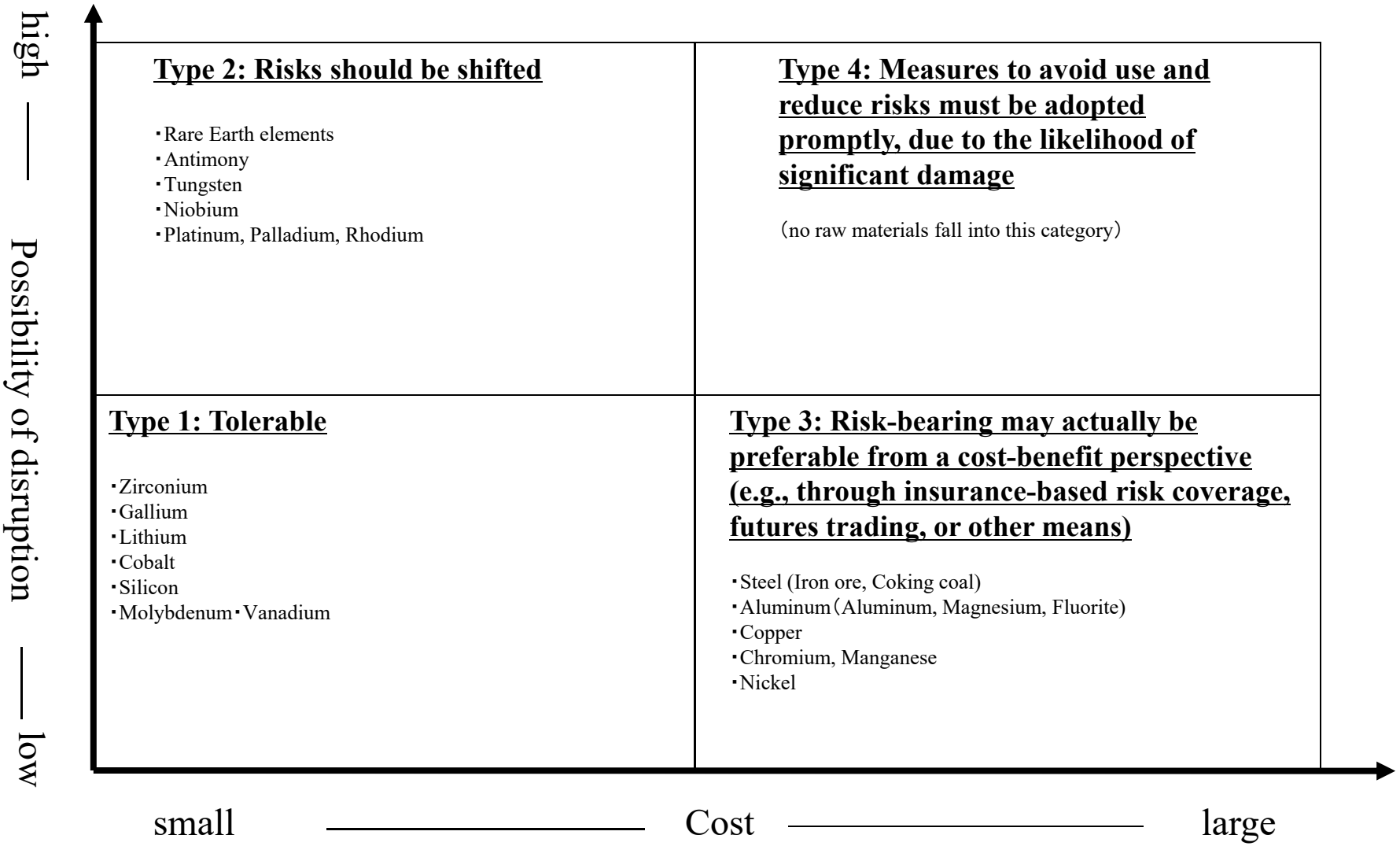
Raw materials with high risks of supply disruptions (those at the top of the graph at right) include rare earth elements, antimony, tungsten, and niobium.

Raw materials associated with high risk of steep price increases (those indicated by larger circles) include antimony and magnesium. The main reason for these low levels of risk is massive increases in production capacity at refineries.

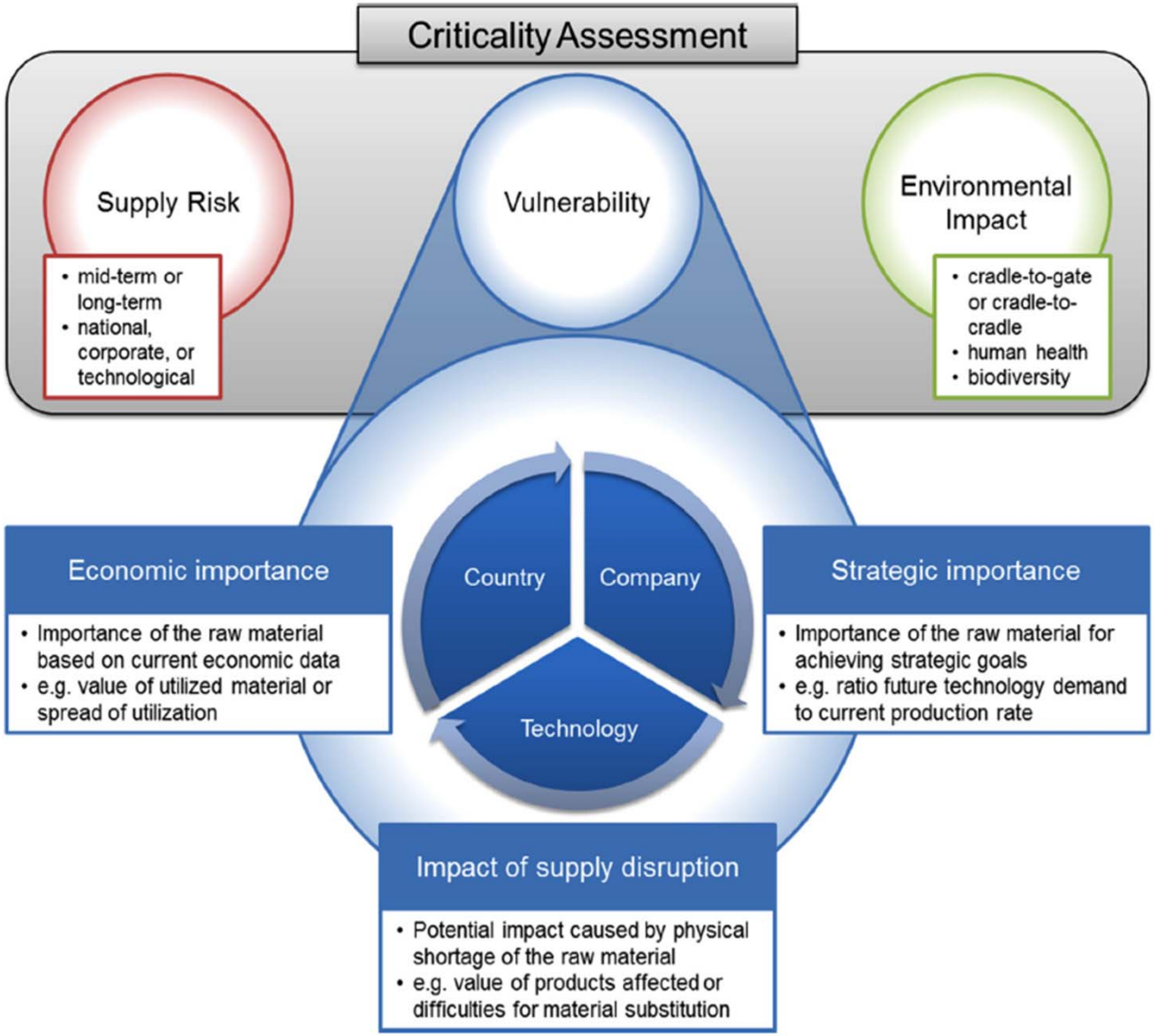
Raw materials associated with high potential impact (i.e., volumes consumed per product include iron ore and raw coal (both for use in steel production) and aluminium.

- Functional materials which is hard to substitute
- Additives for main structural materials
- Other materials with large consumption per product

Case 2: A manufacture (by MURC)



Development of Vulnerability assessment…



（source）Helbig et al. (2016)

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