



Fostering international raw materials cooperation



Japan Contextual analysis of the reference countries

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Abstract

The principal objectives of the INTRAW project (<http://intraw.eu>) are the mapping of best practices and boosting of cooperation opportunities related to raw materials between the EU and 5 technologically advanced non-EU countries (Australia, Canada, Japan, South Africa and the United States). Each of these five "Reference Countries" is subject to similar global challenges. This report presents the contextual analysis of Japan in order to explain the country's historical economic development during the 20th and 21st century in general, and in relation to development of primary raw materials in particular. Three reports focussing specifically on: raw materials research and innovation; education and outreach; and industry and trade in the Reference Countries will be the next outputs from the project to be published. These will underpin the development of a better understanding of the achievements made in these 5 countries in relation to raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution.

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1. Introduction

1.1 General

One objective of INTRAW is to characterise the contextual environment of the 5 Reference Countries for the project (Australia, Canada, Japan, South Africa and the United States) in relation to raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution. This, together with the mapping of corresponding policies and practices for each of these domains, will facilitate the comparative evaluation and cross impact analysis of the raw materials domains between the Reference countries and the EU.

1.2 Introduction to Contextual Analysis (WP1, Task 1.1)

The objective of Task 1.1 of the INTRAW project is to map the contextual environment of the reference countries (Australia, Canada, Japan, South Africa and the United States of America) against the contextual environment in the EU, leading to a better understanding of the achievements made in these countries in relation to *raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution*. This WP will also map the corresponding policies and practices of each of these domains. The data will be centrally processed, which will facilitate the comparative evaluation and cross impact analysis of the raw materials domains in each of the Reference countries and the EU.

1.3 Scope of this report

This report is the **Country Report for Japan, prepared as part of Task 1.1: "Contextual analysis of the Reference Countries"**. It is part of the deliverable for Work Package 1 of the INTRAW project (D1.2). This report on the contextual analysis for Japan is presented in 4 main sections after this introduction:

- **Chapter 2:** An Executive Summary
- **Chapter 3:** A historical overview on raw materials
- **Chapters 4 to 8:** Analysis of the contextual environment, covering 49 explanatory factors, grouped into five main categories:
 - Geo & Environmental (6 factors – Chapter 4);
 - Socio-Cultural (11 factors – Chapter 5);
 - Economic (14 factors – Chapter 6);
 - Political and Legal (14 factors – Chapter 7); and
 - Technological (4 factors – Chapter 8).
- **Chapter 9:** Conclusions.

The description of the analysis of the contextual environment in each of the main sections, Chapters 4 to 8, first describes general economic growth and change drivers associated with each of the explanatory factors, and then draws out findings that are specific to the non-energy raw materials sector. The conclusions section follows a similar pattern, with a general overview followed by conclusions specific to raw materials, arranged under the headings "*Industry and trade*", "*Education and outreach*", and "*Research and innovation*" thus integrating three sides of the 'knowledge triangle': higher education, research and business, that are reflected in the themes of the sector specific reports being prepared as deliverables from WPs 1.2¹, 1.3² and 1.4³.

The report is supported by three appendices:

- **Appendix A1:** Presentation of the method employed to construct a multi-factor matrix and associated radar charts. The multi-factor matrix and radar charts were the tools used to carry out initial organisation and analysis of the information collected and to inform discussions within

1 Transactional analysis on Research and Innovation

2 Transactional analysis on Education and Outreach

3 Transactional analysis on Industry and Trade

the work package team and with members of the expert panel. They are considered as *work-in-progress input* and are included here for completeness.

- **Appendix A2:**

Presentation of summary findings via the “multi-factor matrix” and five- and 12- axis “radar charts”,

and preliminary discussion of the comparative importance of the explanatory factors based on the analysis.

- **Appendix A3:**

Presents the references quoted in this document.

2. Executive summary

During the 20th and early 21st centuries Japan became the 5th largest globalised economy (by Gross Domestic Product – GDP – purchasing power parity) and it ranks as one of the most innovative countries in the world, being the World leader in terms of patenting (patents in force, patent applications).

Its economic development was boosted particularly after World War II (WWII) during a high economic growth era led by industrialisation and technology. Investments in research and development (R&D) and technology innovations (including patenting) became a core competitiveness factor of the Japanese economy, capitalising on technology transfer from the West but also on cumulative knowledge and domestic infrastructure developed after the Meiji Restoration in 1868, a key inflection point in Japan's history. At those times, the country opened its ports and eyes to the Western commerce and trade and has since been guided by the slogan “*wakon yōhsai*” (Japanese Spirit, Western Technology). Public and mainly private R&D investments have resulted in an excellent research and scientific infrastructure. Several economic factors have been important for Japan's development. Japan had long periods of sustained economic growth (1950s-1970s, 1975-1992), and also of no or negligible growth (e.g. 1992-2011). Economic growth was supported by a strong domestic market (large affluent population with high spending power and a high savings rate), low inflation and low unemployment. This was achieved at the expense of an increasing public debt; historically government revenues and expenditure had been balanced until 1965 when government bonds for infrastructure were issued (and bought mainly by the private domestic sector). From then on the public debt has been steadily increasing, but this has not resolved economic growth problems, e.g. in the last two decades.

Another important factor has been reliable freight infrastructure connec-

ting the overseas markets with Japan's domestic industries. This includes ports, roads and railways and also a flourishing shipbuilding industry (the largest in the world by the 1960s). Japan's rapid demographic transition to an affluent population, particularly after WWII, also explain much of the rapid growth era as the growing domestic market enabled the industry to develop rapidly, to test new products and to improve them before competing in external markets. Japan's cultural and religious heritage (Shintoism, Buddhism, and Confucianism) exerts a strong influence on the norms and values of Japanese culture, characterised by the harmonization of government-business relationships, labour-management relations, and the life-long employment system which underpinned Japan's high labour and capital productivity amongst a national context of congruency and shared economic goals. The alignment and goal-sharing of a relatively small government and a large private sector has been a key factor underlying Japan's economic success.

In the field of minerals supply, such alignment is nowadays best exemplified by the JOGMEC (the Japanese Oil, Gas and Metals National Corporation) agency which permanently supports the domestic and overseas development of the minerals industry, both primary and secondary, fostering innovation and cooperation. As an example of deep sea bed resources exploration, in 2014 JOGMEC pioneered the signing of the world's first cobalt-rich ferromanganese crust exploration area contract with the International Seabed Authority (ISA) and secured exclusive interests for Japan.

Education has also been a key pillar. A strong domestic education system has been considered a precondition for the country's economic development, and Japan established high educational attainment levels early in the 20th century, and also a continuous exchange with western economies, promoting techno-

logy transfers. A strong R&D culture, mainly industry-led, and a leading position in the patenting system are an outcome of a long-run policy of basing prosperity in technology advances.

Japan's economic development process has been driven by a large affluent population with high spending power, an important outward flow of foreign direct investment (FDI), trade policies ensuring a stable supply of raw materials and a politically stable institutional context. Much of the outward FDI has been directed to the natural resources sector, more specifically to ensure a stable supply of mineral commodities such as iron ore, coal or copper concentrate via direct investments in large-scale mining projects.

The development of Japan as a "processing country" has been enabled by a successful long-term policy of securing a stable supply of mineral commodities, particularly via securing imports and stockpiling. Such mineral policy has enabled the country to overcome its shortage of raw materials. It has been enacted via multiple parallel strategies adopted by the government in tandem with private companies and has encompassed: i) systematically develop domestic mineral resources (onshore and offshore where Japan has jurisdiction); ii) actively promote exploration and exploitation of overseas mineral resources

(onshore and offshore) through economic cooperation with mineral-rich developing countries via resource diplomacy and commercial agreements (e.g. with Australia since 1957) and via exploration in international deep-sea floor resources; and iii) national stockpiling in Japan and abroad of energy and non-energy minerals. Nowadays Japan is still much engaged in continuing such policies and the JOGMEC agency plays a crucial role. At the same time Japan is complementing this primary raw minerals securement policy with strong research and innovation (R&I) efforts related to the recycling and substitution of metals, among which the "Element Strategy" is the most well-known initiative. The starting point of the "Element Strategy" is to understand the function of each element deeply. Then through utilizing such functions of the element, Japanese scientists aim at substituting, reducing and recycling critical raw materials. Furthermore, the sustainable industrial development is expected to be realised by new functional materials developed based on the Element Strategy. If a certain amount of critical raw materials used in current industry could be replaced by abundant elements such as iron, zinc or aluminium, Japan would considerably reduce its dependence on imported critical raw materials

3. Historical overview on raw materials

By the end of the Tokugawa period (1603-1867) Japan's economy was characterized by scarce capital and low levels of technology, exporting primary commodities and importing manufactured goods (e.g. cotton and woollen fabrics, sugar, firearms and later iron). Raw silk (a semi-manufactured commodity) was by far the most important export item, followed by tea, silkworm eggs, copper, cotton and marine products (Yasuba, 1996). By 1880 Japan's comparative advantage was still in primary commodities, and imported machinery was essential for Japan's development. Most of the traded goods other than low-value coal, kelp, cotton and rice were traded with distant countries. By the turn of the 19th century the Japanese government actively encouraged trade expansion by establishing the Yokohama Specie Bank to facilitate foreign exchange transactions, by strengthening consular economic reporting and by subsidising the construction of an ocean-going merchant marine. Private industry, initially led by the cotton textile manufacturers, started an aggressive export-promotion and, by the 1930s, Japan had become the world's major exporter of cotton manufactures (Hall, 1988).

With regards to the trade in minerals and agricultural food commodities, Japan was a net exporter during the period 1887-1896, but already afterwards it increasingly became a net importer of both minerals and agricultural food commodities (Yasuba, 1996). During 1900 and 1913 there was a steep rise in exports mainly attributable to the expansion of trade in raw silk, silk piece-goods and cotton yarn, establishing Japan's specialisation in textiles or textile materials which was the most prominent feature of Japan's trade until the 1930s (Allen, 2013). During the period 1873-1913 the size of the merchant fleet increased from 26 to 1,514 steamships, reflecting the increase in exporting during this period.

Later, population growth, a rise in per capita output and the emergence of protectionism increased demand for natural resources but, until the rise of militarism in the 1930s, the shortage of indigenous natural resources was never a serious issue (Yasuba, 1996). By 1930 the structure of trade had changed drastically: most of the major exports were industrial commodities such as raw silk, cotton fabrics, silk fabrics and rayon fabrics. All manufactured exports were the products of light industries. Imports included raw cotton, sugar, rice, soy beans, lumber and petroleum; all bulky raw materials originating from nearby East and Southeast Asian countries. During the Japanese colonial empire period (1895-1945) Japan secured a large part of its raw materials supply from its colonies, mainly Taiwan and Korea; in 1928 91% of Korea's exports went to Japan and 71% of Japan's imports came from there (Sugihara, 2004). For many years and during the 1920s, Japan relied on British Malaya and Australia for iron ore, India for pig iron, British Malaya for rubber and the United States of America (from now on USA) and Dutch East Indies for oil (Sugihara, 2004). Among the most famous of the overseas iron and steel manufacturing plants were projects by Mitsubishi Kyom-i-po in Korea, the SMR's Anshan facility in Manchuria and Okura *zaibatsu's*, facilities which began production during World War I and shipped most of their pig iron to Japan. The development of the resources of the colonies was indispensable to the expansion of steel production, which in turn was the key factor in the development of the heavy and chemical industries (Nakamura and Odaka, 2003).

In Japan the domestic shortage of natural resources only became apparent during the 1940s because the military adopted an imperialistic policy shifting the industrial centre from light industrial production to resource-intensive heavy industries. Given that freight rates were high and supply was uncertain, coupled

with the USA embargo on scrap iron and oil, the terms of trade deteriorated. Since World War II, Japan, due to its unfavourable geology, has relied heavily (particularly during the rapid growth era in the 20th century) upon imports of mineral resources. Without significant domestic resources, the Japanese could not compete with other non-Western economies, the development of which was based on the export of either agricultural products or mineral resources. The only remaining avenue was therefore to expand its trade through the export of manufactured goods (Hall, 1988). As a result the Japanese physical economy today depends to a significant degree on net imports (Krausmann et al., 2011).

One of the most heated post-war Japanese debates centred on whether Japan should aim at high economic growth through the growth of foreign trade, or expand the domestic market with the more autonomous resource base (of coal). By the early 1960s the decision was made to go for the former option, with the implicit but firm understanding that imports of oil from the Middle East were to be financed by export earnings. Export industries were expected to combine cheap labour (by Western standards) with technology designed to conserve resources, and the government set an expected ratio of export earnings to energy consumption for each strategically important industry. Thus the post-war strategy was even more dependent on the regime of free trade than it had been before the WWII (Sugihara, 2004).

During Japan's history, Australia became a very important trade partner and provider of raw materials. Australia's attractiveness to Japan as a supplier of energy and raw materials is based on

proximity and cost advantages as well as political stability and openness to foreign investment. Based on bilateral agreements on commerce and business, and notably since the 1960s (Siddique, 2011), Japan has traditionally imported strategic resources (iron ore, coal, manganese) and exported vehicles and machinery to Australia. Nowadays Japan depends on Australia for around 60% of its imports of coal and iron ore (Australia's first and second most valuable exports), and Australia is Japan's main supplier of natural gas and uranium (Drysdale, 2009). Also Japanese companies have been major investors in Australia since they entered into long-term contracts for iron ore, coal and other minerals. For instance Mitsui took a 49% stake in the Moura coal deposit in the Bowen Basin and 10% of Mt Newman in 1967. In subsequent decades, Japanese companies increased investment in joint ventures in Pilbara iron ore projects and east coast coal mines. More recently, investment has vastly diversified (Drysdale, 2009).

During such period and currently, the main objective of Japan's minerals policy has been: a) to secure stable sources of minerals; b) systematically develop domestic mineral resources; c) actively promote development of overseas mineral resources through economic cooperation with mineral-rich developing countries, and d) stockpile rare metals (Tiess, 2011). Currently Japanese authorities administer their overseas exploration and development assistance programmes, e.g. via JOGMEC, so as to diversify sources of supply of minerals and metals. The 2007 agreement between Japan and the Republic of Chile for a Strategic Economic Partnership is one of the main examples of this.

4. Geo and environmental factors

4.1 Geographical situation

A crucial feature of Japan's history has been its island-characteristic with the archipelago lying far away from the Asian mainland. The nearest point between Kyushu and the southern tip of the Korean Peninsula is about 190 kilometres, one-fourth farther than the distance between Florida and Cuba and more than five times that between England and France. China lies some 800 kilometres away, with only a few "lily-pad" islands in the East China Sea to bridge the gap. Japan's distance from the Eurasian mainland means that for most of its history it was barely within reach of its neighbours (Stratfor, 2012). Given its island-characteristic and the need to import resources, Japan became a master of trade. Its geographical situation explains the economic development of Japan to a certain extent much linked to nearby countries which became economically developed (South Korea, Taiwan, etc.). Currently as East Asian countries continue to grow, Japan is strengthening its position as an R&D hub and an important strategic location for businesses in Asia.

4.2 Natural & mineral resources

Japan is often considered a natural resources-poor country and during its recent history had to build its high industrial output and standard of living on a comparatively small domestic natural resource base. 68.6% of Japan's land area is covered by forests. This is the 4th highest percentage in the world after Bhutan, Finland and Laos and far ahead of Canada (34%), the USA (33.1%), China (22%), Australia (19%) and South Africa (7.6%) (The Japan Times, 2012; World Bank, 2015a). Of this, natural forests account for 54%. The country's demand for lumber, pulp, paper, and other wood products exceeds domestic production; in 2013, Japan's self-sufficiency rate for lumber was 28.6%. Forests have a wide variety of trees of high quality and Japan could

be a lumber-exporting country like Canada. However, the ageing population of forestry workers, high extraction costs and stagnant domestic prices have prevented the forestry industry from growing to its potential either to meet domestic demand or for export (The Japan Times, 2012).

Japan has access to coastal waters with warm and cold currents which bring about biotic enrichment. This has traditionally played an important role in food security providing a variety of fish and other marine foods, supplying animal protein and bringing a healthy and rich diet to the population. However, in recent years, consumption of seafood has decreased greatly due to changes in the environment surrounding food in Japan, and it has been pointed out that consumers are «shifting away from fish». The number of workers in the marine fishery industry (workers who engage in work at sea for 30 days or more yearly) has been decreasing constantly. In 2012, there was a 2.4% decrease from the previous year, bringing the count to 174,000 workers (excluding Iwate, Miyagi and Fukushima prefectures) (Statistics Bureau, 2014).

With regards to mineral resources, the focus of Japan's resource development policy remains to secure stable overseas sources of oil, gas, and mineral resources. Japan is a net importer of fossil fuels (oil, gas), copper, zinc and other key metals for industrial purposes. Even though coal was mined for some part of the country's history, the most important coal deposits in Hokkaido and Kyushu are generally low grade, costly to mine, and inconveniently located with respect to major cities and industrial areas (the areas of highest demand). Japan was once a leading producer of copper, but its great mines at Ashio in central Honshu and Besshi on Shikoku have been depleted and are now closed. Reserves of iron, lead, zinc, bauxite, and other ores are negligible. However, Japan has large reserves of industrial minerals, including dolomite, iodine,

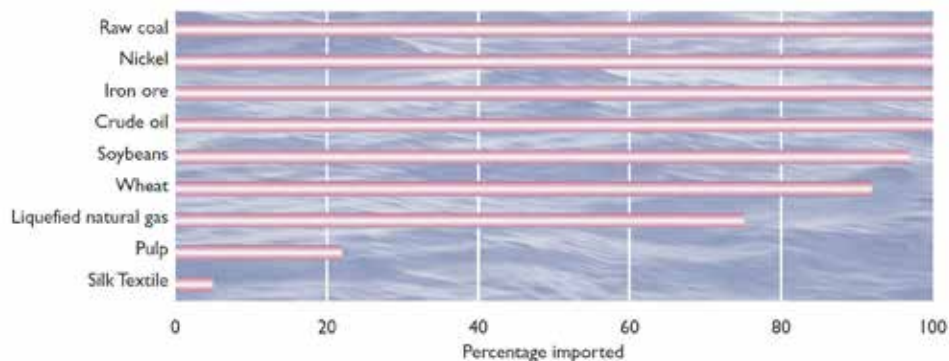
limestone, pyrophyllite, silica sand, and silica stone. Limestone is the most abundant indigenous mineral resource. The country's reserves of nonferrous metals, such as lead, silver, and zinc, are small, with the exception of a medium gold reserve (USGS, 2014).

In 1991 Japan's overseas dependency on imported minerals in percentage

terms was: coal 94%, copper 98.9%, lead 93%, zinc 83%, tin, bauxite and nickel 100% (McMillan, 1996). In 2012 the dependence on imports was: 99.6% for oil, 97.4% for natural gas, 100% of copper ore, and 99.3% for coal.

The Japanese Oil, Gas and Metals National Corporation (JOGMEC) is Japan's main raw materials-related agency which

Figure 1: Japan's percentage of major products imported (2006).



Source: Ministry of Land, Infrastructure, Transport and Tourism (2006)

implements a multi-faceted approach to oil, gas and coal resource-rich countries to ensure a stable supply of resources for Japan. The strategy encompasses joint operations, training for experts, providing equity capital and liability guarantees, conducting joint venture geological surveys, among others. Also, Japan is investing much in offshore exploration for energy and minerals. JOGMEC is investing in prospecting methane hydrate reserves off the Aichi Prefecture as it estimates that methane hydrate reserves around the Japanese archipelago could provide supplies matching the nation's natural gas consumption for more than 100 years. JOGMEC's drilling ship "Hakurei" has also been drilling into the deep seabed in search of hydrothermal deposits created by underwater volcanic activities. These deposits are said to contain large amounts of gold, silver, manganese, chromium, nickel and other heavy metals used to make various types of alloys. In 2014 JOGMEC pioneered the signing of the world's first cobalt-rich ferromanganese crust exploration area contract with the International Seabed Authority (ISA) and secured exclusive interests (JOGMEC, 2014). Another important discovery took place

some years ago when a seabed mud deposit rich in rare earths was discovered near the Minami-Tori-shima island. In order to verify and advance in the commercial mining of the deposit, researchers from the University of Tokyo and the Tokyo Institute of Technology joined with Mitsui Mining and Smelting, offshore drilling rig operator Modec, rare-earth-alloy maker Santoku and other to form a consortium to exploit resources from seabed mud (Asian Nikkei, 2014).

JOGMEC conducts a multi-faceted strategy with metal resource-rich countries to ensure the access of Japan to metals. Thus it conducts overseas geological surveys to help Japanese companies secure mineral interests and to support their exploration projects, conducts deep-sea-floor resource surveys, provides equity capital (for asset acquisition), loans and liability guarantees for metal exploration and development by Japanese companies (e.g. Salar de Olaroz lithium project in Argentina) reducing exploration-related financial risks, e.g. via Grant Delivery Programme for companies exploring uranium ores, collecting, analysing and providing information related to metal mining. JOGMEC also works in the development

of human resources with expertise in the field, develops joint venture exploration techniques (e.g. high resolution electromagnetic geophysical superconducting quantum interference device - SQUID equipment) (JOGMEC, 2013), and develops further production and recycling technologies. The company also implements national stockpiling and supports private stockpiling, e.g. of oil domestically and abroad in partnership with the United Arab Emirates and Saudi Arabia, and domestically of rare earth metals by means of a national stockpile warehouse for storage and management (JOGMEC, 2014). As of 2012, the Government was stockpiling gallium and indium in addition to seven other metals (chromium, cobalt, manganese, molybdenum, nickel, tungsten, and vanadium) for the needs of its high-tech industry (USGS, 2014).

Japan also carries out R&D projects on metallurgical technologies that use bacterial leaching, technologies for recovering rare metals from waste products and processing technologies for refractory ores at domestic nonferrous smelters. For instance, the Japan Metals & Chemicals Co., Ltd. and Honda Motor Co., Ltd. developed a process to extract rare-earth metals from various used parts (initially from nickel-metal hydride batteries) in Honda products by utilizing a newly established technology. The new process, which was to be employed at an existing recycling plant, would be the world's first mass-recycling effort for rare earths. The extraction rate was about 80% of rare-earth metals contained in the used parts (USGS, 2014). Another example is given by the Summit Atom Rare Earth Co. LLP, which was a joint venture between Sumitomo Corp. and national atomic Co. of Kazakhstan, that opened a plant at Stepnogorsk in Kazakhstan in November 2012 to recover rare-earth elements from uranium-ore tailings that Kazakhstan had mined in the past. The plant had set a total output target of 1,500 t/yr of rare-earth oxides (REOs) during the initial years and planned to export the REOs to Japan in 2013 (USGS, 2014). Alongside private companies and JOGMEC, some national bodies are working on research to substitute critical metals. One of the best

known initiatives is the "Element strategy" which aims to understand the function of each element deeply with the objective of substituting, reducing and recycling critical raw materials (Nakamura and Sato, 2011).

Japan's resources policy includes not only securing the supply of primary raw materials via agreements with national countries but also direct investments by private capitals in overseas mines. During years Japan has invested in over 40 iron, nickel, copper, zinc and gold mines in Southeast Asia, Australia, North and South America, and Africa. Most of these investments have been made with the objective of securing an influential, but a minority share of ownership in the target companies. For rare metals and rare earths JOGMEC strives to strengthen relationships with Bolivia, Southern African countries (e.g. Republic of Botswana), Vietnam, Central Asian countries and Canada. In the latter, for instance, JOGMEC has a joint venture with the Montreal-based Midland exploration company in the Ytterby project. For copper, most of the cooperation is with Chile: almost 40% of Japan's copper imports are sourced from there and recently (August 2014) Japan signed a series of deals on science and technology centred on the copper industry. Japanese companies own shares in many of Chile's major copper producing mines: Pelambres (40%), El Tesoro (30%), Escondida and Collahuasi (12%). More recently, Japan's Pan Pacific Copper and Mitsui have fully financed the development of the Caserones copper mine. For lithium, JOGMEC built multiple processes for manufacturing lithium carbonate from brine water in the Uyuni salt lake in Bolivia.

4.3 Water resources

While Japan is not a water-stressed country per se, water availability varies substantially between years, seasons and regions leading to regular and serious water shortages. Annual precipitation in Japan is approximately 1,718 mm, roughly two times as much as the world average of about 810 mm (MLIT, 2008). The annual use of water in Japan (amount of water intake) is approximately 83.5 billion m³

in total which can be broken down into approximately 16.2 billion m³ for domestic use, 12.1 billion m³ for industrial use, and 55.2 billion m³ for agricultural use. The annual amount of use of groundwater is approximately 10.8 billion m³ in total, (roughly 12% of the whole amount of water used) which can be broken down into approximately 3.7 billion m³ for domestic use, 3.8 billion m³ for industrial use, and 3.3 billion m³ for agricultural use (MLIT, 2008). With its abundant water resources, Japan has strong hydroelectric potential, and as a result the country has developed one of the world's largest hydroelectric industries. In spite of that, due to its low food self-sufficiency rate and the need to import food, Japan's virtual water trade balance indicates that Japan is a large net importer of water (Hoekstra and Hung, 2003). From 1997 to 2001 Japan's imports of water-intensive goods saved the country 94 billion m³ of water that would have been required if Japan had produced the goods domestically (World Trade Organisation, 2010).

4.4 Climate

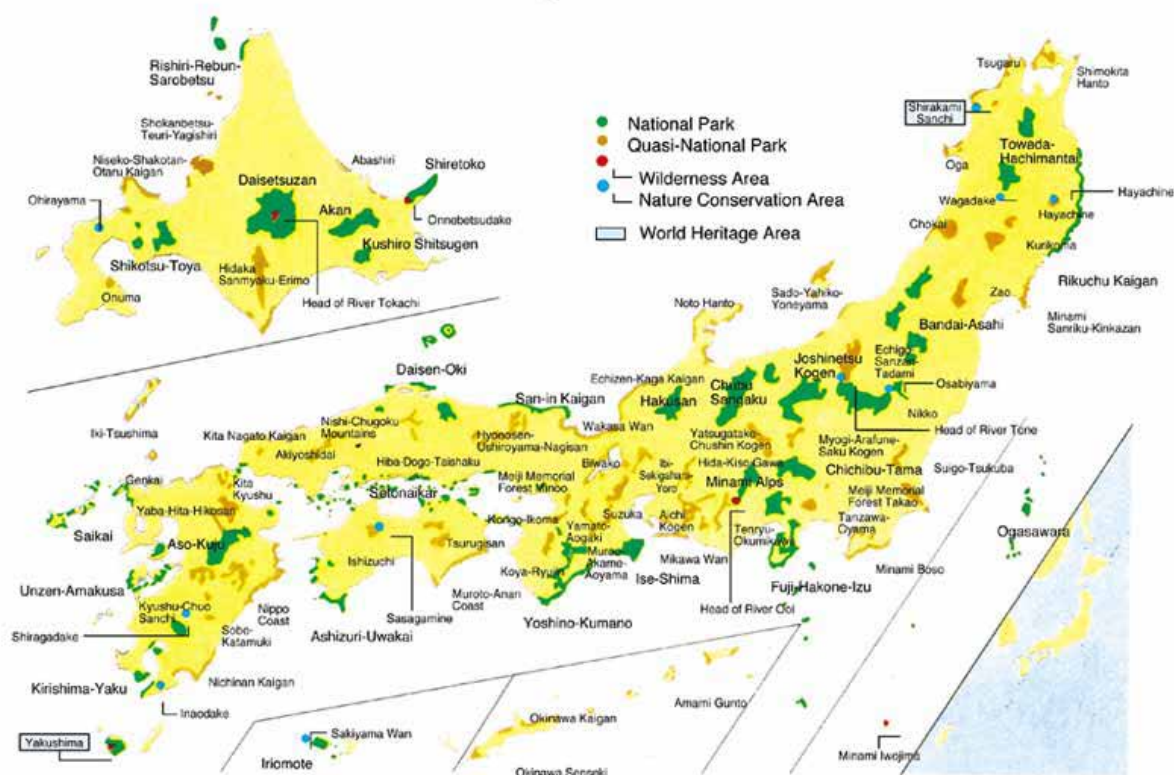
Throughout its history Japan has been subject to periodic natural climate-related disasters such as typhoons, torrential rains, heavy snow falls, flooding and the regular possibility of crop failure (OECD, 2011). About half the population and full three-quarters of its economic assets are concentrated in flood-prone areas and almost five and a half million people live in areas below sea level (OECD, 2009). Against this backdrop, Japan has acquired high level of expertise in dealing with floods, constructing flood defences, advanced flood warning and has developed a total disaster management systems.

4.5 Geological Factors

Being situated near major tectonic plate boundaries and on the Pacific Ring of Fire, Japan has a long history of large earthquakes and seismic activity which has fostered a deep awareness of earthquake (and related tsunami) risk

Figure 2: Japan's ecologically sensitive areas.

Location Map of National Park, Quasi-National Park, Wilderness Area, Nature Conservation Area and World Heritage Area



Source: Japanese Ministry of the Environment, 2015

across the nation. This has resulted in the country developing some of the highest standards for building codes and risk mitigation which may still be outweighed by natural disasters like the Tohoku-oki earthquake and tsunami on March 11, 2011.

4.6 Ecologically Sensitive Areas

Owing to its diverse geology, geography (island characteristic) and climate, Japan is a country rich in biodiversity. However, as a result of accelerated development over the last century, and particularly the post-war decades, Japan's natural environments and the wildlife which inhabit them have come under increased

pressure. Now, much of Japan's natural forest, wetlands, rivers, lakes and coastal environments have been destroyed or seriously degraded as a consequence of development and pollution (Knight, 2010).

Framed by the Nature Conservation Law, Japan's onshore ecologically sensitive areas include national and quasi-national parks, wilderness areas, nature conservation areas and world heritage areas, widely distributed around the country (**Figure 2**). Additionally Japan also features 50 onshore and offshore Ramsar sites (wetlands), including coral reefs.

5. Socio-cultural factors

5.1 Historical Background

Japanese history goes back many centuries in time but the main developments which allow explaining its current situation took place in the last 150 years. During its recent modern history Japan has become known worldwide first due to its "Japan Inc." brand and then mainly due to their manufacturing industries (mainly electronics, automotive, machine tools, ships, chemicals). During the Meiji restoration era (after 1868) Japan opened its ports and eyes to the Western commerce and trade and has since then guided its economic development by the slogan "wakon yohsai" (Japanese Spirit, Western Technology). The Japanese government actively pursued Western-style reforms and development, hiring more than 3,000 Westerners to teach modern science, mathematics and technology to Japan (EconomyWatch, 2013). Likewise, the government sent large numbers of capable students to study abroad which would return to Japan and replace foreign instructors. Even though "Westernization" was interrupted in some periods, it remained as a huge influence. Also a large influence is found in Confucianism and Neo-Confucianism values which were successfully merged with the capitalist production system (Chan, 1991).

Based on a steady foreign learning, high investments in education, a world-class health system and trade policies continuously ensuring the supply of raw materials, Japan achieved an astonishing economic development during the high growth era (1955-1975). In those years a national consensus shared by all economic agents (business, government and labour) and led by a centralized national government allowed a rapid process of catch-up with North American and European industrial economies; in some industries Japanese industry overtook Western competitors. The development of manufacturing industry in Japan created the "Pacific Industrial Belt" which flourished during many years, and Japan became a

worldwide leader in the automotive and electronics industries. Even though such industries declined during the stagnation period of the 1990s and 2000s, trade policies ensuring a stable and competitive supply of raw materials have expanded flexibly, now mostly based on bilateral agreements.

5.2 Human geography

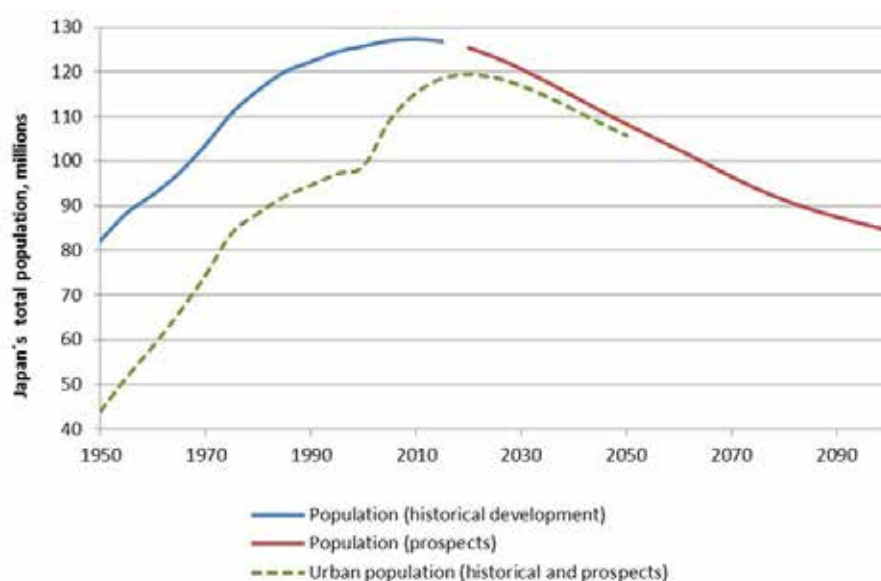
5.2.1 Demographics

A coarse breakdown of Japan's demographic transition shows three periods: a period of high fertility and high mortality rates (up to 1870); a period of high fertility rates but low mortality rates (1870–1960); and a period of low fertility and low mortality rates (1960–present) (JICA, 2003). By 1926 Japan's population had reached 60 million and after World War II it was at almost 72 million. By 1967 the population surpassed the 100 million mark. The population kept growing in the period 1950-1975 at an annual average rate of 1.2% and reached 110 million in 1975. In the subsequent period the growth rate was slowed down to an annual rate of 0.4% driving a growing population which peaked in 2010 at 127 million. In the subsequent five years (2010-2015) the population annually decreased at a 0.08% rate and has fallen to 126 million by 2015. It is forecast that the population will keep on declining and, by 2100, reach a level similar to 1950 (slightly over 82 million inhabitants).

The percentage of the urban population was already 53% in 1950 and started increasing rapidly during the urbanization which took place after the 1960s, driven to a large extent by the young workers' migration programme ("Shudan-shushoku") (Otsubo, 2007).

The latter was implemented by the Japanese Ministry of Labour during the period 1954-1975 and involved a significant rural-urban transfer of young qualified workforce (named "golden eggs") to cater for the labour shortage in the cities. In the period 1955-1975 the percentage

Figure 3: Total and urban population. History and prospects (1950-2100).



Source: UN (2014a), estimates and medium fertility variant

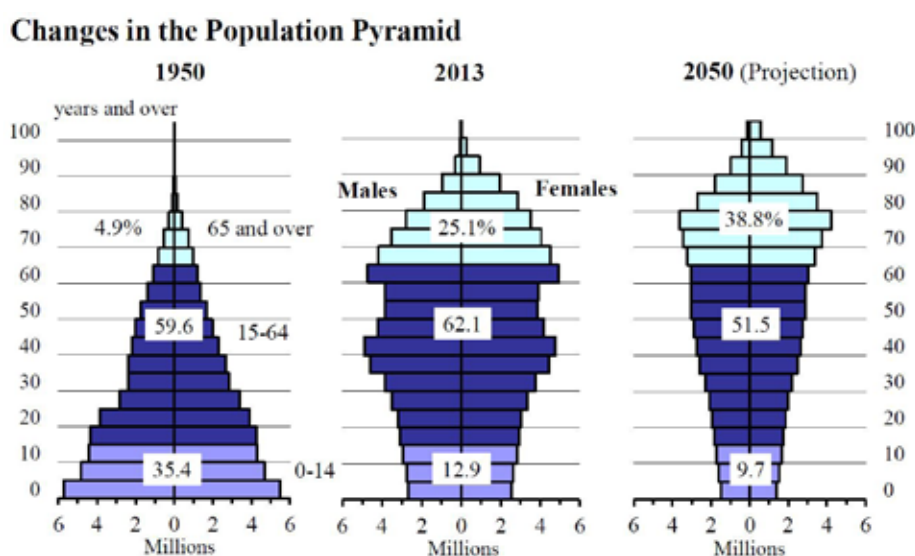
of urban population jumped from 58% to 77%; it currently stands at 93.5% and is expected to reach 97.7% by 2050 (UN, 2014b).

The population pyramid (see Figure 5) shows the transition in Japan from a standard-shaped pyramid (broad base of young people) in 1950 to an aged (and ageing) pyramid currently as both the birth and death rate have declined. The speed of ageing of Japan's population is much faster than in advanced

Western European countries or the USA, and Japan has the oldest population in the world. In 2013, the population aged 65 and above reached 25.1% (31.9 million) of the total population in Japan in contrast to 15% in Canada, 14% in USA or Australia and 6% in South Africa.

It is expected that the aged population (65 and over) will increase to 29.1% in 2020, 31.6% in 2030 and 38.8% by 2050 (Statistics Bureau, 2014). By 2050, it is expected to surpass the aged populations

Figure 4: Japan – Changes in the population pyramid (1950, 2013 and 2050).



Source: Statistics Bureau, MIC; Ministry of Health, Labour and Welfare.

Statistics Bureau (2014)

of all Western Countries and the USA, and this is likely to have an adverse impact on the economy. There has traditionally been a high savings rate in Japan. However, as elderly people tend to spend their savings, whilst this will increase consumption, the reduction in the purchase of Japanese government bonds will affect the cash flow cycle of the economy (Rimkus, 2012). In 2005, the natural change rate¹ (per 1,000 people) fell for the first time since 1899, and has since been on a declining trend. In 2013, the natural change rate was -1.9 per 1,000. The decline in the birth rate may partly be attributable to the rising maternal age at childbirth. The average age at first childbirth rose from 25.6 in 1970 to 30.4 in 2013. Average life expectancy in Japan climbed sharply after World War II, and is today among the highest levels in the world. In 2013, the

¹ i.e. the birth rate minus the death rate.

life expectancy at birth was 86.6 years for women and 80.2 years for men setting a record (Statistics Bureau, 2014), with Japan nowadays ranking 3rd in the world after Monaco and Macau (CIA, 2015a).

With regards to its spatial distribution, the Japanese population is spread in the four «home islands» (Hokkaido, Honshu, Shikoku and Kyushu) and over 6,800 smaller islands. At 378,000 km², Japan's surface area is larger than Germany. However, 75% of its territory consists of steep mountains, ravines, forests and wasteland, inimical to human habitation (Stratfor, 2012).

Honshu is the biggest island (taking up about 60% of the country's surface), with well over half the country's population, particularly due to the Tokyo-Yokohama urban area (largest in the world) housing over 37 million inhabitants (Demographia, 2015), i.e. a population larger than Canada or Australia. After Tokyo the major

Figure 5: Population density by Prefecture (per km², 2010) and major cities.



Source: Statistics Bureau (2014) and Citypopulation (2015)

cities are Osaka (2.6 million) and Nagoya (2.2 million), followed by Sapporo (1.9 million), Kobe (1.5 million). The highest population densities are by far found in the Tokyo-Yokohama urban area, and then in Osaka and Nagoya.

5.2.2 Ethnic composition

Japan belongs to the group of more ethnically homogeneous countries in the world (Fisher, 2013). One of the few native groups formally recognised by the government is the Ainu of whom only a small group remain fluent in their traditional language.

5.2.3 Language

The number of individual languages listed for Japan is 15, and these are all identified as living languages (Lewis et al., 2015). There are a large number of dialects throughout the four main islands and the smaller islands. Some dialects such as those spoken in the southern parts of Japan (Kyushu, Okinawa) are incomprehensible to the speakers of other dialects, requiring the use of the standard dialect. The two dialect families with the largest number of speakers are the dialect spoken in and around Tokyo, which is equivalent to the «common» dialect, and the dialects of the Kansai region spoken in western Japan in cities such as Kyoto and Osaka (Miyagawa, 1999).

5.2.4 Religion

Shinto and Buddhism are Japan's two major religions (Japan-guide, 2015). Shinto is as old as the Japanese culture, while Buddhism was imported from the mainland in the 6th century. Most Japanese consider themselves Buddhist, Shintoist or both. Yet, Confucianism, even more than Shintoism and Buddhism, is claimed to have been the ideological inspiration and ethical orientation during the Taika Reform, the Meiji Restoration and after World War II (Pittau, 1999). Christianity has been only a minor movement. Religion has been claimed to be much interlinked with the economy in Japan. The Japanese value system, which emphasizes harmony or communion with one's environment (in a broad sense including not only material objects but also words and

spirits of ancestors), can be traced back to Shintoism. Shintoism teaches that spirits are present everywhere in nature. Every natural phenomenon such as a mountain, lake, tree, waterfall and even rock has a spirit. In this sense, the devotion of Japanese workers and businessmen to their work stems from religious convictions (Koizumi, 1977). In the Japanese logic, if receiving profits is made possible by doing business that is designed to benefit other members of society, as long as one's business benefits others, one acquires the right to secure benefits for oneself. In other words, there is no contradiction between commercial activities and Confucianism. As long as profit making was for the good of the community, commercial activities are ethical (Ornatowski, 1996). If the profit motive is highly commendable, a successful businessman has every right to be respected and such respect can be turned into human worship. For Japanese, even in pursuing such a secular activity as business, there comes a point where the distinction between economic motive and religious conviction ceases to exist and it becomes futile to distinguish *homo religious* and *homo economicus* in the Japanese (Koizumi, 1977).

5.2.5 Cultural Norms, Values & Conflicts

The fundamental orientations of (Neo) Confucianism still form the ethical underpinnings of the Japanese economy today. From this Confucian attitude it can be argued that Japanese see themselves primarily as members of groups in which specific intragroup or intergroup relationships take precedence. These relationships and associated values are evident in the employment system, particularly in big corporations where employees have a 'job for life' (*shushinkoyou* system). In this system, promotion and salary is based on length of service, the rights and duties of employer and employee are extended to their families, and the company often provides most of the employee's basic needs (Pittau, 1999). In such a system loyalty and benevolence to the company is the most important virtue. The Japanese executive tends to think of himself as a community builder as much as a

profit maker, and considerations of prestige and social responsibility can weigh as heavily with him as monetary reward (Pittau, 1999). Accordingly in Japan employees are not just considered to be an asset; they are the bed-rock of an organisation because Japanese employees live for and through their jobs. By 2001, having survived the economic stagnation in Japan during the 1990s, roughly 87% of the Japanese workforce was in a lifetime employment situation (Uzama, 2008).

Another cultural norm which has been posited as precondition for Japan's economic development is collectivism (collectivist values) and the development of national goal congruency, i.e. shared goals among different stakeholders. This took place in Japan and other Asian countries driven by nationalism in the face of much national adversity (Bhawuk et al., 2009). During the period of the high growth, the Neo-Confucian culture supported and enabled the economic development as Confucian values of education and learning fostered labour productivity, "familism" and loyalty smoothed labour-management relationships (Chan, 1991; Ornatowski, 1996). Such values were very important in Japan, which rapidly achieved virtually full literacy by the turn of the 20th century, a success possible due to parents' eagerness to send children to schools (and not only a result of compulsory education) (Odagiri and Gotō, 1996).

According to Hofstede's model, Japan ranks with an intermediate score in "power distance", i.e. it has a borderline hierarchical society in which business decisions are made in a hierarchical way but not by any single person; decisions must be confirmed by each layer. In this sense Japan is not as hierarchical as other Asian cultures (The Hofstede Centre, 2015).

In terms of individualism, Japan scores low as it is intrinsically a collectivist society, in which the harmony of group has an importance above the expression of individual opinions. However, Japan is not as collectivistic as other Asian nations, and the most popular explanation for this is that the Japanese society does not have an extended family system, which forms the basis of more collectivistic societies

such as China or Korea. Japanese do not work hard for personal distinction, but rather for the good of the group. If an employee gives it all, the firm, the same as with the family, is expected to give something in return (OECD, 2011). In relation to "masculinity", a dimension addressing the extent to which a society is driven by competition and achievement (The Hofstede Centre, 2015) Japan appears as one of the most masculine societies in the world. However, competition tends not to be between individuals, but between groups; for instance competition may occur in corporate behaviour and be stimulated by the drive for excellence and perfection in material production and presentation in every aspect of life (The Hofstede Centre, 2015).

With regards to avoiding uncertainty Japan scores very high as Japanese plan as much as they can, e.g. to reduce risks of natural disasters. From cradle to grave life is highly ritualised and, in corporate decisions, much time is taken to map all risk factors before any project can start. In terms of long-term orientation, Japan also scores very highly with Japanese seeing their life as a very short moment in a long history of mankind (The Hofstede Centre, 2015). In corporate Japan, long-term orientation occurs in a number of ways, for example: in the constantly high rate of investment in R&D even in economically difficult times; in a generally high "own capital" rate; in priority being given to steady growth of market share rather than to a quarterly profit, and so on. The idea behind it is that the companies are not expected to make money every quarter for the shareholders, but to serve the stakeholders and society at large for many generations to come (The Hofstede Centre, 2015).

5.2.6 Civil society & environmental awareness

Traditionally civil society in Japan has been considered as passive or docile, which is, to a certain degree, explicable because of government regulations and restrictions (Hirata, 2005). It has been characterised by some as weak, politically ineffectual, without genuine labour unions and it has been claimed that "company

loyalty" precludes political activism (van Wolferen, 1993). However, more recently, it has been determined that there is a growth of critical NGOs in Japan which explain a recent rise of activism; state officials are now paying more attention to NGOs (Hirata, 2002). Japanese companies, having experienced first-hand the harmful effects of pollution during Japan's exceptionally rapid economic growth in the 1960s or more recently during the Fukushima Daiichi nuclear accident in 2011, have continuously strengthened their environmental conservation capabilities over the years. At the same time, there has been a notable increase in the environmental consciousness of the government and people of Japan (Ito, 2006).

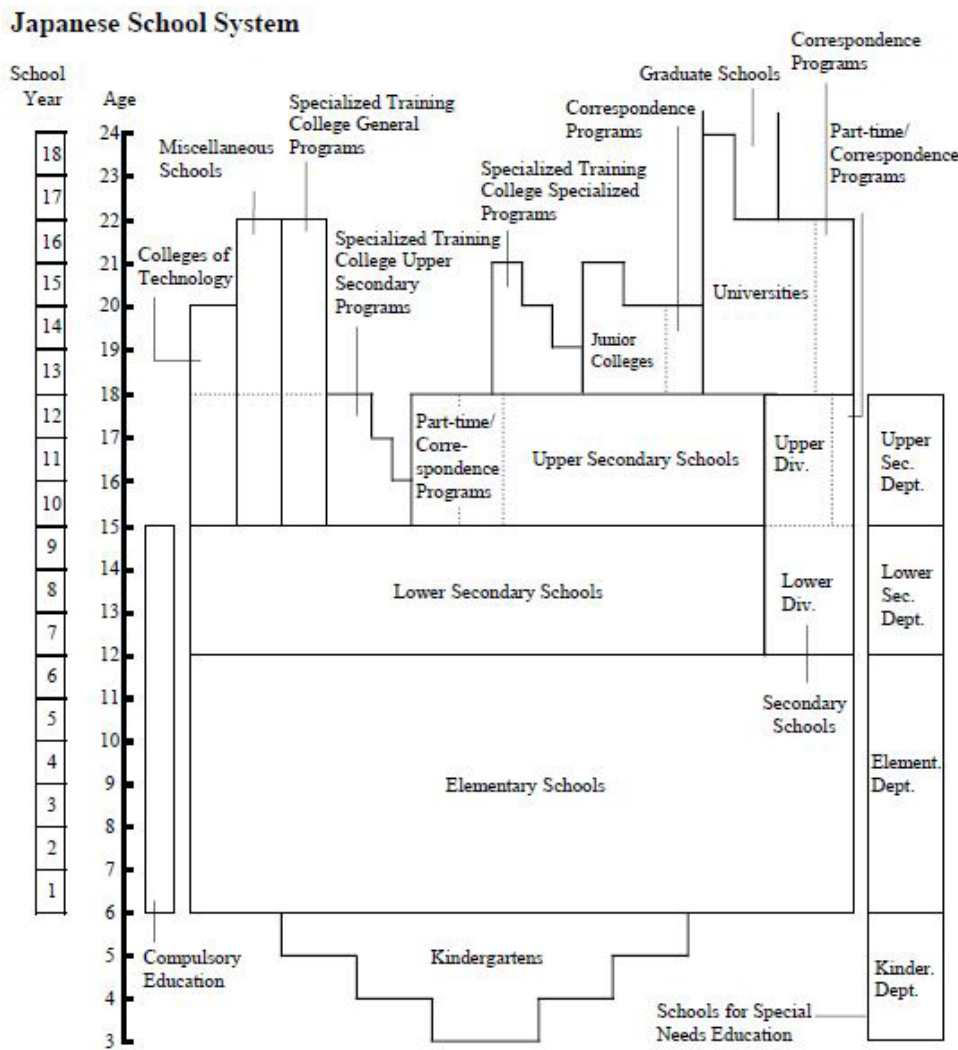
5.3 Education

5.3.1 Education system

In Japan, it was recognised early on that a lack of indigenous natural resources meant that the best way to succeed was through developing human capital. The result is a culture in which great value is placed on education and skills and on group and social relationships (OECD, 2011), a fact that has led authors to identify education as one of the most important prerequisites for economic success (Teichler, 1989).

The investment by the Japanese in a compulsory elementary and lower secondary level education (education is compulsory only until the age of 15, i.e. until the end of junior high school) and in a strong

Figure 6: The Japanese school system (2014).



Source: Ministry of Education, Culture, Sports, Science and Technology

higher education system laid the foundations for Japan's economic development (Odagiri, 2006). Japan's primary, secondary and tertiary education is based on a 6-3-3-4 system: 6 years in elementary school, 3 in lower secondary school, 3 in upper secondary school and 4 in university. Higher education institutions are universities, junior colleges and colleges of technology. The period of compulsory schooling is the 9 years at elementary and lower secondary schools. However, even when the compulsory schooling period ends, the percentage of students advancing to upper secondary (or high) school stands at 98.3% (2012) (in comparison to a 43% in 1947).

Although the number of all school students who undertake a course of study after completing high school has been particularly high in recent years, and is still above 50%, it is generally very difficult to gain admission to a Japanese university. The entrance examinations are especially difficult. There are basically two types of university: those offering a four-year course, which concludes with a Bachelor's degree and which then can then lead to a Master's or a Doctorate course of study; and those offering a short course, which lasts two years and provides quicker entry to a career. An important element of the education system in Japan is the system of *juku*, known as 'cram schools'. These are special private institutions which complement the lessons in regular schools and especially to prepare for entrance examinations to the next level of school. One third of Japanese children as young as elementary school age are sent to these institutions (Deutsche Industrie- und Handelskammer in Japan, 2015).

As education is highly-valued in Japan, the rate of illiteracy or other learning problems is practically zero. The high level of literacy in Japan goes back in time. By 1850 at least a quarter of the Japanese were literate, putting Japan about even with Europe (OECD, 2011). During the Meiji Restoration era (1868-1912) the Japanese decided to match the achievements of the West in education, science and technology and, for that, they borrowed administrative schemes and pe-

dagogical paradigms from France, Germany, England and the USA. The modern nation state decreed universal, compulsory education and abolished class distinctions; they needed every Japanese citizen to be as well educated as possible (OECD, 2011). In 1890 the Imperial Rescript of Education was released which restated Japanese values guiding the new compulsory education system emphasizing Confucian virtues of loyalty, respect for one's elders, and the importance of modesty and moderation, among others.

The Japanese, like most East Asians, believe that academic achievement is more a matter of effort than natural ability (OECD, 2011), and they therefore demand that the effort be made and have high expectations. Doing well in exams is a paramount requirement for getting a good job. Japan has a meritocratic society and high school and university entrance exams represent gateways to status in Japanese society. Exam success does not only reflect on the individual (and their intelligence or capacity) but also on their mother, other family members and teachers. This network of support shares the responsibility for failure and creates pressure to succeed (OECD, 2011). This has changed with the new Fundamental Education Law passed in 2006 which allows the use of other criteria than entrance exams results to determine entrance to Japanese colleges. This new law provided more flexibility and time for students by reducing the school week from six to five days and reduced the curriculum emphasis on rote learning and memorization in favour of experimentation. A new course, the Period of Integrated Study has been added which aims at fostering student's abilities in problem-solving and introduces experimental learning.

The comparatively good educational performance in Japan is explained to some extent by the value ascribed to belonging to a group. Strong group identity means that individuals gain esteem, acceptance and status by doing things that the group values. The emphasis and primary goal of Japanese teachers at schools is student engagement, e.g. students are engaged in class to resolve

practical problems and all conceptual and mathematical foundations are learned through practical problem solving. The point of teachers' questions is not to get the right answer but to make students think, i.e. to stimulate real understanding (OECD, 2011). Practical education, such as commerce and engineering, on top of purely scientific education was very important in the catch-up process during the Meiji era and the post-WWII period. Most of the engineer-turned entrepreneurs of pioneering firms in Japan were graduates from Kogakuryo (later the Engineering Department of Tokyo University) and similar educational institutions (Odagiri and Gotō, 1996).

Another key to the quality of Japanese education is the quality of teachers. Teaching is seen with high regard and respect, it is a highly desirable job and teachers are still by law among the highest paid of civil servants. Because they do not want to let the group down, teachers work hard to develop superior lesson plans, to teach them well and to provide sound and constructive critiques of colleagues' lesson plans (OECD, 2011). The deeper purposes of the system go way beyond the development of students' cognitive capacities to the development of members of a society with values based on ethical behaviour, meritocratic advancement and social cohesion. The entire system is aligned not just to produce high student achievement but to help the whole country realize its fundamental societal values (OECD, 2011).

5.3.2 Education infrastructure

Japan ranks 10th in the world in the category "Quality of primary education" of the Global Competitiveness index and ranks 3rd globally in the primary education enrolment rate with a 99.9% (World Economic Forum, 2014). Yet its tertiary education enrolment rate is not as high, it ranks 39th in the world with a rate of 61.5. Japan spends a 3.5% of its GDP on education, lagging behind the USA for instance (6.5%). It is widely accepted that the educational system produces highly qualified and effective workers (Ito, 1996).

The Japanese spend less on their schools than a number of other OECD countries

but get better results. One reason is that they spend their money differently, i.e. schools are perfectly functional but very plain. For instance, there is no cafeteria and students serve the meals from a central kitchen to their teacher and classmates in the classroom; students are also responsible for cleaning their classroom, textbooks are very simply produced in paperback format and are much smaller than in many other industrialised countries. Money is allocated to teachers and instruction instead of buildings and facilities, non-teaching staff, central office specialists and administrators, full colour glossy textbooks, etc. (OECD, 2011). Japan ranks second (after Switzerland) in the world under the category "extent of staff training" (investment in training and employee development) of the Global Competitiveness index 2014.

Japanese schools are focused on equity: there is no tracking, classes are heterogeneous and no student is held back or promoted on account of ability. The system is set up so that high-achieving students can help lower-achieving students within a group, within a classroom and within a school. Research literature shows that all students are helped by this approach, because the students who teach and tutor learn as much or nearly as much in the process of tutoring as the recipient of tutoring (Cohen et al., 1982). In the educational system the only tests (besides some tests administered to only sample of students) are the entrance exams for high school and university; the drawback of this is that such exams create extreme pressures on the students which may lead to detrimental results in case of failure, at the worst suicide.

As of 2010, more than 2.8 million students were enrolled in 758 universities (including public and private institutions and colleges). Major subjects include social sciences (business, law, and accounting), humanities and engineering. The proportion of tertiary-educated adults in Japan increased from 34% to 47% between 2000 and 2012. In 2010 public expenditure on education in Japan was 22.8 trillion yen, which was equivalent to 14.3% of the net expenditure of national and local governments. With regards to

mineral resources, a leading Japanese university is the Akita University (successor of the National Akita Mining College established in 1910), where a series of skills related to mining operations are taught, ranging from prospecting, exploitation, smelting, to environmental conservation. The former also hosts the International Centre for Research and Education on Mineral and Energy Resources (ICREMER), which actively cooperates with universities and research institutions engaged in the field of resource studies in resource-rich countries, providing assistance to the formulation of their programs to enhance education and research capabilities and to their human resource development.

5.4 Health

5.4.1 Health system

In Japan universal medical care insurance (*kaihoken*) was established in 1961 and provides a world-class health system and low healthcare expenditure per capita as compared to other industrialised countries. For 2013 the per capita healthcare expenditure (in current USD) reached 3,966, which is considerably lower than in the USA (9,146), Canada (5,718), or Australia (5,827) but substantially higher than South Africa (593) (OECD, 2014; World Bank, 2015b). Japan spent around 10.3% of its GDP in 2012 on healthcare (public and private spending), making it the 3rd largest healthcare spender in the world after the USA and China. Around 66% of the system is financed by the government (The Economist, 2011). Public health insurance covers most citizens and pays 70% or more of the cost of each treatment or procedure and of prescribed drugs. Together with improvements in the living environment and better nutrition, as well as the high standard of the healthcare provided, this medical care system has contributed to Japan achieving one of the highest life expectancy rates in the world and also a dramatic improvement in general health throughout the population. Between 1950 and 1975,

the average life span of the Japanese was lengthened from 60 years for males and 63 years for females to 71 and 77 years, respectively. It continued to lengthen after the end of the rapid growth period, and now stands at 81.4 for males and 88.2 for females (CIA, 2015b).

Currently, reform of the whole system is being undertaken in order to preserve the stability of this medical insurance system in the future. In Japan, every citizen, including the unemployed, can enrol in the National Healthcare Insurance (NHI) system. A rapid increase in health care expenditure due to Japan's ageing society and the growing prevalence of chronic diseases has prompted the government to launch a number of initiatives to control spending, such as encouraging the use of cheaper generic drugs and increasing preventive care and self-management of chronic diseases (Deloitte, 2014).

Another consequence of the high living standards and the medical system can be seen in that Japan boasts one of the lowest infant-mortality rates in the world. For 2013, the mortality rate was 2 per 1,000 live births; lower than but comparable with the USA (6), Canada (5), Australia (3) but in contrast to South Africa (33) (World Bank, 2015c). However, Japan also experiences one of the highest suicide rates in the world (around 30,000 persons per year since the late 1990s) (McCurry, 2014) and the population is affected by smoking issues.

5.4.2 Health infrastructure

Japan's medical care infrastructure ranks among the best in the world which partly explains the high life expectancy rates. During the high economic growth era public and private investment improved the health infrastructure which improved health conditions and increased labour quality (Mosk, 2004). Currently Japan ranks 15th globally under the indicator "health infrastructure" (Institute for Management Development, 2014).

6. Economic factors

6.1 Economic Geography

6.1.1 Economic structure

Japan's current economic structure (in terms of GDP per economic sector, period 2002-2012) is led by the services sector which has maintained a share of 69%-73%, followed by industry with a share oscillating between 29% and 25% and a small agricultural sector representing around a 1% of the total economy (Statista, 2015). This is the result of a process of rapid industrialization in which, from 1955 to 1970, the share of total nominal GDP represented by primary industry decreased from 19.2% to 5.9%, while that of secondary industry increased from 33.8% to 43.1% (Otsubo, 2007). During the 1980s, the proportion of persons employed in secondary industry and related GDP also began to decline gradually. On the other hand, the proportions of both employed persons and GDP in the services sector (banking, finance, power and water, insurance, real estate, transportation, communications, public administration) have risen consistently. In 1970, primary industry accounted for 19.3% of employed per-

sons, secondary industry 34.1% and tertiary industry 46.6%. In 2010, the corresponding shares of these three sectors were 4.2%, 25.2% and 70.6%, respectively (Statistics Bureau, 2014). The construction industry, accounting for about 10% of both GDP and all employed persons, is one of the core industries in Japan. The automotive industry is one of Japan's core industrial sectors and accounted for 16.4% (2010) of the total value of Japan's manufacturing shipments, mainly destined in 2012 to North America (35% to the USA), Europe and Asia. The domestic mining industry in Japan is small-scale, low-tonnage and minimal in terms of GDP contributions. However, the mineral processing industry is large and includes the processing and production of chemicals, fabricated metal products, industrial mineral products, iron and steel, nonferrous metals, and petroleum products for manufacturing and construction industries.

6.1.2 Industrial Geography

Manufacturing, which provides most of the nation's exports, is of major importance to Japan's economy and its export-

Figure 7: Japan industrial areas.



Source: *The Human Mosaic: A Thematic Introduction to Cultural Geography* by Terry G Jordan-Bychkov and Mona Domosh, 2010, W.H. Freeman and Company, New York.

led manufacture-oriented growth model.

Mainly as a result of the high growth era, manufacturing industries are spatially concentrated along the Pacific coast of southern Honshu (the "Pacific Industrial Belt"), primarily in the Tokyo-Yokohama, Osaka-Kobe-Kyoto, and Nagoya areas and in northern Kyushu. The concentration in the Tokyo-Yokohama area ("Kanto district or region") is especially large, accounting for about a third of Japan's manufacturing, followed by the Kansai region (Keihanshin district). The principal manufacturing activities include the making of industrial machinery, durable consumer goods (inclusive of motor vehicles and their parts), iron and steel, ships, chemicals, and textiles. With regard to the automobile industry, Japan remains the third largest producer in the world with an annual production of 9.9 million automobiles in 2012 and it provides employment to 8.8% of the Japanese workforce.

Japan's iron and steel industry uses imported ore and coal. Production facilities are modern and highly efficient, enabling Japan to export large amounts of iron and steel and making Japan the second largest producer of pig iron and crude steel in the world after China. Many nonferrous metals are also smelted and refined in Japan. Large-scale concentration of iron and steel industry occurs in the Tokyo-Yokohama, Nagoya, Osaka-Kobe, Fukuoka-Yamaguchi, Oka-Yamaha and Hokkaido regions, all situated near tidewater.

Japanese shipyards (shipbuilding demands around 12% of Japanese steel) account for as much as half of the tonnage launched in the world each year. Most of the ships are large cargo vessels built for foreign fleets; some of the petroleum supertankers have been in the range of 400,000 to 700,000 tonnes. Much of Japan's shipbuilding success has stemmed from cost-cutting procedures and the development of new techniques.

From the 1990s onward, unprecedented exchange rate appreciation led factories to relocate to lower wage Asian countries through foreign direct investment (FDI). More recently, production processes and firm organisation have become more complex; many Japanese firms build pro-

duction networks linked to domestic and overseas production by the purchase of intermediate inputs, FDI and outsourcing (Okubo and Tomiura, 2010) following the modularisation and the "global best outsourcing" (Schaede, 2010) new model imposed by global competition. Overseas expansion by companies in the manufacturing industry is progressing, against the background of the advancing appreciation of the yen after the 2008 Lehman Brothers bankruptcy, or the decentralisation of production bases that occurred after the Tohoku-oki earthquake and tsunami on 11 March 2011 (also known as the Great East Japan Earthquake). As an example, the global operations of Japanese automobile manufacturers continue to grow, focusing increasingly on on-site manufacturing to meet local needs.

According to the Ministry of Economy, Trade and Industry, the number of overseas affiliates in the manufacturing industry was 10,425 companies at the end of 2012, and the overseas production ratio was 20.3%. In the future, it is anticipated that companies in the manufacturing industry in Japan will expand their overseas businesses. There are many companies that are planning on expanding their business to Indonesia, India, Thailand, China, Singapore and, more recently, the Philippines. Recent prospects indicate relocation trends towards the Philippines due to an English-speaking workforce and tax benefits established by the Philippines government (Philippine Economic Zone Authority) (Rappler, 2015). In addition, there is also increasing interest in new markets such as Mexico and Myanmar (Statistics Bureau, 2014). Likewise, not only production but also administrative operations have been shifted overseas; for example, global companies operating in Asia, (such as Nokia, USA medical device manufacturer Medtronic and goods manufacturer P&G) all relocated their headquarters from Japan to Singapore in 2009 (Ministry of Economy, Trade and Industry, 2010).

6.1.3 Commercial Geography

Japan's rapid economic growth over the past century has gone hand in hand with a very distinctive performance in in-

ternational trade. What Japan has sold to the world has changed continuously and dramatically over time and, at the same time, Japan has consistently imported a distinctively low level of manufactured imports (Saxonhouse, 1993). Throughout the high-growth period of the 1960s Japanese imports and exports increased considerably each year, but the type of products exported changed drastically. Whereas textiles and related goods accounted for 30% of overall exports in 1960, by 1970 this percentage had dropped to 12.5%. During the same period the percentage of exports accounted for by machinery and equipment rose from 23% to 46.5%. To support this development, raw material imports of crude oil, liquefied natural gas, coal and other mineral fuels increased in the 1960s and 1970s.

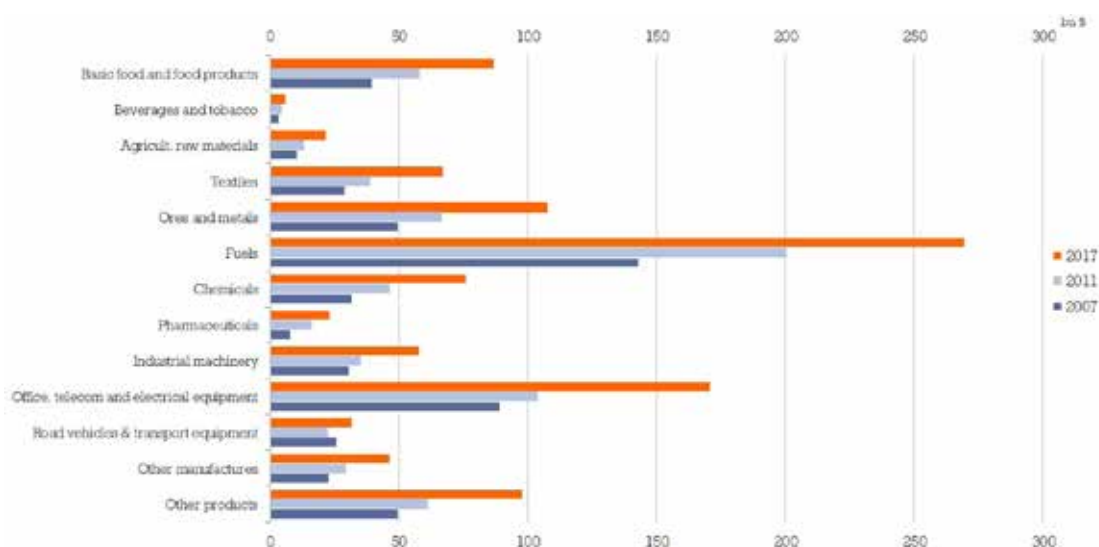
Trade trends during the 1970s were based on a move towards knowledge-intensive industries. Export of machinery and equipment increased from 46.3% of all exports in 1970 to 62.8% in 1980 (with cars leading the segment), placing Japan in the position of a high-technology heavy industrial nation. Japanese exports classified by destination showed a steady growth in Europe, increasing from 13.3% in 1960 to 19.4% of all exports by 1980. By then North America was the destination of 29.3% of all exports and Asia 38% (Sumiya, 2000). Currently, major Japanese imports comprise mainly machinery and

equipment; mineral commodities (iron ore, bauxite, nickel, copper concentrate, lumber, cotton); energy minerals (oil, liquefied natural gas, coal); agricultural products; and fishery products. By 2017 Japan is expected to import mainly fuels, office telecom & electrical equipment and ores and metals which together account for 52% of total imports. In the list of the largest importers worldwide Japan is expected to remain at number 4 in the coming years (ING, 2012). The main origins of imports involve China, the European Union, USA, Australia, and Saudi Arabia. Lumber is mainly imported from Russia, Canada and the USA.

With regards to exports, they mainly include electrical equipment and machinery, electronics, telecommunication and computer devices and parts, transport equipment and motor vehicles, non-electrical machinery, chemicals, and metals (iron and steel).

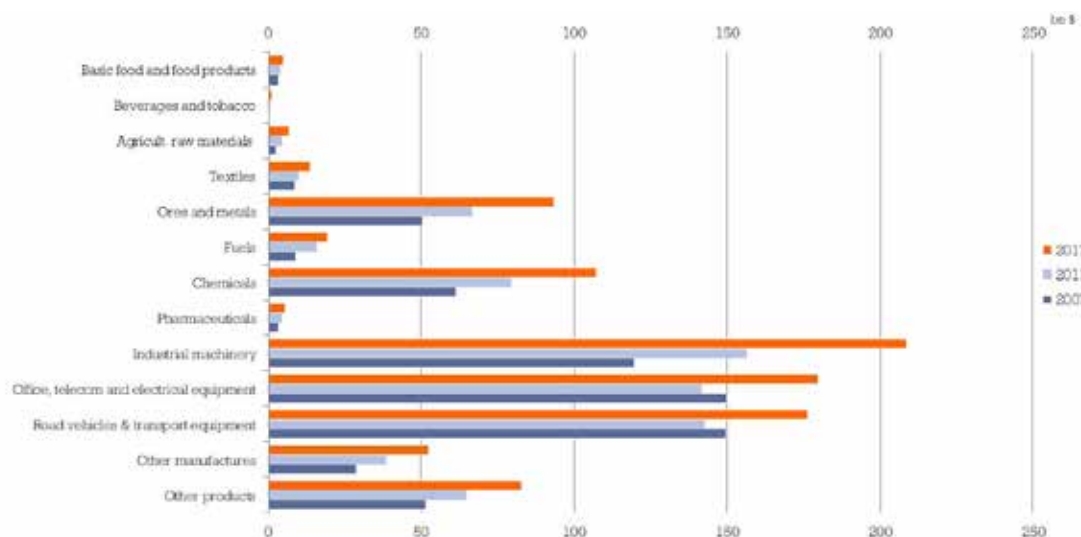
Japan's exports in 2013 consisted mostly of transport equipment (cars, vehicle parts), which accounted for the largest portion of total export value (23.4%) followed by general machinery and electrical machinery, making up 19.1% and 17.3%, respectively. Motor vehicles, which are in the transport equipment category, constituted 14.9% of the total export value. One characteristic of Japan's exports is the large proportion of high value-added products manufactured with ad-

Figure 8: Japan. Imports by product group (billion USD).



Source: ING (2012)

Figure 9: Japan. Exports: key product groups (billion USD).



Source: ING (2012)

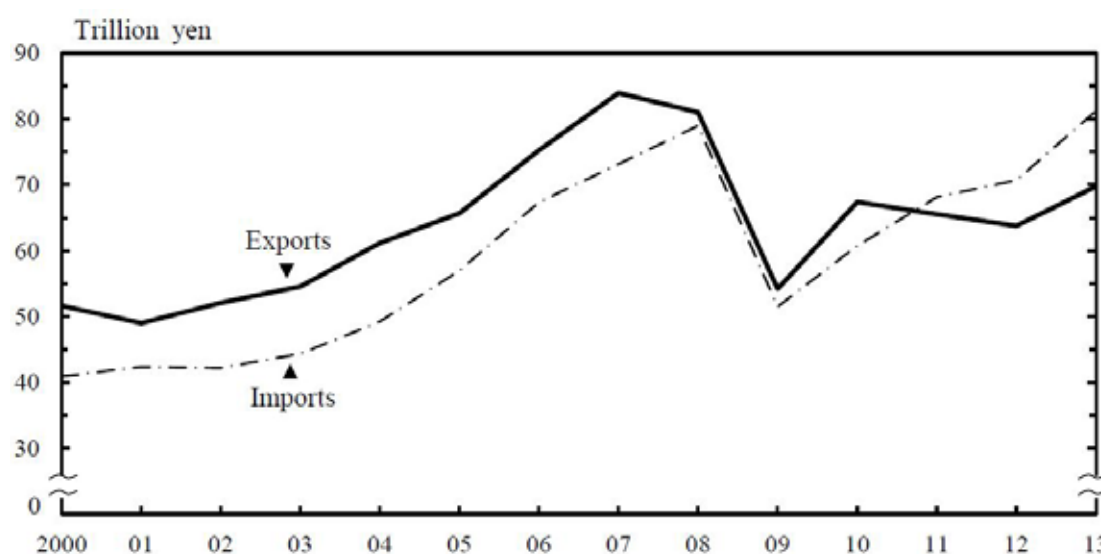
vanced technology, such as motor vehicles, iron and steel, integrated circuits, industrial printers and machinery having specialist functions.

Key destination markets for exports are the USA, China, the European Union, South Korea, Taiwan, Thailand and Hong Kong. In the coming years the rank of Japan in the list of largest exporters worldwide is expected to decrease to position 5 (following a trend of Japan falling in the share of world exports from nearly 10% by 1994 to 4% in 2012). All in all, Japan's major trading partners are the Asian Paci-

fic countries, the USA and the EU, three regions that account for 80% of Japan's trade (Ministry of Foreign Affairs, 2002). Japan's main single trading partner is the USA which is the recipient of 17.6% of Japanese exports and accounts for 10.2% of Japanese imports. China is the top exporter to Japan, accounting for 18.9% of Japanese imports.

With regard to the balance of trade, it was historically positive until 2011 when Japan entered into a trade deficit for the first time in 31 years. Since then Japan has been in a trade deficit. In terms of

Figure 10: Japan's foreign trade (2000-2013).



Source: Ministry of Finance

international and bilateral trade agreements, Japan is pursuing a strategy of free trade agreements. In the view of the Japanese Ministry of Foreign Affairs, free trade agreements (FTAs) offer a means of strengthening partnerships in areas not covered by the World Trade Organisation (WTO) and achieving liberalisation beyond levels attainable under the WTO. Entering into FTAs has been found to be a highly effective way of broadening the scope of Japan's economic relationships with other countries; FTAs lead to the expansion of import and export markets, the conversion to more efficient industrial structures, and increase Japan's bargaining power in WTO negotiations.

In strategic terms, the Ministry claims that priority should be given to concluding FTAs with countries and regions where, despite close economic relationships, relatively high trade barriers exist that pose obstacles to the expansion of Japan's economy. From this standpoint, East Asia is the region with the most promising counterparts for negotiations, and in light of the feasibility criteria and political and diplomatic criteria cited above, the Republic of Korea and ASEAN are the most likely partners for negotiations. At the same time, an FTA with Mexico would be desirable since Japanese businesses have to pay relatively high tariffs, in comparison to the North American Free Trade Agreement (NAFTA) and the European Union (EU) that have already concluded FTAs with Mexico (Ministry of Foreign Affairs, 2002).

6.1.4 Agricultural Geography

In Japan the amount of arable land has been steadily declining since the 1960s; the amount of land under cultivation in Japan declined from 6.09 million hectares in 1961 to 4.65 million hectares in 2006 which constitutes only about 12% of the country's land area (37.8 million hectares) (Stratfor, 2012). The ratio of arable land to population is among the lowest in the industrialised world (OECD, 2011). The temperate climate, and rich soil are conducive to high crop yields, and Japanese farmers historically have been highly efficient. However, the country's food self-sufficiency, based on the amount of ca-

lories consumed, was 39% in 2010 (Barret and Notaras, 2012) compared to 73% in 1965 and the current target of achieving 45% by 2025 (The Japan Times, 2015).

Throughout Japanese history, the three plains of Kanto, Yamato (Kinki) and Nobi provided the greatest agricultural potential and served as the economic, political and cultural centres of Japan, with the Yamato plain as the original centre of power and the Kanto plain later supplanting it. Japan's agricultural production has been led by rice, followed by sugar beet, potatoes and Japanese radishes. Japanese agriculture is characterized as small-scale which makes it uncompetitive. The changes in food consumption patterns have contributed to a decline in Japan's food self-sufficiency since there are considerable imports of wheat and meat. This is against the backdrop that rice and fish were traditionally self-sufficient. The concept of food miles refers to the distance that food travels from where it is grown to where it is consumed. Japan's food miles are much higher than other industrial countries; of the total, 59% of Japanese food miles are attributed to imports from the USA.

6.2 Key Economic Figures

6.2.1 Economic diversity

Japan's economy is highly concentrated in the services sector, including trade, advertising, data processing, tourism and leisure industries, and the manufacturing industries. Major services in Japan include banking, insurance, retailing, transportation and telecommunications. The Tokyo Stock Exchange is the third largest stock exchange in the world by market capitalisation (EconomyWatch, 2013).

6.2.2 Economic output

Japan's highly industrialised market economy is currently the 5th largest in the world measured in terms of GDP on the purchasing power parity basis ("PPP"), after China, the European Union, the USA and India (CIA, 2015c); GDP per capita (PPP) ranks 43rd in the world (CIA, 2015d).

After being devastated during World War II (WWII), Japan's economy was the second largest in the world from

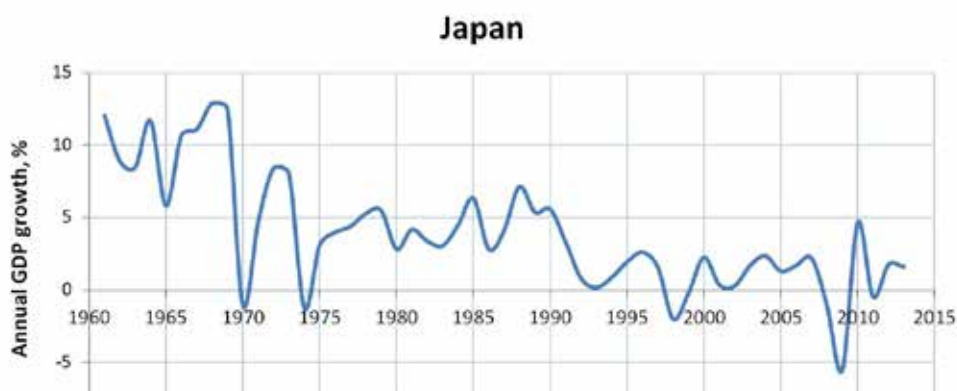
1968 until 2010, when it was overtaken by China. After the recovery period of 1945-49 and the Korean War from 1950 to 1953, the Japanese economy grew by approximately 10% from the middle 1950s to the early 1970s. This rapid economic growth was supported by: (i) expansion of private investments in plant and equipment, backed and enabled by sufficient domestic demand (due to a large population and supported by protection and procurement) and a high rate of personal savings (encouraged by the national government and due to the lack of spending possibilities outside of Japan) which were used by banks for providing loans to expanding companies; (ii) a large shift in the working population from primary to secondary industries, and an abundant qualified labour force supplied by a high rate of population growth; (iii) an increase in productivity brought about by adopting and improving foreign technologies (Statistics Bureau, 2014); and iv) the accumulation of technological capabilities in the early period of industrialization (from the Meiji Restoration until the end of WWII) acquired from abroad by the private sector. Other factors which explain the high growth rate were: 1) a high standard of education; 2) good relations between labour and management; 3) ready access to leading technologies and significant investment in R&D; 4) an increasingly open world trade framework; and 5) a large domestic market of discerning consumers (Department of Foreign Affairs and Trade, 2015; Odagiri, 2006). The horizontal and

vertical *Keiretsu* groups, conglomerates covering industries around one big manufacturer, have also been identified as a key element in Japan's development (Grabowiecki, 2006).

Moreover, the Japanese national government consistently applied 14 economic plans during the post-World War II era, each with a duration of five to ten years with discussions among government sections, businesses, consumers and academia contributing to the national consensus building on development strategies (Otsubo, 2007). These plans influenced the free market economy in an indicative manner (rather than a command-type), i.e. state-assisted capitalism (Ellington, 2004) and were geared to communicate the government's view on the future of the economy to the public and form a national consensus. The economic growth during the 1960s was led mainly by the private sector, by heavy and chemical industries (steel, shipbuilding, petrochemical) and by light industries (automotive, electrical appliances, etc.).

By 1968 Japan had overtaken West Germany and had become the second largest economy in the capitalist world (Ohno, 2006) with, for instance, the car industry already flourishing. In the period between the 1970s and late 1980s collective business practices and government interventions largely remained along with a lack of innovative investment opportunities and poor corporate governance. As a result business firms and financial institutions rushed into speculation in finan-

Figure 11: Japan's annual GDP growth rate (percent, 1961-2013).



Source: United Nations (2015) based on World Bank data

cial and real estate, creating a “bubble” economy. During the 1990s the Japanese economy struggled with the aftermath of the “bubble”: excessive investment; excessive employment and lending; and over-borrowing resulting in excess capacity. This resulted in stagnation, persistent deflation and financial crises. Moreover, post war development was characterized by a persistent trade surplus leading towards accumulation of foreign reserves and the appreciation of the yen (Siddiqui, 2009).

Following the simultaneous terrorist attacks in the USA in September 2001, further slowdown of the world economy became a matter of serious concern, resulting in greater uncertainty over the outlook for the Japanese economy. There were several causes for this long-term slump in the Japanese economy. Among them, the following two factors likely had the biggest impacts. First, Japanese banks were saddled with large nonperforming loans. A vicious circle developed, in which the long-term economic stagnation exacerbated the bad loan situation, while the bad loans hindered economic growth. Second, there was another vicious circle, in which the continuing economic slump led to pessimism about the future on the part of corporations and consumers, and their hesitation generated further recession. Subsequently, the Japanese economy maintained a long-lasting recovery beginning in early 2002.

At the start of 2008, the Japanese economy was faced with a standstill in its path to recovery as private consumption and investments in plant and equipment fell flat and so did production. In early 2011, however, the Japanese economy began to rally. The Great East Japan Earthquake in 2011 and the nuclear power plant accident it caused weakened the economic recovery. In order to achieve an early end to deflation and break free of economic stagnation, in January 2013 the Government of Japan set forth its «three-arrows» strategy (also known as «Abenomics»¹). The first «arrow» is «aggressive monetary policy» to exit deflation through quantitative and qualitative monetary easing by

the Bank of Japan, intended to double the monetary base over two years. The second «arrow» is «flexible fiscal policy». This is an emergency economic stimulus package with a scale of approximately 10 trillion yen. The third «arrow» is «growth strategy that promotes private investment» in order to boost real output growth to 2% over the next decade by encouraging investments by private corporations based on easing of regulations. Based on this, economic conditions have turned toward recovery, as exemplified by an exchange rate that has shifted toward a weakening of the yen, and significant increases in stock prices. Changes have also been observed in the prolonged situation of deflation (Statistics Bureau, 2014).

6.2.3 Labour costs, mobility & employment

In Japan labour productivity has increased but, since 1990, worker incomes in real terms have remained more or less flat (Ministry of Economy, Trade and Industry, 2010). With regards to labour costs, they were low during the rapid industrialization period but they have continuously increased in the last three decades. The sharp increase in Japan of the cost of labour input has been due mainly to the (floating) exchange rate. The currency appreciated from 250-240 yen per US dollar in 1985 to just over 120 per US dollar by the end of 1987 and then further to 84 per US dollar in 1995. The yen would drift weaker to the 100-150 per dollar range for the next decade and a half before appreciating back to the () range of 80-85 per dollar in 2011. This currency movement undid the 0.5% per year decline in unit labour cost in local currency terms that Japanese manufacturing has sustained over the last three decades (The Globalist, 2011).

The Japanese employment system is based on three pillars: lifetime employment, seniority wages and enterprise unionism. The highly valued “Shinsotsu” culture of recruiting batches of new graduates every April is still a vital practice in most Japanese companies. Companies hire, train and develop the future talent of the company in a systematic matter

¹ From the name of the Prime Minister of Japan, Shinzō Abe.

Figure 12: Japan's unemployment rate (percent, 1953-2015).



Source: Trading economics (2015a)

(DISCO, 2012); the wages are kept low for young employees and are increased as their job skills improve with age and experience, earning more (seniority-based wages) as they spend more time in the company. The seniority-based payment system is now being criticized, particularly due to the sluggish economy, and some companies are abandoning it (e.g. Hitachi in 2014).

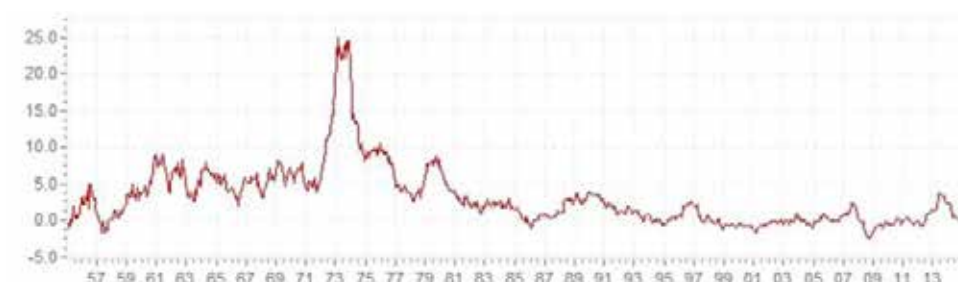
Because Japanese firms generally believe that they will employ people for a long time, there is a strong willingness to invest heavily in the continuing education and training of employees. Employers are interested in applied intelligence, i.e. not just whether a candidate is smart but whether he can do something with his intelligence. Over the long term, the percentage employed in primary industry has been continually falling, while the percentage employed in tertiary industry has been continually rising. The percentage employed in secondary industry has also been trending downward. By in-

dustry, the number of persons employed in the primary industries of agriculture and forestry, and in the secondary industries of construction has been on a downward trend. In terms of occupation, employment in the «manufacturing process workers» category has been declining in recent years, due to the overseas relocation of production sites and increased imports of manufactured goods (Statistics Bureau, 2014). In the period 1953-2014 the unemployment rate in Japan averaged 2.7% and only surpassed 5% in the years 2001-2002 and in 2009. In April 2015 it reached 3.3%, one of the lowest in the last 18 years but not at as low as during the 1970s and 1980s. Despite the stagnant economy during the 1990s the unemployment rate was maintained at reasonable levels.

6.2.4 Interest rates

In Japan the “Extraordinary” Interest Rate Control Law, enacted in 1948 to control increases in interest rates during

Figure 13: Japan's historic CPI inflation (yearly basis, 1955-2014).



Source: Inflation.eu (2015)

the post-war hyper-inflation, survived 40 years and kept deposits and loan rates generally at low levels. Together with this interest rate regulation, the official discount rate (the rate of the Bank of Japan to commercial banks) was also kept at a low level (Otsubo, 2007). The interest rate substantially declined from being around 8% in the beginning of the 1980s, to 6% by the beginning of the 1990s; such high interest rates are considered to have been responsible for triggering the financial bubble in the 1990s (Siddiqui, 2009). Rates were then lowered to a range between 0% and 1% in 1996. From the 2000s the rate has been maintained at 0.1% (Trading economics, 2015b) in order to reduce borrowing costs. Despite years of near-zero interest rates, Japan has suffered chronic deflation over the two decades since the bursting of its real estate bubble in the late 1980s (McBride, 2015), and the economy has remained sluggish.

6.2.5 Inflation rates

In Japan the rate of inflation often refers to the rate of inflation based on the consumer price index, or CPI. The Japanese CPI shows the change in prices of a standard package of goods and services which Japanese households purchase for consumption. In order to measure inflation, an assessment is made of how much the CPI has risen in percentage terms over a given period compared to the CPI in a preceding period. In the period displayed below (**Figure 13**) the inflation rate has been kept low except for a peak in 1974; from the mid-1990s, Japan has been experiencing periodical deflation periods, reflecting a stagnant economy due to restrained labour costs, business fixed investments, restrained consumption, lack of incentives for investment. Since the “Abenomics” era started inflation rates have been around 3%.

6.2.6 Customer liquidation and spending power

Household saving rates have been declining in Japan falling from between 15% and 25% in the 1980s and 1990s to under 3%, reflecting decreasing incomes and the aging population. The debt of Japanese households as a percentage

of net disposable income is around 130%, lower than in Canada, the USA or Australia. Household debts in Japan did not increase considerably in the last decade and a half because the country, the same as Germany, did not experience a housing boom causing debt to accumulate as it occurred in the U.S., Britain or Canada.

Japan has a well-educated, industrious work force and its large, affluent population makes it one of the world's largest consumer markets. Historically, the government took measures to boost the spending power of workers in the era of rapid economic growth by the Income Doubling Plan in 1960. This aimed at doubling workers' income, creating a true mass market and setting high living standards in the period 1961 to 1970 by greatly increasing the amount of central government investments in private and public firms (Takada, 1999). In that period the Japanese understood that, with greater consumer purchasing power, production would be stimulated while also raising the Japanese standard of living. Thus private consumption became increasingly important for Japan's high economic growth, especially attached to the role of women (housewives) as the agent managing household budgets (Garon and MacLachlan, 2006).

The spending power of the Japanese, expressed as GDP (PPP), is very high, totalling USD 4.73 trillion with a global rank of 5, only behind China, the European Union, USA, and India. It had a positive growth of 32.5% in the 10 years from 2003 to 2013, with only a negative growth during the Great Recession years (2007-2009). However, over the 2002 to 2007 period, wages were stagnant or declining despite economic growth (Ministry of Economy, Trade and Industry, 2010) which has maintained stability in domestic private consumption.

6.2.7 Foreign investment

Inward foreign direct investments (FDI) have historically been limited in Japan. As an example, in the late 1980s and early 1990s FDI accounted for less than 1% of the value of assets or of the share of sales or employment. In contrast, outward Japanese FDI flows have become increa-

singly important. After World War II such flows remained low until the 1960s, mainly concentrated in natural resource sectors (to secure the stable supply of raw materials), and commerce (distribution network). During the 1970s the FDI started to increase rapidly with a concentration in Asian newly industrialised economies in manufacturing activities such as textiles and consumer electronics. Outward FDI was deterred due to the oil crisis and only slightly increased by the end of the 1970s with the appreciation of the yen. In the early 1980s the “second FDI boom” took place with much investment related to natural resources (resource development) in developing countries (Urata, 1993). Currently Japanese corporations continue boosting FDI overseas (Ministry of Economy, Trade and Industry, 2010). This shifting towards overseas operations is expected to keep on increasing with Japan being in 2012 the largest source of FDI in the USA for the first time since 1992 (The Japan Times, 2014).

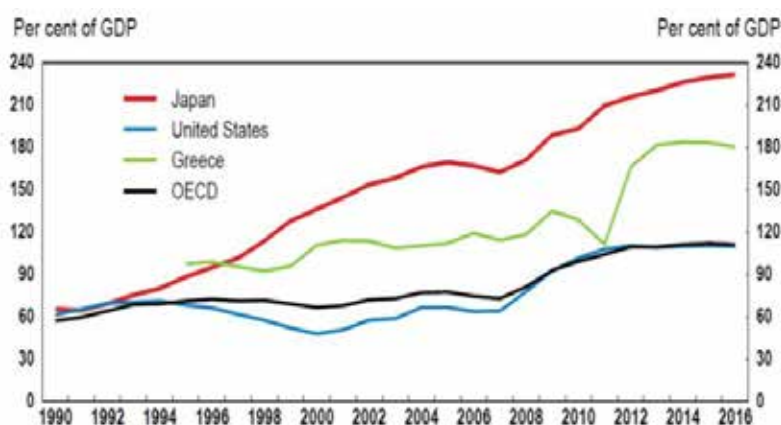
Part of Japan’s outward FDI (Japan’s resources policy) keeps on directed to securing the supply of “target” raw materials for their domestic minerals processing industry, i.e. Japan-based smelters particularly targeting iron ore, base metals, rare metals and rare earths, besides energy minerals. JOGMEC plays an important role coordinating this as it provides key technical, intelligence and financial assistance for active investment in exploration and development by Japanese

companies abroad. For instance, it provides equity capital (for asset acquisition), loans and liability guarantees for metal exploration and development by Japanese companies.

6.2.8 Public finance situation

The national budget has historically been small relative to GDP in Japan, i.e. Japan has maintained a small government, even during its developmental stage. However, this small government has had a key role in Japan’s history, closely coordinating firms, sectors (including horizontal and vertical Keiretsu groups) and finance enabling the Japanese state to organise economic expansion (Bunker and Ciccantell, 2005). Historically, government revenues and expenditure were balanced until 1965 when government bonds for infrastructure were issued (Ito, 1996). Government deficits grew rapidly in the second half of the 1970s and the big budget deficits only occurred since the bubble burst in the late 1980s, particularly during the 1990s. During that decade the Japanese government spent trillions of yen to stimulate the economy and overcome the recession; government expenditure as a share of GDP rose almost 5 percentage points from 1991 to 1995 but revenue as a share of GDP fell 2.5 percentage points. The magnitude of the stimulus effort together with the impact of the recession on tax revenue can be seen in the increase in debt. However, despite the level of government spending

Figure 14: Japan’s public debt evolution (percentage of GDP, 1990-2016).



Source: OECD Economic Outlook Database

and increase in the national debt, the economy's growth remained sluggish.

In 2013 Japan's public debt reached USD 11.9 trillion, the second largest government debt in the world after the USA. If expressed as a percentage of GDP, in 2013 this reached 240%, which is the world's largest and significantly more than several European countries like Greece (150% of GDP), Italy (112% of GDP), UK (77% of GDP) or the U.S (173%), demanding a strategy of GDP growth if the ratio is to decline. Currently, Japanese government borrowing accounts for 7% of GDP. One advantage of Japan against other highly indebted countries like Greece is that Japan does not rely on external financing of its public sector debt; a high percentage of Japanese public sector debt is held domestically. 70% of public sector debt is held by the Bank of Japan and most of the rest is held by Japanese trust and investment funds. The Japanese private sector, both household and corporate, has a large appetite for buying government bonds. This is because domestic savings are (and have historically been) relatively high. Even though a high savings rate does not guarantee per se high economic growth (Lingle, 2000; households should spend those savings in order to activate the economy) it provides people and firms spare cash to buy bonds and lend the government money. In a country with a very low saving rate, there would be fewer people willing or able to buy government debt (Economicshelp, 2014).

Another explanation of how Japan

has maintained low interest rates lies in the trade surpluses it maintained until 2009. With such surpluses Japan built a large portfolio of foreign currencies and invested in foreign assets, earning Japan a stream of income, giving Japan the advantage of earning more income on foreign currency holdings than they pay out to investors. Corporate Japan places that money into the banking system which then gets levered up and expands its purchasing power; and the banks, life insurance companies and pension funds buy considerable amounts of Japanese government bonds, making the cash flow fund itself (Rimkus, 2012).

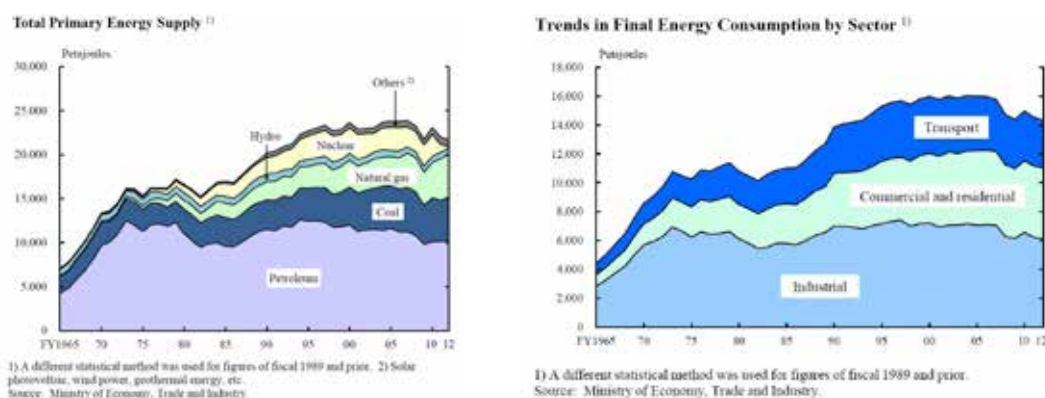
6.3 Energy & Infrastructure

6.3.1 Energy system, consumption & access

Since experiencing the two oil crises of the 1970s, Japan has taken measures to promote energy conservation, introduce alternatives to petroleum, and secure a secure supply of petroleum through stockpiling and other measures. As a result, its dependence on petroleum declined from 77.4% in 1973 to 43.7% in 2010, shifting to a more balanced mix.

However, after the Great East Japan Earthquake in 2011, the percentage of fossil fuels has been increasing, as a substitute for nuclear power as fuel for power generation. The level of dependence on petroleum which had been on a declining trend in recent years, increased to 47.3% in 2012, followed by imported coal and natural gas. Japan is dependent

Figure 15: Total primary energy supply and final energy consumption (2013).



Source: Statistics Bureau (2014)

on imports for 96% of its primary energy supply (The Federation of Electric Power Companies of Japan, 2015) which is, to a large degree, destined for industrial purposes. In 2012 Japan ranked as the second largest net importer of fossil fuels in the world, trailing only China. Japan is now the fourth largest crude oil importer in the world behind the USA, China, and India. Furthermore, it ranks as the world's largest importer of liquefied natural gas (LNG) and second largest importer of coal (U.S. Energy Information Administration, 2013).

The generation of electric power in Japan was dominated by hydropower and thermal power (using domestic coal) until the 1950s when it was shifted to imported petroleum (Kimura, 2009), following world trends as oil became cheaper (Ohno, 2006). Japan is primarily dependent on the Middle East for its crude oil imports; 83% of Japanese crude oil imports originated from the Middle East in 2012 (U.S. Energy Information Administration, 2013).

Because of its limited natural gas resources, Japan relies on imports to meet nearly all of its natural gas needs. In 2012 Japan consumed 4.4 trillion cubic feet (Tcf) of natural gas. More than 95% of Japan's gas demand is met by LNG imports. Japan uses most of its natural gas

in the power sector (64%), followed by the industrial sector (21%) and residential (9%) sectors (U.S. Energy Information Administration, 2013). Typically used as a baseload source for power generation, coal remains an important fuel, and coal-fired generators accounted for nearly 27% of Japan's electric capacity in 2010. Domestic coal production ended in 2002, and Japan began importing all of its coal, primarily from Australia (U.S. Energy Information Administration, 2013).

With the aim of securing the supply of mineral resources, in 2004 the Japanese government created the administrative agency Japanese Oil, Gas and Metals National Cooperation (JOGMEC) to which the coal and geothermal units were later added. JOGMEC consists of a worldwide network of 13 overseas offices gathering relevant information and among its activities figure: providing financial assistance to Japanese companies for mineral exploration and deposit development, gathering and analysing information on mineral and metal markets to better understand risk supply and managing Japan's stockpile of oil, liquefied petroleum gas and rare metals. JOGMEC seeks to secure the supply of overseas resources by promoting early-stage exploration and support for advance-

Figure 16: Japan's main railroads and highways.



Source: World Bank (2009)

stage projects, by developing recovering technologies for recycling, developing alternative materials and stockpiling. JOGMEC closely observes strategic minerals considered of high importance, including zinc, chromium, cobalt, manganese, molybdenum, nickel, tungsten, vanadium, PGMs and lithium (Katayama, 2012).

6.3.2 Transport infrastructure

Japan's transport system is highly developed, with road and rail networks covering virtually every part of the country together with extensive air and sea services. The Japanese took advantage of their extensive and indented coastline and of the willingness of key raw materials-exporting nations to build their own ports and railroads, to build a tightly integrated, highly efficient environment that connected foreign mines to foreign ports to ports to smelters and then to downstream fabricators (Bunker and Ciccantell, 2005).

6.3.2.1 Road infrastructure

Regarding road infrastructure, highways are Japan's chief means of passenger and freight transport (57% of all domestic cargo is done by road). To ease rapidly increasing traffic problems, construction of an extensive highway system was begun in the 1970s. Extensive road construction continued throughout the 1980s associated with the motor vehicle industry. Japan ranks 10th in the world under the category "Quality of roads" of the Global Competitiveness index 2014 (World Economic Forum, 2014). With regards to railway infrastructure, until the mid-1960s railways were the chief means of passenger transportation and the second largest freight carrier. Today they rank second in passenger transport and third, behind coastal shipping, in freight transport. Most of the railway system is operated by companies that are part of the Japan Railways Group.

6.3.2.2 Railway infrastructure

Japan has several high-speed rail (bullet-train) lines that provide passenger service between most major cities. The Tokyo-Osaka bullet-train line, opened in 1964, was Japan's first high-speed rail line. Japan ranks first in the world under

the indicator "quality of railroad infrastructure" (World Economic Forum, 2014). Japan's early construction and operation of railways were conducted by both the Japanese government and private investors. The length of the railway is 23,670 km more than half of which is electrified. Railways are the most important means of passenger transportation in Japan, maintaining this status since the late 19th century.

6.3.2.3 Port infrastructure

With regards to port and ship infrastructure, the Japanese developed a vibrant maritime culture which had worldwide effects. Japan particular historical situation at the beginning of the high economic growth era (extreme resource dependency combined with great distance from available sources under the USA hegemony) drove the Japanese to increases in the scale of ports, ships and integrated transport systems to reduce the costs of distance to politically acceptable raw materials sources in the context of the Cold War. By expanding its transport system the Japanese led a transport revolution changing the raw materials markets and costs by expanding global transport systems at a rate the world had not seen since the rapid increase in transport scale that British steamships had led at the turn of the 20th century (Bunker and Ciccantell, 2005).

Currently there are 1,770 km of waterways in Japan and some 994 ports (2014), 23 of which are specially designated major ports, distributed all over the country but highly concentrated on the Pacific Ocean side where the population and the industrial activities are. Japan ranked 26th in the world under the category "quality of port infrastructure" of the Global Competitiveness index 2014 (World Economic Forum, 2014). Japan had been the dominant ship building country from the 1960s through to the end of 1990s but gradually lost its competitive advantage to the emerging industry in South Korea, which has now been currently overtaken by low-cost high-volume shipbuilding in China. Yet, Japan remains second to South Korea in the world shipbuilding market share with a 29% (the number of

shipyards in Japan is over 1,000). In order to maintain that the Japanese industry is investing in innovating: for instance in

2013 the Maritime Innovation Japan (MI-JAC) corporation was founded.

7. Political and legal factors

7.1 Political factors

7.1.1 Administrative structure

Japan's governmental structure has three tiers: national, prefectural and local. There are 47 prefectures and 1,788 local municipalities. Each tier is governed by elected assemblies. Japan does not have a federal system and the two lower tiers of government are, to a large extent, fiscally dependent on the national government (Department of Foreign Affairs and Trade, 2015), which allows only limited judicial autonomy.

7.1.2 Governmental stability & transparency

Economic growth and political stability are interconnected. Political instability lowers the predictability of government policies for firms and households, thus making it harder for them to commit to aggressive plans for investments and consumption. Japan is a democratic, constitutional monarchy with a parliamentary government headed by a Prime Minister. Japan is considered one of the most successful democracies in the world and a politically stable country. During the rapid economic growth Japan had a stable political democracy which only became more unstable during the 1990s (Columbia University, 2009). More recently, in the period 2006-2010 the Prime Minister turnover rate became much higher than in other parliamentary democracies. Japan ranks 15th in the world in the corruption perceptions index (2014) produced by Transparency International, appearing as a "less corrupt country" (a qualification similar to the U.S and worse than Canada or Australia which appear in positions 10th and 11th in the world ranking) (Transparency International, 2015). Japan ranks 11th in the world in the "Transparency of government policy making" indicator (World Economic Forum, 2014).

7.1.3 Fiscal policies

The Japanese income tax system was redesigned following World War II. As such it has features of the systems of both Europe and the USA. Japan's rise to the status of an economic super power has partly been attributed to the tax policy employed by the Government that has relied heavily upon the use of tax incentives and "picking winners" (Dabner, 2001).

Prior to 2009, Japan taxed on a worldwide basis, provided foreign tax credits, allowed deferral of tax on active income until repatriation, and claimed the highest corporate tax rate in the developed world. In introducing the 2009 budget, however, the Japanese Minister of Economy, Trade, and Industry (METI) announced that his country would move to a policy of territorial taxation as part of a "new growth strategy" designed to stimulate innovation in Japan through strengthening the competitiveness of Japanese firms in foreign markets and encouraging repatriation of overseas earnings (Tax Foundation, 2012). Japan has also entered into tax treaties with several countries to avoid double taxation that can occur when a party is subject to two tax regimes ("Double Tax Treaties"). For Japanese resident taxpayers (corporations or individuals), tax is payable on income generated in Japan and abroad (DLA Piper, 2013).

Income tax is imposed on the income of individuals who reside in Japan (including resident foreign nationals). Income tax is relevant to corporations for some categories of income as well. Japan is not a highly taxed country and the tax burden for employees has historically been very low, although the proportion of revenue raised from companies is one of the highest in the world. In fact, possibly 20% of employees do not pay income tax. The generally low personal tax burden in Japan has positively influenced the composition of savings and the amount of corporate debt finance.

In contrast to the low reliance on personal income tax, relative company tax revenues are the second highest in the OECD (Dabner, 2001) (corporate tax rates declined from a 40% in 2006 to a 33% in 2015). Japan's broad based consumption tax (similar to VAT) was introduced in 1989 at a rate of 3% and increased in 1997 to a 5%; yet it remained among the lowest in the world, similar to Canada (Nippon.com, 2013). In August 2012, the Japanese government took measures to increase tax revenues through legislation to raise the consumption tax from 5% to 8% in April 2014, with plans to again raise the rate of this tax to 10% (Department of Foreign Affairs and Trade, 2015). The International Tax Competitiveness Index (ITCI) measures the degree to which the tax systems of the 34 OECD countries (inclusive of Corporate Taxes, Consumption Taxes, Property Taxes, Individual Taxes, and International Tax Rules) promote competitiveness through low tax burdens on business investment and neutrality through a well-structured tax code. Japan's tax competitiveness does not rank well in the ITCI

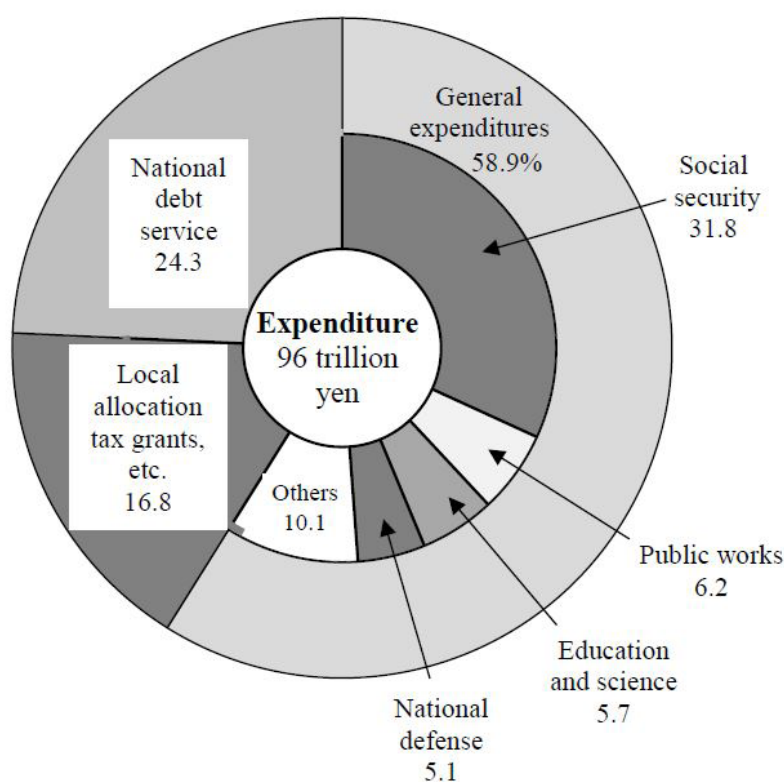
(ranks 25th in the OECD below Australia and Canada) (Pomerleau and Lundeen, 2014). This ranking is due to a high top marginal corporate tax, the complexity in complying with corporate income taxes, and high taxes on properties (taxes on real estates) and international tax rules.

Since the collapse of the asset price bubble in the early 1990s, numerous fiscal stimulus packages and rising social outlays, due in part to population ageing, have driven up government spending. Meanwhile, a prolonged period of weak economic growth and tax cuts have constrained revenue, resulting in two consecutive decades of budget deficits. Tax revenues in Japan have been declining since the 1990s.

7.1.4 Government spending priorities & allocation

Japan's government expenditure (as % of GDP) increased from 17% in the 1960s to 32% by 1980, 31% in 1990, almost 36% by 1996 and reached 40% by 2014 (Quandl, 2015). A substantial part of the public expenditure was invested in infrastructure

Figure 17: Japan's government expenditure per sector (2014).



Source: Statistics Bureau (2014)

(Yoshida, 2000), especially transportation and communications (Kim, 2006).

Japan is considered a country with a low share of public spending (Dewan and Ettlinger, 2009) with respect to the GDP and compared to other OECD countries; the average for the period 2004-2007 was 36.9% of GDP, in a position similar to the USA and Canada, all reflecting a trend to leave the private sector to itself with less government intervention. Japan's public expenditure on education was 3.5% of GDP in 2012, comparatively lower than the USA or Australia. In 2014, major expenditures included social security (31.8%), national debt service (24.3%), local allocation tax grants, etc. (16.8%), public works (6.2%), education and science (5.7%) and national defence (5.1%).

7.1.5 National Security

According to Japanese security policy, maintaining a military establishment is only one method, and by no means the best method, to achieve national security. Diplomacy, economic aid and development, and a close relationship with the USA under the terms of the 1960 security treaty are all considered more important (Wikipedia, 2014a). The Japan-USA alliance is the cornerstone of Japan's foreign policy and national security. Japanese cooperation with the USA through the USA-Japan Security Treaty has been important to maintaining stability in the region. The USA military maintains a presence of approximately 38,000 personnel in Japan under the USA-Japan Treaty of Mutual Cooperation and Security of 1960. The USA Seventh Fleet is based in Yokosuka and the 3rd Marine Expeditionary Force is based in Okinawa. (Department of Foreign Affairs and Trade, 2015).

Japan's national security policy is driven, first of all, by a strong perception of a shifting balance of power at the global level since the start of the twenty-first century. In this regard, the documents make reference to the emerging countries, especially to China's increasing international presence, as well as to the changing relative influence of the USA (Atanassova-Cornelis, 2014). Japan's military expenditure (as % of GDP) was at 0.9% by 1988 and it remained at the same

level until 1999 when it reached 1%. From then on it has remained at around 1% until now (World Bank, 2015d). After the USA, China, Russia and Saudi Arabia, Japan has the 5th largest defence budget in the world having reached USD 41,600 million in 2015. It has a large and sophisticated Self Defence Force consisting of the Ground Self Defence Force, the Maritime Self Defence Force, and the Air Self Defence Force. As part of its national security, Japan practices national stockpiling of minerals, e.g. of petroleum since 1978, liquefied petroleum gas, rare metals, plutonium, among others.

7.1.6 Safety & crime

Crime in Japan is low and the country is considered safe. Violent crime is rare. The number of reported crimes in Japan peaked in 2002 and has since been on the decline. A major contributing factor is the ongoing reduction in thefts, which account for over half of reported crimes (Nippon.com, 2014). The exception is cybercrime: the number of arrests for cybercrime in 2013, involving the abuse of computer technology and telecommunications technology, was 8,113. This represented about a nine-fold increase from the 913 cases registered in 2000 (Statistics Bureau, 2014). Tokyo and Osaka have recently been ranked as the 1st and 3rd safest cities in the world (The Economist, 2015).

7.1.7 Trade policies

The post-war Japanese economy saw the development of the "processing nation" under the idea that the nation must import raw materials to be processed and exported with greater value added to the basic inputs. Japan's methods of promoting exports took two paths. The first was to develop world-class industries that can initially substitute for imports and then compete in international markets. The second was to provide incentives for firms to export. During the first two decades after World War II, export incentives took the form of a combination of tax relief and government assistance to build export industries. After joining the International Monetary Fund (IMF) in 1964, however, Japan had to drop its major

export incentive, the total exemption of export income from taxes, to comply with IMF procedures. It did maintain into the 1970s, however, special tax treatment of costs for market development and export promotion.

By the late 1950s, Japan's international trade had regained its pre-war level, and its balance of payments displayed sufficient strength for its rigid protectionism to be increasingly difficult to justify. The IMF and the General Agreement on Tariffs and Trade (GATT) strongly pressured Japan to free its commerce and international payments system. In 1957 Japan signed an important Commerce Agreement with Australia by which Australia would provide much of the commodities needed by Japan for its industrialisation. Beginning in the 1960s, the government adopted a policy of gradual trade liberalisation, easing import quotas, reducing tariff rates, freeing transactions in foreign exchange, and admitting foreign capital into Japanese industries, which continued through the 1980s. Under heavy pressure of its trading partners and competitors such as the USA, Japan began to open its economy to foreign competition late in the 1980s. That resulted in a higher rate of imports, which lowered trade surpluses until early in the 1990s.

Japanese government policy has consistently used an ABC policy approach (ABC stands for Australia, Brazil and Canada), a term applied to describe a diversification of source markets for raw materials, and in some cases, the strategy of playing one country off against another. This policy has been applied to maximize supply security and favourable costs for the purchase of raw materials. This policy has been complemented with tactics such as stockpiling, developing new sources, and overseas joint ventures. Throughout the 1950s and 1960s the MITI attempted to keep the level of fragmentation of the resource-based industries high by discouraging vertical integration (McMillan, 1996). Since the 2000s, Japan has pursued negotiations with Asian countries with which it has a comparatively limited trade volume and, while it currently has FTAs with 13 countries, various South American countries included,

they only account for 18% of Japan's total trade. With these agreements also exempting many products, primarily agricultural, from liberalisation, Japan has generally been well behind the rest of the developed world in freeing up trade (Nezu, 2013). Nowadays, unlike most other countries, Japan is advancing towards Economic Partnership Agreements (EPAs) rather FTAs.

7.1.8 Bilateral, Multilateral & International agreements

In terms of international organisations, Japan belongs to the United Nations, G-7, G-20, Organisation for Economic Cooperation and Development, Asia-Pacific Economic Cooperation forum, ASEAN Regional Forum, International Monetary Fund, World Bank, and World Trade Organisation. Japan also is a Partner for Cooperation with the Organisation for Security and Cooperation in Europe and an observer to the Organisation of American States.

Japan has diplomatic relations with nearly all United Nations member states and has been an active member and supporter of the UN since 1956. Japan is the second-largest contributor to the UN budget and a large donor of official development assistance (ODA). Japan has a specific alliance with the USA which is seen by the latter as the cornerstone of USA security interests in Asia and is fundamental to regional stability and prosperity. The USA and Japan cooperate on a broad range of global issues, including development assistance, combating communicable diseases such as the spread of HIV/AIDS or avian influenza, and protecting the environment and natural resources. The countries collaborate in science and technology in such areas as mapping the human genome, research on ageing, and international space exploration.

Japan relies almost solely on imports to meet its oil consumption needs and maintains government-controlled oil stocks against a supply interruption. Japan has signed agreements with oil-producing countries such as Saudi Arabia and the United Arab Emirates in recent years that involve Japan leasing crude oil storage for these countries, with Japan having a

priority to purchase the oil in the event of a serious supply disruption. Japan has a three-year lease to store 6.3 million barrels for each of these producers (U.S. Energy Information Administration, 2015).

By now Japan has either signed or already operating bilateral economic partnership agreements with the ASEAN, Singapore, Mexico, Malaysia, Chile, Thailand, Indonesia, Brunei, Philippines, Switzerland, Vietnam, India, Peru, Australia (Japan is Australia's second-largest export market) and Mongolia. Under negotiation are agreements with Canada, Colombia, Republic of Korea and the EU (Ministry of Foreign Affairs, 2015). In 2012, Japan was a founding party to the launch of negotiations on the Regional Comprehensive Economic Partnership. In 2013, Japan entered negotiations on the Trans-Pacific Partnership (TPP).

7.1.9 Sustainable development policies

Japan does not have a national sustainable development strategy, but an environmental plan that, in its latest version, also addresses cross-cutting issues. The Basic Environment Plan was initially developed in 1994 based on the Basic Environmental Law (enacted in 1993) with the long-term objectives of developing recycling, a harmonious coexistence between nature and people, participation by society, and the promotion of international activities. The second Plan was issued in 2000, and the third plan – the New Basic Environment Plan – was adopted by the government in April 2006 and focused on materials recycling, global warming and biodiversity. The fourth Basic Environment Plan was adopted in April 2012 and features a renewed interest in a low-carbon society with a sound material-cycle (recycling) and a society in harmony with nature while ensuring security and safety (Ministry of the Environment, 2012). In relation to recycling, Japan has been a promoter of the “3R” for a long time and now strongly advocates for a material-cycle society and a circular economy.

7.2 Legal Factors

7.2.1 Legal Framework

Japan's legal system is modelled after the European civil law systems and has English-American influence, judicial review of legislative acts in the Supreme Court, and they accept compulsory International Court of Justice (ICJ) jurisdiction with reservations. The present national authorities and legal system are constituted by the Constitution of Japan, adopted in 1946 after the World War II. The Japanese Constitution contains thirty-one articles relating to human rights and providing for the separation of powers vested in three independent bodies: the Legislature, Executive and Judiciary. The National Diet of Japan is the bicameral supreme legislative body in Japan, consisting of the *Sangi-In* (the upper house) and *Shuugi-In* (the lower house). Besides the Constitution, Japan's legal system comprises five codes: Civil, Commercial, Criminal, Criminal Procedure and Civil Procedure. In 2014 Japan ranked 41st in the world under the category “Legal and regulatory framework” of the Global Competitiveness index (Institute for Management Development, 2014) indicating a certain degree of discouragement of the competitiveness of enterprises by the legal framework. The early provision of soft infrastructure (Commercial Code, Patent Law, the Antimonopoly Law, and other legal systems) was essential for Japan's economic development (Odagiri, 2006).

7.2.2 Resources Ownership & Property Rights Law

Property rights are defined by law and are not freely definable by transactional parties (Civil Code, article 175). The types of statutory property rights are: 1) Possessory rights (*senyūken*); 2) Title (*honken*); 3) Freehold or Ownership (*shoyūken*, the absolute ownership of land and building); 4) Restricted rights (*seigen bukken*); 5) Usufructuary rights (*yōeki bukken*); 6) Surface rights (*chijōken*, the land is leased, for buildings owners have the right to buy/sell as they please); 7) Tenant farming rights (*eikosakukken*); 8) Easements (*chiekiken*); 9) Rights of common (*iriainen*); 10) Collateral rights (*tampo bukken*); 11) Possesso-

ry liens (*ryūchiken*); 12) Property liens (*sakidori tokken*); 13) Pledges (*shichiken*); and 14) Mortgages or hypothecs (*teitōken*). In 2006 37% of the land was owned by the public sector (27% by the Central Government and 10% by local government) and 63% by the private sector. The laws of Japan provide a certainty to investors that private property rights will be protected and respected. In Japan the judiciary is independent and provides secure protection of real and intellectual property rights. According to the Property Rights index (part of the Economic Freedom rank) Japan ranks 3rd in the world (value of 80 in 2015) (Global Property Guide, 2015; The Heritage Foundation, 2015).

7.2.3 Business legislation

In general business legislation favours investments in Japan. However, Japan ranks 29th in the world under the "Ease of doing business" which indicates that the regulatory environment is not highly conducive to the starting and operation of a local firm; Japan ranks relatively poorly due to high corporate taxes and the length of time it takes to secure construction permits (World Bank, 2015e).

7.2.4 Employment, Labour laws & Unions

Traditionally, in Japan, many employees work under the notion that they will not change employers during their career. This concept is known as life time employment, whereby employers were expected to employ workers until retirement. Japanese labour laws are very employee-friendly in order to provide for a long and positive relationship between employer and employee. Employees enjoy security in continued employment. There is no concept of "at-will" termination. Termination of employees generally must be for "cause" (DLA Piper, 2013).

In Japan there are two types of collective agreements. The most common type is a labour-management agreement ("*roshi-kyotei*") which is an agreement between management and either the representative of the majority of employees in the workplace or a labour union to which a majority of the employees belong. The purpose of this is to contract

out of restrictive provisions of the Labour Standards Act, such as wage deduction or working time. The second type of agreement is a collective bargaining agreement ("CBA") ("*roudo-kyoyaku*") which is between a labour union and an employer. CBAs are not particularly common in Japan as the proportion of the workforce that is unionised has fallen to below 20% (DLA Piper, 2013).

Labour unions emerged in Japan in the second half of the Meiji period, after 1890. Until 1945, however, the labour movement remained weak, impeded by lack of legal rights, anti-union legislation, management-organised factory councils, and political divisions between "cooperative" and radical unionists. After World War II, the USA Occupation authorities initially encouraged the formation of independent unions and membership rapidly rose to 5 million by 1947, making the period from 1945 to the 1950s one of complete conflict between labour and management. However, from the latter half of the 1960s, the situation gradually began to change with the perspective shifting among union leadership from a focus on conflict with management to an approach centred on collaboration. Another change was one that occurred on the management side. Noticing that productivity did not increase in circumstances where there was conflict between labour and management, the number of companies changing their approach to workplace management began to increase (Fujimura, 2012).

7.2.5 Environmental regulations & their enforcement

During the rapid growth era, with the advent of four major pollution-related diseases, the government took anti-pollution measures such as the enactment of the Basic Law for Anti-pollution Measures in 1967 and the establishment of the Environmental Agency in 1971 (Otsubo, 2007). The Environmental Basic Act (EBA) sits at the top of the environmental regulatory scheme and consists of 46 articles and supplementary provisions. The EBA itself does not have direct effect on corporations or individuals, but instead serves as a framework that requires the legislature to

establish environmental protection laws" (DLA Piper, 2013).

In the 1990s, Japan's environmental legislation was further developed. Overall, the mix of instruments used to implement environmental policy is highly effective. Regulations are strict, well-enforced and based on strong monitoring capacities. Significant progress has been made in tackling non-conventional air pollutants (e.g. dioxins, benzene), and waste management can be expected to improve further with the recent overhaul of the relevant legislative framework (OECD, 2002). With regards to CO₂ emissions, even though Japan is very energy efficient compared to other OECD members, it is

still one of the world's largest CO₂ emitters, mainly due to its concentration of manufacturing industries. Japan's emissions reached 1.3 Gt CO₂ in 2007 and touched a record emissions of 1.4 Gt in 2014 (Reuters, 2015). In terms of global cumulative CO₂ emissions in the period 1850-2011, Japan has been responsible for 11%, the third largest behind the USA and the European Union. Likewise, in the period 1990-2011 Japan was responsible for 15% of the global cumulative greenhouse gas emissions (Ge et al., 2014). In recent years, GHG emissions have been on the rise, with emissions in 2013 10.8% higher than in 1990 (NIES, 2015).

8. Technological factors

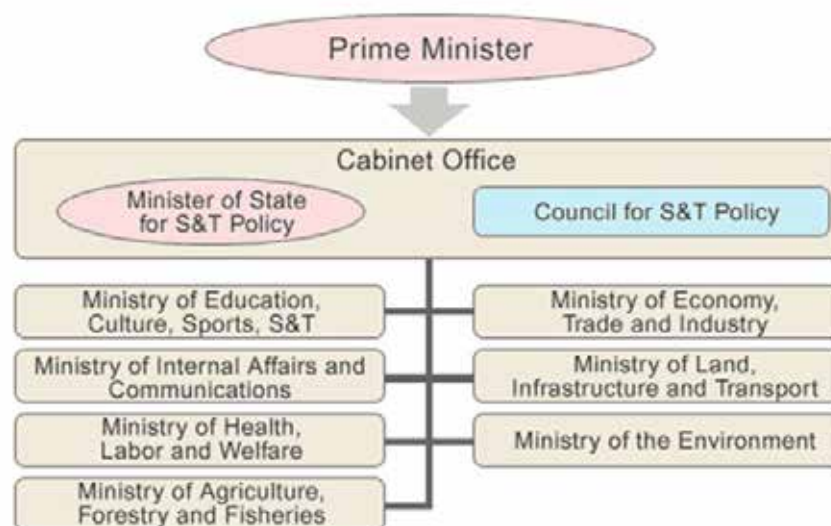
8.1 Research and Development (scientific infrastructure)

8.1.1 Knowledge and resource base

In Japan, the Cabinet Office coordinates the policies of each ministry and promotes particularly-important policies such as economic and fiscal, science and technology and so on. As for R&D, the Cabinet Office organises the Council for Science, Technology and Innovation (CSTI). CSTI is one of the four councils for policy development in the Cabinet Office and comprises the Prime Minister,

relevant other Ministers, and experts and plays important role in the promotion of Science & Technology (S&T) policy of Japan based on the Science and Technology Basic Plan and other related strategies. The National Institute of Advanced Industrial Science and Technology (AIST) is Japan's largest public research organisation under the Ministry of Economy Trade and Industry (METI). The private sector is regularly involved in the instigation of research policies and programmes via the industry associations (*Keidanren*) and individual member companies.

Figure 18: Science and Technology Administration in Japan.



Source: Cabinet Office (2014)

The knowledge and resource base (infrastructure) in Japan is among the largest in the world. In terms of scientific infrastructure, after the USA, Japan ranks 2nd in the world in terms of total expenditure on R&D representing 3.3% of its GDP. Likewise its level of total expenditure on R&D per capita in 2012 reached USD 1,562, placing it 6th in the world only behind Scandinavian countries. Japan also ranks 2nd in the world in business expenditure on R&D after the USA and 2nd in the world after China in the total amount of personnel working on R&D. With regard to the avail-

ability of scientists and engineers, Japan ranks 3rd in the world after Finland and Qatar according to the Global Competitiveness index (World Economic Forum, 2014). This high proportion of scientists and engineers was an important factor that provided Japan an advantage during the post-WWII era when the proportion of top management personnel with a science or engineering background was much higher in Japanese firms than in large American firms (Odagiri, 2006). Likewise, Japan ranks 13th in the world in terms of qualified engineers available in

the labour market and 3rd in the world (after the USA and China) in the number of scientific articles published by origin of author (Institute for Management Development, 2014). Japan's Tokyo and Kyoto universities rank high among the world's best universities and very high in the Asia university rankings.

With regards to geoscientist data, the Geospatial Information Authority of Japan (GSI) is the only national organisation that conducts basic survey and mapping and instructs related organisations to clarify the conditions of land. Information on mineral resources is available at a database managed by the Geological Survey of Japan.

8.1.2 R&D culture

Before World War II Japan's national innovation system was characterized by capital inflow from abroad as a means of technology transfer, the movement of people from Japan towards educational centres in the West, and the invitation of experts from abroad to come to Japan to teach advanced technologies and management methods from the West. Technology transfer was done mainly via the import of goods embodying technology which would be disassembled and reverse-engineered for domestic production. Strategies to obtain technology from abroad included: 1) alliances with foreign partners (e.g. Toshiba, Mitsubishi and Fuji had agreements with General Electric, Westinghouse and Siemens respectively); 2) licensing of patents and know-how; 3) buying of blueprints (inventions still at experimental stage); and 4) inviting foreign partners to become shareholders of domestic firms like Toshiba or Mitsubishi Electric in return for technologies and management know-how (Odagiri, 2006; Odagiri and Gotō, 1996).

After WWII, inward FDI into Japan was restricted, and the rate remained low even after the capital liberalisation of the 1970s. From the end of the war until around the 1980s, Japan engaged in a technological catch-up period with the advanced industries of the West. At that time, as a "latecomer", Japan benefited from several advantages: i) the import of foreign technology was given high prio-

riety and manufacturing technicians and workers used their skills and knowledge to utilise, emulate and improve imported technologies (reverse and improved engineering); ii) Japanese businesses benefited from a lower business risk through having foreign businesses as a reference; iii) Japanese manufacturing companies achieved sales success in the markets of advanced economies and this helped to demonstrate the quality of their products in the domestic market with consequential impacts on competitiveness (Otsubo, 2007); iv) Japan had a large domestic market which enabled firms to test new products in the internal market before competing in the international market.

After WWII Japanese firms were aware of the size differences with American ones (e.g. in 1965 General Motors was 26 times larger than Toyota) and thus Japanese firms made every effort to catch-up technologically and improve productivity. Likewise, not only external competition but also internal competition ("entry and competition") was a central force in Japan's technological development, as exemplified by the automobile industry (Odagiri, 2006). The innovation system began changing with Japanese firms diversifying their production portfolio during the 1950s, and heavily investing in domestic R&D, first to assimilate imported technologies and then in the invention of original ones (Odagiri, 2006). All this catching-up process was industry led, with a very low government expenditure in R&D.

From the late 1980s the international community began to criticise Japan as a "Free-rider". Then, industries as well as the government increased investment in R&D, especially for basic sciences. Currently, and as responses to changing market needs and as a consequence of conscious policy efforts, Japan's innovation system is transitioning towards a science-based one promoting the advance of science-based industries (SBIs): life sciences; information and telecommunications; environmental sciences; nanotechnology; and materials (Odagiri, 2006). In science-based industries, scientific research outcomes are applied and developed for industrialisation, and any

discoveries during R&D research are fed back to the research system.

One requirement of this new system is university-industry (UI) collaboration. Japan has been engaged in policy shifts to promote joint research in the following ways: by easing the acceptance of research funds from industries for universities; by building of university special facilities for UI joint research; by universities offering space to start-ups at a low rent; by the founding of technology licensing offices (TLOs) at universities; and through special tax concessions on company R&D expenditures used for UI collaborations (Odagiri, 2006). The UI collaboration in Japan received impulse stimulus in 1995 through the implementation of the Science and Technology Basic Law and then, in 1998, with the Act for Promoting Technology Transfer (from universities to industry), and in 2000 by the Industrial Technology Enhancement Act. It has been determined that these policies significantly increased the number of patents resulting from university-industry collaborations (Motohashi and Muramatsu, 2012). Over 200 universities have now established their own offices for industry-university collaborations and 42 TLOs are working with universities (Hashizume, 2012). Also important is the National University Corporation Law, through which every national university can hold patents, whereas in the past patents belonged to the nation. Owing to these reforms, UI collaboration has been increasing rapidly (Odagiri, 2006). However, knowledge transfer between companies and universities is evaluated to be relatively low in Japan, ranked only 24th in the world according to the IMD (in contrast to the USA ranked second or Canada ranked 11th with a highly developed knowledge transfer situation; Institute for Management Development, 2014).

Intellectual property rights (patents, copyrights) are strategically important for SBIs; in 2002 Japan enacted the Basic Law on Intellectual Property emphasising a wider utilisation of patented technologies, and a stronger enforcement of patent rights. Firms are also changing their R&D boundaries by using outside suppliers and partners due to the impracticability of performing all R&D works in-house

(Odagiri, 2006). In this respect, it appears that UI collaborations are likely to play an increasingly strong role in reducing the dependence of the national innovation system on in-house R&D in large corporations (Motohashi, 2005).

Through the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan is promoting industry-university-government cooperation to transfer the university research to society. Since 2011, MEXT has been promoting the «Regional Innovation Strategy Support Programme» as part of a project for developing innovation systems aimed at establishing and improving the systems that enable individual regions to proactively create innovations through the industry-academia-government collaboration policy. Even though the number of patents in Japan is high, the rate of entry (the number of new enterprises as a percentage of the initial number of enterprises) has dropped in Japan from 5.9% between 1975 and 1978 to 3.1% between 1999 and 2001. The number of start-ups grew during the 2000s (peaked at 250 in 2004) but it remains small (47 in 2010) as compared, for instance, with the USA (651 in 2010) or the UK (268 in 2010) (Nishimura, 2013). In order to change this, in 2002 the government started to give tax advantages to individuals investing in start-up companies (the Angel Tax System), and reduced the minimum amount of capital required to found a stock company (Odagiri, 2006).

Japan ranks 4th in the world in terms of leading innovation (GE, 2013) and is a leading OECD country in terms of R&D. Japan (like South Korea) has a very high proportion of R&D financed by the private sector; in 2012 business enterprises with a strong international orientation spent 12.2 trillion yen (70.2% of the total R&D expenditure). In contrast, in that year, non-profit institutions and public organisations spent 1.6 trillion yen (9.2%), and universities and colleges spent 3.6 trillion yen (20.6%). Universities and colleges spend more than 90% of their R&D expenditure on natural sciences for basic research and applied research, while business enterprises allocate over 70% for development purposes. Approximately 90% of the 481,400 research

chers at business enterprises at the end of March 2013 were in the manufacturing industries; the largest number was in «the information and communication electronics equipment industry,» followed by «the motor vehicle, parts and accessories industry» (Statistics Bureau, 2014). One of the problems of Japanese R&D strategy is that markets requiring cutting-edge technology tend to be small in size in their initial stage and tend to be overlooked by giant corporations; such markets are more suitable for SMEs. However, SMEs in Japan face financial and human resources constraints (Toshihiko, 2013).

JOGMEC is committed to securing additional resources through the contribution in innovative R&D, technological support and transfer, and advanced training programs. JOGMEC is developing a new technology to extract vast lithium reserves from the Uyuni Salt Flats in Bolivia, where recovery was difficult in the past. JOGMEC has two important research centres in Japan: Metals Technology Centre and the Technology & Research Centre in Oil and Gas.

In 1980s, Japan possessed the world's highest competitiveness especially in automobile, chemical, electric, and semiconductor industries. Even though it is pointed out that the competitiveness has been decreased recently, manufacturing still remains a core element for the Japanese economy. Since Japan is poor in natural resources, Japanese understand very well that it is critical to improve manufacturing through cutting-edge technologies in order to be a country of affluence and vitality.

In today's industry, the role of critical raw materials such as dysprosium, palladium, indium, or niobium is getting more and more important for high-functional and high-performance devices. However, it becomes challenging to maintain a sustainable procurement of such critical raw materials since the global economy is highly expanding and emerging markets like those of China and India are rapidly industrializing. In addition, critical raw materials are eccentrically-located in specific countries (**Figure 19**).

For example, neodymium magnet is cri-

Figure 19: Top Producing Countries of Critical Raw Materials.

	Top Producing Countries and Share (2014)						Total Share of Top 3 countries
	1st		2nd		3rd		
Rare Earths	China	86%	U.S	6%	India	3%	95%
Vanadium	China	53%	South Africa	27%	Russia	19%	99%
Tungsten	China	83%	Russia	4%	Canada	3%	90%
Platinum	South Africa	68%	Russia	16%	Zimbabwe	7%	91%
Indium	China	51%	South Korea	18%	Japan	9%	78%
Molybdenum	China	38%	U.S	25%	Chile	15%	78%
Cobalt	Congo	50%	China	6%	Canada	6%	62%
Manganese	South Africa	26%	China	18%	Australia	17%	61%
Nickel	Philippines	18%	Russia	11%	Indonesia	10%	39%
Copper	Chile	31%	China	9%	Peru	7%	47%
Zinc	China	38%	Australia	11%	Peru	10%	59%
Lead	China	54%	Australia	13%	U.S	7%	74%

※ Refinery Production

Source: USGS, (2015)

tical for small motors in automobile, home appliance, hard disks, wind power generators and so on. However, China is almost the only country which can produce dysprosium for neodymium magnet. As a practical matter, in 2010 China, with close

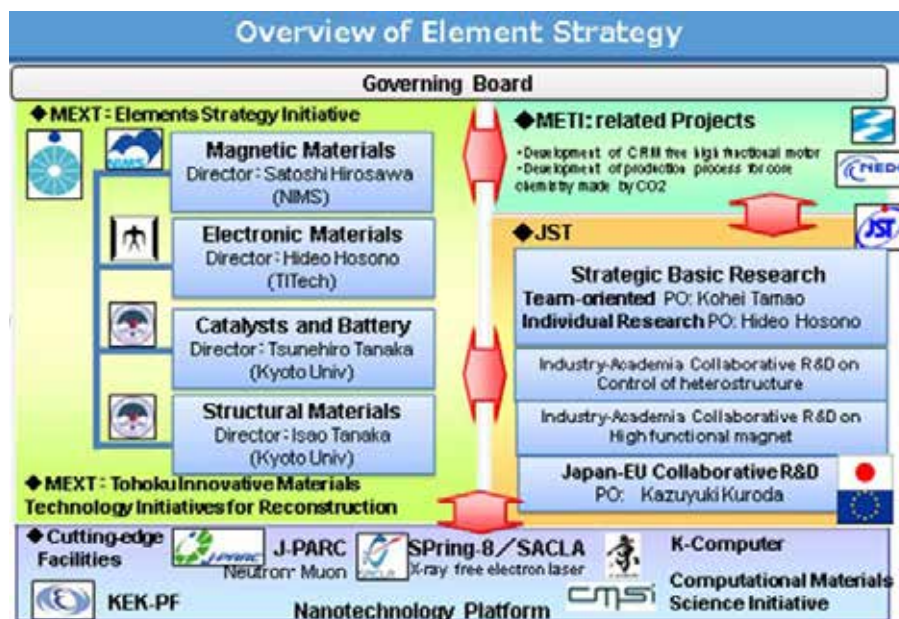
to 90% of the world rare earth production, implemented export controls, thus disrupting many supply chains and affecting many sectors of the global industry.

The Japanese scientific community has sensed the issue from early on. In 2004, Dr.

Eiichi Nakamura, Dr. Shinji Murai, Dr. Kohei Tamao, et al advocated the concept of “Element Strategy” (Nakamura and Sato, 2011). The starting point of the “Element Strategy” is to understand the function of each element deeply. Then through utilizing such functions of the element, they aim at substituting, reducing and recycling critical raw materials. Furthermore, the sustainable industrial development will be realised by new functional materials developed based on the Element Strategy. If a certain amount of

critical raw materials used in current industry could be replaced by abundant elements such as iron, zinc, aluminium, Japan would considerably reduce its dependence on imported critical raw materials. Besides, Japan could contribute to the international community through providing such technology for resource issues in the world as well. Therefore, the government of Japan has been promoting R&D based on the Element Strategy by cross ministerial approach of METI and MEXT since 2007 (**Figure 20**).

Figure 20: Overview of R&D on Element Strategy in Japan.



Source: Japan Science and Technology Agency

Until now, through such R&D projects, research teams of Japan achieved a number of outstanding outcomes which could pave the way for sustainable industry development in not only automobile, chemistry, electric/semiconductor but also in other manufacturing sectors. For example, Dr. Kazuhiro Hono, from the National Institute for Materials Science is conducting R&D on “Coercivity enhancement of Nd-Fe-B based permanent magnets” under the JST-CREST¹ funding programme and he has succeeded in development of dysprosium-saving neodymium magnet. Prof. Hiroshi Kitagawa, from Kyoto University, has succeeded in the development of solid solution of alloy nanoparticles of immiscible palladium

and ruthenium elements neighbouring on rhodium. This new materials show higher catalyst activity than that of rhodium which is used as catalyst for purifying automobile exhausts in the industry². In this way, R&D based on the concept of “Element Strategy” is one of the important activities since it is highly contributing to the manufacturing of Japan, which is still a core element of the Japanese economy.

8.2 Patents, products, technologies generated

In terms of patenting, Japan is consolidated as a world leader and thus it is

2 Pers. Comm. Kana Asano (JST), also http://www.jst.go.jp/tt/EN/cips_details/pdf_2/8-2.pdf and <http://pubs.acs.org/doi/abs/10.1021/ja409464g>

1 <http://www.jst.go.jp/kisoken/crest/en/>

considered among the world's most innovative countries. In recent decades the total number of patent applications remained robust; in and after 1998 more than 400,000 applications were filed every year, but a gradual drop has been seen since 2006. However, the number of patent applications has recovered and in 2012 it reached 486,070, second only in the world after China (Institute for Management Development, 2014). In terms of patents granted, Japan ranked 1st in the world in 2012, significantly ahead of the runner-up, the USA. If examined by the total number of patents in force, Japan ranked also 1st in the world in 2012, followed by Switzerland, Taiwan and South Korea. In terms of software development Japan lags significantly behind the USA (BBC News, 2013) and this explains to some extent the loss of Japanese firms in the share of global electronics market (The Economist, 2014). In contrast Japan is investing substantially to remain the leader in the robotics industry (Bremner and Kim, 2014).

8.3 Telecommunications & E-commerce

In 2014 Japan ranked 19th in the world under the category "Communications technology" which measures if the country meets business requirements (Institute for Management Development,

2014). In terms of number of computers in use, despite its population differences, Japan ranks 3rd in the world after the USA and China (2013) and 22nd in the world in computers per capita. In Japan the user population of the Internet, the commercial use of which began in 1993, continues to increase with Japan ranking 13th in the world in terms of "internet users – number of internet users per 1,000 people". In terms of investment in telecommunications (2012, % of GDP), Japan ranks 51st in the world (Institute for Management Development, 2014).

Japan is a strong e-commerce market, with a high proportion of urban population and a significant internet penetration rate at almost 80%. 75% of the population have purchased products online, and 89% of this group have done so from a mobile device. Japanese merchants have been exporting significant amounts of merchandise cross-border, primarily to the USA and China. Conversely, cross-border e-commerce imports are lower, with only 20% of Japanese online consumers buying from abroad. The B2C e-commerce market growth rate was 7% in 2014 with a market size of USD 118.5 billion (EKOS, 2014). Japan ranks 4th in the world in the Global Retail E-Commerce Index after the USA, China and the U.K. (AT Kearney, 2015).

9. Conclusions

9.1 Overview of economic development – history and drivers

Main historiographic interpretations argue that, since the Meiji restoration era (after 1868) and during the entire 20th and 21st century the Japanese have led a process of modernisation and economic development based on the slogan “*wakon yohsai*” (Japanese Spirit, Western Technology), i.e. integrating their economy, lifestyles and development process to Western-led world economy. Under a centralised government, some of the key factors which have allowed the Japanese to develop and adapt their economy to changing global trends include: 1) a well-educated population; 2) a world-class health system; 3) a strong R&D culture (first by importing and imitating and then by leading in innovation and new original products); 4) sustained bilateral and international trade policies to ensure the competitive supply of raw materials; 5) provision of reliable infrastructure and communications; and 6) a strong legal system (Commerce Code, Antimonopoly Law).

In the Meiji restoration era Japan introduced a universal compulsory education system, following the USA model for the school system and France’s centralised system for educational administration. This has been changing and adapting according to the industrial needs of the nation since 1868 and throughout the 20th and 21st centuries. The level of education of Japan has traditionally been very high; for instance, already by 1850 at least a quarter of the Japanese were literate, putting Japan about even with Europe, by 1950 school enrolment during the compulsory education period of 9 years had reached 99.2%. The profession of teacher has been considered “sacred” for years and the Japanese have traditionally invested considerable sums in educational infrastructure, teacher training and quality of teaching, continually benchmarking their educational achievements in comparative studies. In Japan, education

plays a crucial social role and success or failure in exams is not seen as individual’s achievements alone but also that of his family and teachers.

Such high levels of education of the workforce, supported by a world-class health system (Japan has one of the highest life expectancy rates in the world for men and women), have been key in developing and maintaining Japan’s innovation capacity at a high level. Even though Japan is under much competition from global competitors in terms of innovation (e.g. South Korea, China) and despite lagging behind in some sectors Japan (e.g. software), a sustained strong investment in R&D infrastructure and personnel, to a large part by the private sector, places Japan among the top five leading innovative countries. Throughout its history the Japanese have shown their innovation capacity in re-structuring industry in response to globalisation of production (e.g. the automotive industry of which they remain leaders or the ship building). Currently high investments continue to be made in technology, infrastructure and manufacturing capacity, aimed at Japan maintaining its leadership position in some global markets, e.g. robotics, and automotive industry (reflected by patent grants and number of patents in force).

Another key aspect which interacts with other factors and provides a context to explain Japanese economic development lies in the Japanese culture, highly influenced by Shintoism, Buddhism and Confucianism values (hierarchies, harmony of things) and well adapted to the capitalist system. The Japanese have succeeded in merging Confucian principles with commercial activities, overcoming contradictions and ensuring cooperative, harmonious labour-management relations. Likewise, Confucian values help explain the role of the State in the economy, the national consensus and close relationships between government and business (industry) and the labour cooperation with management through the

system of company unions. Confucianism permeates the complex interaction of companies, markets, business networks, and state which has, over time, created a globally competitive industrial system. They also help explaining the historical high level of savings (thrifty households) which enabled the economic growth in the rapid industrialization era. The spending power of the Japanese creates a very large domestic market and their outward foreign direct investments have also been a key pillar of Japan's economic development, e.g. FDI into more than 40 overseas large-scale metal mining projects securing the supply of key metal commodities such as copper concentrate or iron ore.

9.2 Conclusions specific to the non-energy raw materials sector

9.2.1 Industry and trade

The role of imports and exports (trade policies) must be highlighted as it has created a “virtuous circle” of reinforcement between the economy, the national innovation system and the level of economic and technology developments of the country. The profile of Japan as a “processing country” was made possible by a very well-developed and competitive transport infrastructure which changed the structure of transport costs for raw materials and allowed the implementation of a trade policy based on exporting knowledge-intensive and high value-added manufactured goods, while importing the necessary raw materials (non-energy and energy minerals) to ensure a sustained working industry.

The development of Japan as a “processing country” has been enabled by a successful long-term policy of securing a stable supply of mineral commodities, particularly via securing imports. Such mineral policy has been enacted via multiple parallel strategies encompassing: i) systematic development of domestic mineral resources (onshore and offshore); ii) active promotion of exploration and exploitation of overseas mineral resources (onshore and offshore) through economic cooperation with mineral-rich developing countries via resource diplo-

macy and commercial agreements (e.g. with Australia) and via exploration in international deep-sea floor resources; and iii) national stockpiling in Japan and abroad of minerals.

International cooperation via agencies such as JOGMEC has been crucial to achieve such strategies. JOGMEC is a multi-faceted agency which conducts plenty of research to develop the primary extraction of resources. By means of public-private partnerships or direct support to private companies JOGMEC provides financial, intelligence and technical assistance for exploration, development and production of non-ferrous metals and minerals. JOGMEC conducts overseas geological surveys to help Japanese companies secure mineral interests, conducts deep-seafloor resource surveys, provides equity capital (for asset acquisition), loans and liability guarantees for metal exploration and development by Japanese companies, works in the development of human resources with expertise in the field and develops joint venture exploration techniques.

A more complete and detailed analysis of this issue will be found in the Report produced in WP1.4 (D 1.5 *Report on transactional analysis of Industry and Trade*).

9.2.2 Education and outreach

Also in the field of mineral resources, education is considered of high importance to achieve the afore-mentioned strategies. One of the leading Japanese universities in this respect is the Akita University, where a series of skills related to mining operations are taught, ranging from exploration, exploitation and smelting to environmental conservation. The former also hosts the International Centre for Research and Education on Mineral and Energy Resources (ICREMER), which actively cooperates with universities and research institutions engaged in the field of resource studies in resource-rich countries, providing assistance to the formulation of their programs to enhance education and research capabilities and to their human resource development.

A more complete and detailed analysis of this issue will be found in the Report produced in WP1.3 (D 1.4 *Report on tran-*

sactional analysis of Education and Outreach).

9.2.3 Research and innovation

JOGMEC also plays an important role as main actor driving R&I in recycling technologies of secondary resources, mine pollution and control technologies, e.g. through its Technology and Research Centre (TRC). Likewise private companies and other government-funded agencies (e.g. the Japan Research and Development Centre for Metals, the National Institute for Materials Science, the Tokyo

Institute of Technology) alike are strongly investing in the substitution of critical elements. The “Element Strategy Initiative”, which aims at substituting, reducing and recycling critical raw materials, is one of the most known projects expected to deliver further solutions and reduce Japan’s minerals import dependency in the long run.

A more complete and detailed analysis of this issue will be found in the Report produced in WP1.2 (D 1.3 *Report on transactional analysis of Research and Innovation*).

Appendix J1: Multi-factor matrix and radar charts

The multi-factor matrix

The information in the preceding sections of this report is summarised in a multi-factor matrix which is presented in Appendix A2. In each Country Report, the findings of the research (presented in Chapters 4 to 8 inclusive) have been used to develop a “multi-factor matrix”. The matrix for each Reference Country aims to both summarise the findings of the research and to represent the relative importance of each factor to the economic development of each country.

The weightings ascribed to factors in the matrices (and the ‘radar charts’ to which they give rise) are included for completeness in this report; this organisation of information and preliminary analysis of findings provides the basis for ongoing discussion within the WP1 team and between the WP1 team and the expert panels.

Each matrix has 6 columns as indicated below.

Category | Code | Subcategory | Weight | Justification of judgement | Source

Five main categories of factors have been considered (column 1), reflecting the main chapter headings in each of the country reports (see above).

These are further divided into subcategories, consistent with the sub-sections of each chapter (one for each of the 49 explanatory factors), and the codes ascribed to the sub-categories are the sub-section numbers (columns 2 and 3). The importance of each subcategory has been ascribed a numerical weight in column 4, using the following scale:

Table 2: Numerical weights for fulfilling the multi-factor matrix

Weight	Level of importance
5	Very high importance
4	High importance
3	Medium importance
2	Low importance
1	Very low importance

The assignment of weights for the multi-factor matrices has been a collaborative effort between WP 1 partners with input from the country experts. A short justification for the ascribed weighting is given in column 5 and the source(s) of information are given in column 6.

Sub-totals are given for the weighting scores at the end of the matrix section for each main category and, at the end of the matrix, an average score is created for each main category by dividing the sum of the weighting scores by the number of factors (subcategories) considered.

Radar charts

The information and weighting scores assigned in the matrix have been summarised via 5- and 12- axis “radar charts” (**Figure 21** and **Figure 22**). The five axis charts depict the relative importance of the five main categories of factors considered, by plotting the average weighting score on the relevant axis. To further emphasise the relative importance of the primary factors, the sizes of the points on the radar chart are proportional to the average scores.

To provide more detailed insight into the relative importance of factors in the multi-factor matrices, a more 'granular' radar chart has been produced for each country, with 12 axes, each representing one (or a group) of the subcategories in the matrix. The 12 factors selected are as follows (numbers in brackets are the codes (and subsection numbers) relating to the 12 factors chosen):

Geo-environmental Factors (Chapter 4)

1. Natural and mineral resources (4.2)

Socio-cultural Factors (Chapter 5)

2. Demographics and immigration (5.2.1)
3. Cultural norms and values (5.2.5)
4. Education system & infrastructure (average of 5.3.1 and 5.3.2)

Economic factors (Chapter 6)

5. Economic output (6.2.2)
6. Foreign investment (6.2.7)
7. Energy system and consumption (6.3.1)
8. Transport infrastructure (6.3.2)

Political and legal factors (Chapter 7)

9. Resources ownership & property rights law (7.2.2)
10. Trade and trade policies (average of 6.1.3 and 7.1.7)

Technological factors (Chapter 8)

11. Knowledge and resource base and R&D culture (average of 8.1.1 and 8.1.2)
12. Patents, products and technology (8.2)

The choice of 12 factors and groups of factors from the 49 subcategories in the multi-factor matrix was subjective and the final selection was based on discussion within the WP1 team and with the country experts. These are intended to allow for more detailed characterisation of and comparison between the reference countries and, ultimately, with EU countries. They have been selected to be broadly consistent with key factors provided by the World Economic Forum in its Global Competitiveness Report, and to be equally relevant to explaining economic development in general and the raw materials sector in particular in all countries included in this project. Unlike the 5 axis chart, the plotted points on the 12 axis chart are all the same size.

5 axis radar chart for Japan

The five axis radar chart below reflects the highest importance of technological factors in explaining Japan's economic development, followed by economic and socio-cultural factors.

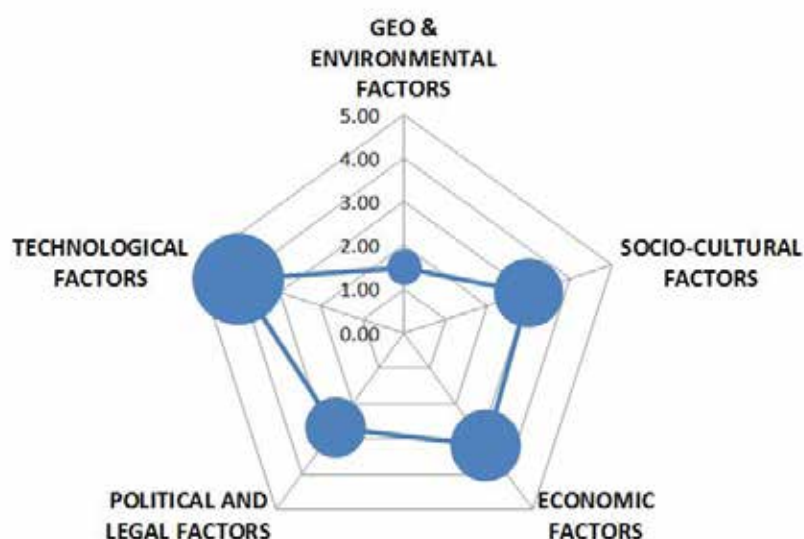


Figure 21: Five axis radar chart for Japan.

The high importance of technological factors is due to the continuous investment the Japanese have made in technology, first when catching-up with the West since the Meiji restoration early industrialization and later during the rapid economic growth era in the 1970s and 1980s when Japan started leading innovation (original products).

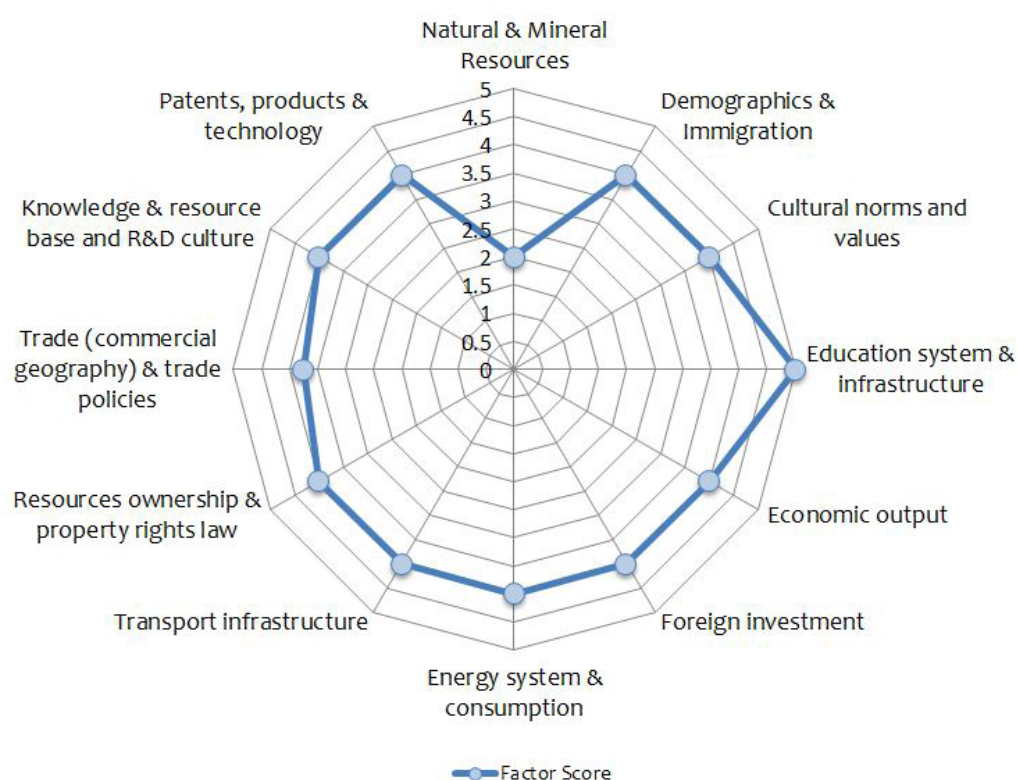
12 axis radar chart for Japan

Public and mainly private R&D investments have resulted in an excellent research and scientific infrastructure and Japan is acknowledged as one of the world's leader in terms of patenting (patents in force, patent applications). Japan has also traditionally been a leader in the telecommunications sector and is considered a strong market for e-commerce (ranks 4th in the world). Economic factors have also been important mainly due to Japan's industrial structure, based on successful commerce agreements (e.g. with Australia since 1957, the first trade agreement of Japan after WWII) providing the necessary resource and energy inputs (commodities) for the industry to remain competitive.

Thus, a reliable freight infrastructure connecting the overseas markets with Japan's inland industries (including ports, roads and railways but also a flourishing shipbuilding industry, largest in the world by the 1960s) was also of essential importance. Japan's rapid demographic transition and an affluent population, particularly after WWII also explain much of the rapid growth era as the growing domestic market enabled the industry to develop rapidly, test new products and improve them before competing in external markets. Japan's historical cultural and religious heritage (Shintoism, Buddhism, and mainly Confucianism) explain the norms and values of the Japanese culture which promoted the harmonization of government-business relationships, labour-management relations, and the life-long employment system (including seniority-based wages) which underpinned Japan's high labour and capital productivity amongst a national context of congruency and shared economic goals.

Consistent with the five axis chart, the twelve axis radar chart also highlights the importance of education in Japan as a key pillar. Excellence in the Japanese education

Figure 22: Twelve axes radar chart for Japan.



sector (at all levels) has been considered a precondition for the country's economic development, and Japan attained high educational attainment levels early in the 20th century and has maintained them. There has also been continuous exchange with the Western economies, promoting technology transfers. A strong R&D culture, mainly industry-led, and a leading position in the patenting system are an outcome of a long-run policy of basing prosperity on technology advances.

The radar chart also reflects the importance of a large affluent population with high spending power (e.g. due to the high savings rate and low inflation) and an important outward flow of FDI, of trade policies ensuring the supply of raw materials and of the stable institutional context (including the legal system). And finally, it also shows the relatively very low importance which the availability of indigenous raw materials has had in Japan's economic development history.

Appendix J2: Japan multi-factor matrix

Category	Code	Subcategory	Weight	Justification of judgement	Source
GEO & ENVIRONMENTAL FACTORS	4.1	Geographical Situation	3	Japan's island characteristics have provided military protection in the past. Japan's location in Asia has provided access to Japan's colonies in the past and more recently access to trade routes securing Japan's raw materials supply and safe export routes for Japan's manufactures. Japan's central location in the Asia Pacific region has been of moderate importance for the country to prosper.	Stratfor, 2012
	4.2	Natural & Mineral resources	2	Japan is endowed with coastal waters rich in fish and fertile soils which have allowed the development of a large extensive forest cover (68.6% of the land is covered by forests) and of small-scale rice agriculture (also of sugar beets, potatoes). These resources, along with some coal and copper mineral deposits, contributed substantially to the development of a prosperous population during many years and still contribute to some extent nowadays. Yet, Japan's economic and industrial development was not deterred by the fact that the country is, comparatively, a mineral resource-poor one. A successful trade policy allowed the country to have a secured and stable supply of raw materials which allowed the development of the domestic industry. Accordingly, the resources availability was overcome and did not play an important role in the Nation's development.	The Japan Times, 2012
	4.3	Water resources	2	Japan is not a water-stressed country, i.e. has had sufficient surface and groundwater for domestic, agricultural and industrial use. Its abundant water resources have also enabled the country to develop one of the world's largest hydro-electric industries. Its access to coastal marine waters rich in biotic resources has provided sufficient sea food for the country during centuries. More recently the country has been benefited by imports of virtual water.	Hoekstra and Hung, 2003; MLIT, 2008; World Trade Organization, 2010
	4.4	Climate	1	Japan has been subject to regular frequent disasters such as typhoons, torrential rains, tsunamis, heavy snow falls, flooding and the regular possibility of crop failure but this has not impeded its economic development. Likewise, such climatic risks have not contributed substantially in developing the country's economy.	OECD, 2011; OECD, 2009
	4.5	Geological Factors	0	Japan has a long history of large earthquakes and seismic activity but this factor does not contribute to explaining Japan's technological and economic development.	-
	4.6	Ecologically Sensitive Areas	1	Japan is believed to have hosted a rich biodiversity in the past owing to its diverse geologic, island characteristic and climate but as a consequence of economic development much has been negatively impacted. Japan has traditionally exploited arable land to a maximum with the place of ecosystems being left behind. Thus, the role of them in the economic development has not been significant.	Knight, 2010
Subtotal		All geo & environmental factors (6)	9		

Category	Code	Subcategory	Weight	Justification of judgement	Source
SOCIO-CULTURAL FACTORS	5.1	Historical Background	4	Japan has a very long history which has influenced its cultural development and its economic growth history. Yet, the most important developments took place since the Meiji restoration era when Japan opened up to the Western world and began guiding its development by the "waken yohsai" slogan. Japan's history of "Westernization", imitation first and then innovating, and becoming a leader in industrial production was allowed by the merge of deep cultural values (Shintoism, Buddhism, Confucianism) with the post-war capitalism production system which enabled the country to leap frog and become technologically and economically advanced in the second half of the 20th century.	Chan, 1991; EconomyWatch, 2013
	5.2.1	Demographics	4	The current demographic structure of the country goes hand in hand with the industrial production system created during the 20th century, spatially concentrated in the Pacific Industrial Belt urban agglomerations. The demographic transition of the country evidences the rapid industrialization process and the importance of an abundant workforce which developed the country. Likewise, the urban-rural internal labour migration programme was of importance to supply workforce to the growing industry. The large affluent population in Japan has constituted a domestic market which was important for the development of industries and for innovation as enterprises could test products before starting exporting. Thus, the importance has been high.	Stratfor, 2012; Statistics Bureau, 2014; UN, 2014b; JICA, 2003; UN 2014a
	5.2.2	Ethnic composition	0	Japan belongs to the group of more ethnically homogeneous countries in the world and minorities have not played any substantial role in the economic development.	Fisher, 2013
	5.2.3	Language	1	The number of individual languages listed for Japan is 15, all living languages, but due to the concentration of the population in few cities there exists a "common" or "standard" dialect which people use to communicate. Language has not been judged as a key factor explaining the economic development.	Lewis et al., 2015
	5.2.4	Religion	4	Shinto and Buddhism are Japan's two major religions. Yet, Confucianism, even more than Shintoism and Buddhism, is claimed to have been the ideological inspiration and ethical orientation during the Taika Reform, the Meiji Restoration and after World War II. Religion has been claimed to be much interlinked with the economy and the successful economic development of Japan.	Pittau, 1999; Japan-guide, 2015; Omataowski, 1996; Koisumi, 1977
	5.2.5	Cultural Norms, Values & Conflicts	4	The popularized Confucianism principles and values (cooperation between members instead of individualism- points towards a social harmony, loyalty, respect for learning, and respect for the elders) have been claimed to have highly influenced and enabled the rapid industrialization process in Japan. Examples were the harmonization of government-business relationships, labour-management relations, the employment system (life-long employment and seniority-based wages) and high labour productivity in the context of national economic goals and congruency. Another example is given by the sports in which competition exists but not between individuals but between groups in the drive for excellence and perfection.	Pittau, 1999; Uzama, 2008; Bhawuk et al., 2009; Chan, 1991; Omataowski, 1996; The Hofstede Centre, 2015

Category	Code	Subcategory	Weight	Justification of judgement	Source
	5.2.6	Civil society & environmental awareness	1	The civil society has traditionally been considered passive and docile. The environmental awareness has grown substantially in the last decades and somehow imposed higher environmental standards and regulations to the industry. Yet, the industry has responded well in achieving high environmental standards. This factor has not played an important role in the country's economic development.	Hirata, 2005; van Wolferen, 1993; Hirata, 2002
	5.3.1	Education system	5	The educational system is highly relevant as Japan has a high literacy level since already the 19th century promoted by the compulsory education laws and the permanent international benchmarking that Japan has maintained in comparison to Western countries. Japan has traditionally re-structured and adapted its educational system to match industrial requirements and keep up with the international benchmarks. The educational system is considered a most important prerequisite for economic success and as a backbone of Japan's economic development.	Teichler, 1989; OECD, 2011; Odagiri, 2006; (Deutsche Industrie- und Handelskammer in Japan, 2015; Odagiri and Goïo, 1996
	5.3.2	Education infrastructure	3	Japan's investments in educational infrastructure have historically remained moderate and the Japanese educational system is widely accepted to produce highly qualified and effective workers. Yet, it is claimed that the Japanese spend less on infrastructure than in the qualification of teachers themselves, which yields a medium importance to the infrastructure in terms of economic development (vs a higher importance on the teaching quality)	World Economic Forum, 2014; OECD, 2011
	5.4.1	Health system	4	A universal health care system has been a cornerstone of development in Japan. It was established in 1961 and provides world-class health system and low healthcare expenditure per capita as compared to other industrialised countries. Due to the excellent system (among other factors) Japanese have one of the highest life expectancy rates (at birth) in the world.	OECD, 2014; World Bank, 2015b; The Economist, 2011; Deloitte, 2014
	5.4.2	Health infrastructure	3	The investments in health infrastructure improved the health conditions of the workforce and improved the labour quality accordingly. This had a medium importance in Japan's economic development as it did with other industrialised nations.	Mosk, 2004; Institute for Management Development, 2014
Subtotal		All socio-cultural factors (11)	33		
ECONOMIC FACTORS	6.1.1	Economic structure	3	The evolution of the economic structure reflects the economic development of Japan passing to a services economic structure. This transition explains well the economic development process of Japan.	Statista, 2015; Ofsubo, 2007; Statistics Bureau, 2014

Category	Code	Subcategory	Weight	Justification of judgement	Source
	6.1.2	Industrial Geography	4	The agglomeration of the industry and the population along the Pacific Industrial Belt during the 1960s explains much of the rapid industrialization process. Economies of scale allowed a competitive industry until the 1990s when the process of globalisation led to the re-structuring of the sector based on a "global best outsourcing" new model.	Statistics Bureau, 2014; Rappler, 2015; Schaele, 2010; Okubo and Tomiura, 2010
	6.1.3	Commercial Geography	4	The imports and exports sector (trade) has been a key one during the economic development of Japan as it has been the link to the world economy supplying indispensable raw materials and shipping Japan high-value and knowledge-intensive exports. What Japan has sold to the world has changed continuously and dramatically over time, and at the same time, Japan has consistently imported a distinctively low level of manufactured imports	ING, 2012; Sumiya, 2000; Saxonhouse, 1993
	6.1.4	Agricultural Geography	1	Japan's proportion of arable land to population is among the lowest in the industrialised world but it has been efficiently used for agriculture during Japan's history. Even though the supply of rice and other vegetables was for a long time sufficient to complement fisheries, the food self-sufficiency rate has been declining passing from a 73% in 1965 to a 39% in 2010, i.e. the sufficiency has been declining alongside economic development.	Straffor, 2012; Barret and Nofaras, 2012; The Japan Times, 2015
	6.2.1	Economic diversity	2	Japan's economy is highly concentrated in the services sector, including trade, advertising, data processing, tourism and leisure industries, and the manufacturing industries. Its high concentration either on services or manufacturing has played against its economic development as it has been difficult to exit stagnation of the economy (e.g. during the 1990s)	EconomyWatch, 2013
	6.2.2	Economic output	4	Japan's (history of its) economic output explains how the country became economically developed. The evolution of the GDP is an important indicator to explain how the country's economy behaved during its economic development path.	Grabowiecki, 2006; Otsubo, 2007; Ellington, 2004; Ohno, 2006; Siddiqui, 2009; Statistics Bureau, 2014; Department of Foreign Affairs and Trade, 2015; Odagiri, 2006
	6.2.3	Labour costs, mobility & employment	3	Labour costs in Japan have been increasing during the past three decades compromising the competitiveness of the industry, i.e. they have not been a major factor for its competitiveness. On the contrary, the employment system (based on life-long employment and seniority-based payment) has been claimed to have been a key factor during the rapid economic growth of Japan (e.g. keep unemployment rate very low), although it is now being criticized and abandoned by some big corporations due to the economic difficulties.	DISCO, 2012; The Globalist, 2011

Category	Code	Subcategory	Weight	Justification of judgement	Source
	6.2.4	Interest rates	2	Despite Japan's very low (or near zero) interest rate in the last decade and a half of the economy has not been fully activated. Despite years of near-zero interest rates, Japan has suffered chronic deflation over the two decades since the bursting of its real estate bubble in the late 1980s. Over that period, the Japanese government has spent trillions of dollars in various bids to lift the economy, in the process accumulating the largest public debt in the developed world (in relative terms, i.e. debt-to-GDP ratio, otherwise the largest is held by the U.S).	Otsubo, 2007; Siddiqui, 2009; Trading Economics, 2015b; McBride, 2015
	6.2.5	Inflation rates	3	Japan's inflation rate has been kept relatively stable (except in the mid-1970s and mid-1980s when it was risen to a 6%) and Japan has from the mid-1990s actually incurred in deflation periods which have stagnated the economy. The inflation rate has not become a useful economic tool for the Japanese government to overcome a stagnant economy (e.g. mid-1990s). In the economic development it is considered of medium economic importance particularly during the rapid growth era when it average between 1% and 5%.	-
	6.2.6	Customer liquidation and spending power	3.5	Household savings have had a moderate to high importance as they have acted as one of the pillars of the high spending power of an affluent domestic market. During the high economic growth era it has been widely acknowledged that increasing the spending power, particularly of domestic private consumption, had a very important role in the industrialization of the country.	Trading Economics, 2015
	6.2.7	Foreign investment	4	Inward FDI has been limited in Japan but outward FDI by Japanese firms has been on the increase and has been an important factor in the economy's development.	Takada, 1999; Garon and MacLachlan, 2006; Ministry of Economy, Trade and Industry, 2010; Urata, 1993; The Japan Times, 2014
	6.2.8	Public finance situation	3	Given that Japan has an economy driven by the private sector (the national budget has historically been small relative to the GDP) the government expenditures and the public finance situation only explain to a relatively small extent the economic development of the country. In the 1990s even though government spending increased considerably and the national debt increased accordingly, the economy remained sluggish.	Bunker and Cantelli, 2005; Ito, 1996; Lingle, 2000; Economicshelp, 2014
	6.3.1	Energy system, consumption & access	4	The supply (import) of energy minerals to Japan during the rapid industrialization period and beyond has been one of the key factors enabling its growth as the country is virtually to a 100% dependent on mineral and energy imports.	The Federation of Electric Power Companies of Japan, 2015; U.S. Energy Information Administration, 2013

Category	Code	Subcategory	Weight	Justification of judgement	Source
	6.3.2	Transport infrastructure	4	The development of internal and external infrastructure as well as integrated logistics and transport systems created a transport revolution in the world in terms of raw material markets and costs. The lowering of marine transport costs was a key factor enabling the supply of raw materials to the country which in turn enabled the development of the Pacific Industrial Belt in the mainland, its economies of scale and the regional and international trade dominance of Japan.	World Economic Forum, 2014; Bunker and Ciccantelli, 2005
		All economic factors (14)	44.5		
POLITICAL AND LEGAL FACTORS	7.1.1	Administrative structure	2	Japan's administrative division reinforces the country's centralist decision making, judicial system and fiscal dependency. Although the role of the government has been pivotal during the Japanese high economic growth period, its administrative division was not a key factor enabling the economic development of the country.	Department of Foreign Affairs and Trade, 2015
	7.1.2	Governmental stability & transparency	3	Governmental stability is often considered a prerequisite for investments and economic growth. Japan is considered a relatively transparent country (ranks 15th in the world according to Transparency International). Japan has remained in general a politically stable monarchy, despite the high rate of Prime Minister turnover during the 1990s and during 2006-2010.	Transparency International, 2015; World Economic Forum, 2014; Columbia University, 2009
	7.1.3	Fiscal policies	3	Japan's economic development has been moderately influenced by the tax policy (low personal tax burden, higher tax burden on corporations). Japan does not rank well in the International Tax Competitiveness Index which indicates that its tax scheme is not attractive to business investment.	Pomerleau and Lun-deen, 2014; Dabner, 2001; Tax Foundation, 2012; DLA Piper, 2013
	7.1.4	Government spending priorities & allocation	3	The government investment in public infrastructure was very important during the Japanese high economic growth era as it allowed the rapid development of transport and communications infrastructure which underlie the Japan's economy. Yet given that Japan is considered a country with a low share of public spending, the factor score is medium.	Quandt, 2015; Yoshida, 2000; Kim, 2006; Dewan and Etlinger, 2009
	7.1.5	National Security	2	Japan's expenditure on national security during the high economic growth era was low and it has remained also low (in terms of % of GDP) during the last decades.	Wikipedia, 2014a; Department of Foreign Affairs and Trade, 2015; Atanassova-Cornelis, 2014; World Bank, 2015e

Category	Code	Subcategory	Weight	Justification of judgement	Source
	7.1.6	Safety & crime	1	Japan has historically been considered a safe country, with low crimes rates. High safety and low crime is considered a consequence of the Japanese culture and the high standard of living but not a key factor in determining economic development.	Nippon.com, 2014; Statistics Bureau, 2014
	7.1.7	Trade policies	3.5	Active government trade policies have been a relevant factor in the effective and successful development of the international trade by Japan. Protectionism and liberalisation measures were gradually changed by the government throughout the history to regulate the country's industry sectors.	McMillan, 1996; Nezu, 2013
	7.1.8	Bilateral, Multilateral & International agreements	4	Bilateral and international agreements have been a most important factor for Japan to achieve securing its raw materials supply and also for the marketing of its exports. This can be evidenced by the high grade of integration of Japan in international organisms and the high number of bilateral commercial agreements.	(Ministry of Foreign Affairs, 2015; U.S. Energy Information Administration, 2015
	7.1.9	Sustainable development policies	3	Japan does not have a national sustainable development strategy but an environmental plan. The sustainability aspects have not themselves been a key in Japan's economic development but Japan has also kept the pace in improving resource and energy efficiency measures, therefore it is assigned a level of medium importance.	Ministry of the Environment, 2012
	7.2.1	Legal Framework	2	The legal framework is not considered to have been particularly attractive to investments in Japan for external firms, but certainly for the Japanese internal well-functioning of the economy. Yet, cultural norms and values have played also an important part in keep the system working.	Institute for Management Development, 2014; Odagiri, 2006
	7.2.2	Resources Ownership & Property Rights Law	4	The securing of property rights and the respect for the rule of law have had a moderate importance during Japan's economic development. According to the Property Rights index (part of the Economic Freedom rank) Japan ranks 3rd in the world.	Global Property Guide, 2015; The Heritage Foundation, 2015
	7.2.3	Business legislation	3	In general business legislation favours the investments in Japan. Japan ranks 6th in the world under the category "Competition Legislation" of the Global Competitiveness index	World Bank, 2015d
	7.2.4	Employment, Labour laws & Unions	2	During the high economic growth era Japan managed to reduce at a minimum the conflicts between labour and management. The union rate in the country has remained historically low below the 20% of the workforce.	DLA Piper, 2013
	7.2.5	Environmental regulations & their enforcement	2	Environmental regulations have been strongly deployed in Japan and have made the country very energy and emissions efficient. Yet the country remains one of the largest CO ₂ emitters worldwide due to the size of the industry. During its economic development, environmental regulations are not ascertained to have had an important role.	Otsubo, 2007; Reuters, 2015; DLA Piper, 2013; Ge et al., 2014; NIES, 2015
Subtotal		All political and legal factors (1.4)	37.5		

Category	Code	Subcategory	Weight	Justification of judgement	Source
TECHNOLOGICAL FACTORS	8.1.1	Knowledge and resource base	4	The knowledge and resource base (infrastructure) in Japan is among the largest in the world which is the result of a policy of continuous high level of public and private expenditure in R&D infrastructure. In terms of scientific infrastructure, after the USA, Japan ranks 2nd in the world in terms of total expenditure on R&D with a 3.3% of the GDP. Likewise its level of total expenditure on R&D per capita in 2012 reached USD 1,562, placing it 6th in the world only behind Scandinavian countries.	World Economic Forum, 2014; Institute for Management Development, 2014)
	8.1.2	R&D culture	4	Japan's R&D culture developed during the 20th century led by technology transfer process from the West to Japan during the catch-up period and afterwards when Japan took the lead in innovation. Japan ranks fourth in the world in terms of leading innovation and is a leading OECD country in terms of R&D, of which a 70% is financed by the private sector. Knowledge transfer between companies and universities is low in Japan occupying the position 24 in the world (2014), and start-ups are still low in comparison to other countries. Japan's national innovation system is now in a transition towards science-based industries. All in all, the R&D culture is still maintained as a key to resume economic growth.	Motohashi and Muramatsu, 2012; Hashizume, 2012; Otsubo, 2007; Odagiri, 2006; Odagiri and Gotō, 1996; Motohashi, 2005; Toshihiko, 2013
	8.2	Patents, products, technologies generated	4	In terms of patenting, Japan is consolidated as a world leader and thus it is considered among the world's most innovative countries. In terms of patent grants Japan ranked 1st in the world in 2012 largely surpassing the runner-up, the USA if examined by the number of patents in force, Japan ranked also 1st in the world in 2012. In terms of patent applications, it ranks 2nd in the world after China.	BBC News, 2013; Bremner and Kim, 2014; The Economist, 2014
	8.3	Telecommunications & E-commerce	4	The telecommunications sectors, including the ICT one, have been very important for Japan's economy. Since its beginning Japan has kept pace with investments and ranks relatively high in the world in terms of computers in use and internet connections but relatively low in investment in telecommunications. With regards to e-commerce Japan is considered a strong market. Consequently, given the low level of achievements of the Japanese economy in the last 2 decades, the subcategory is awarded a low importance level.	Institute for Management Development, 2014; EKOS, 2014
	Subtotal		16	All tech factors (4)	

RADAR CHART	Sum of weights	Number of factors	Average	Multiplied by ten (to create the size of the point in the radar chart)
GEO & ENVIRONMENTAL FACTORS	9	6	1.50	15.0
SOCIO-CULTURAL FACTORS	33	11	3.00	30.0
ECONOMIC FACTORS	44.5	14	3.18	31.8
POLITICAL AND LEGAL FACTORS	37.5	14	2.68	26.8
TECHNOLOGICAL FACTORS	16	4	4.00	40.0

Appendix J3: References for Japan country report

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