

# Nickel Institute

## Socio-Economic Impact of the Nickel Industry and Nickel Value Chain in Japan

February 2009



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## 1 Executive Summary

In this report we have examined the economic impact of the Japanese nickel industry, (“the nickel industry”) and its associated value chain. Because Japan is a major global producer of stainless steel and end-use products that rely on nickel as an input, and is not a producer of nickel ore, the results of the analysis emphasize the importance of the first-use and end-use industries..

To provide the context of the nickel industry’s operating environment, we also determined the key challenges being experienced by the industry. Social contributions provided by the nickel industry to employees and communities was obtained to augment the value chain results and provide further insight into company activity.

### 1.1 Economic impact of the Japanese Nickel Value Chain

The nickel value chain encompasses the flow of nickel and nickel-based products from the extraction of nickel ores to end-use products containing nickel as a material input such as home appliances and industrial machinery. This study is primarily concerned with the evaluation of the impacts, both social and economic, of this value chain in Japan.

Perhaps the most important measure of total economic impact is the value-added contributed by an industry. Value-added measures the contribution of the factors of production to raising the value of a product. Value-added corresponds with GDP, which is the standard measure of national income. Value-added for an industry, therefore, can be thought of as its contribution to national income.

Total value-added generated by the nickel value chain in Japan is estimated to be ¥2,775billion (US \$23.8 billion). Moreover, it is estimated that the nickel value chain generates employment of 210,000 with associated salaries and wages of ¥1,617 billion (US \$13.9 billion).

### 1.2 Opportunities and Challenges for the Nickel Industry

The factors presented below were widely reported through company annual reports and corporate social responsibility (CSR) reports and were considered as either an opportunity or challenge that could affect the growth of the industry.

### 1.3 Industry Contribution to Social Development

In Japan, opportunities for the stainless steel industry present themselves in the ongoing global demand for products. The uses of stainless steel include a broad array of products as mentioned above. As well, the increasing sophistication of applications and uses continually provides opportunities for adaptation and improvement to existing products. Japan stainless steel companies are well positioned to respond to this demand as they have formed stand-alone research institutes that have resulted in expanded country-wide research and development capacity.

Industry challenges for Japan's stainless steel industry are focused on remaining cost-competitive due to the instability of base metal prices, increased production capacity from markets such as China, and rising energy prices. Domestic challenges include the expected immediate and long-term skilled labour shortage due to Japan's aging population.

A particular challenge for nickel metal producers is the threat of material substitution. Stainless steel companies have been mitigating the impact of increased metal prices by passing along price increases to customers. They have also, however, used this situation to make investments in comparable products without nickel content. While this does not extend across all nickel containing products, it does impact nickel demand.

## 2 Background and Study Purpose

### 2.1 Background

The Nickel Institute has requested the development of a baseline analysis of the global socio-economic impact of the nickel industry including production, use and recycling of nickel and nickel-containing products and materials. The purpose of the analysis is to further promote the availability and quality of socio-economic data that supports evidence of the contribution that the nickel industry makes to the sustainability goals of society.

This analysis expands upon the work<sup>1</sup> that was undertaken in 2003/2004 to generate and analyze nickel end-use data and socio-economic data for the Member States of the European Union (pre-expansion).

### 2.2 Study Purpose

It is expected that the analysis generated through these studies will produce relevant and reliable data and fill some data gaps that currently exist associated with the socio-economic impacts of nickel. The analysis is intended to foster a greater understanding of the global nickel economy.

The Nickel Institute is the industry association representing the interests of companies within the global primary nickel industry. The Institute promotes the production, use and re-use of nickel in a socially and environmentally responsible manner,<sup>2</sup> and seeks to understand and manage the many sustainability challenges facing the global nickel industry, as relevant to the social, economic and environmental aspects of the entire life cycle of the element.

### 2.3 Scope of the Research and Analysis

The scope of this study was to produce a socio-economic impact analysis that would provide a country-specific analysis of the Japanese nickel industry and associated value chain. The country-specific analysis includes the following subject areas:

- Value-added
- Employment
- Salaries and wages
- Capital expenditures
- Capital employed
- Taxes
- Research and development

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1 The Socio-economic impact of the Nickel Industry in the EU: A baseline analysis, prepared for the European Nickel Group, The Weinberg Group LLC, 2004.

2 The Nickel Institute, About the Nickel Institute, [http://www.nickelinstitute.org/index.cfm/ci\\_id/2/1a\\_id/1.htm](http://www.nickelinstitute.org/index.cfm/ci_id/2/1a_id/1.htm), Accessed September 25, 2007

Analysis was completed using the value chain methodology that follows the flow of nickel, from extraction of nickel ores to production of nickel concentrate, through to fabrication and manufacturing, ending with the recycling of nickel from finished products.

The value chain methodology follows the distinct stages of production in the material flow. Stages are categorized into four stages: direct nickel industry, first-use, and end-use. The value chain can be further analyzed according to whether nickel use is part of the broad value chain, narrow value chain or that of critical dependency. Measuring the “narrow” value chain separate from the “broad” value chain would require not only industry, but product-specific data. Unfortunately, industry data collected by Japan’s Statistics Bureau does not provide this level of detail. Therefore, our estimates should be considered measures of the “broad value chain.”

Our scope of work included the following tasks:

- Reviewed background reports and information provided by the Nickel Institute, including the Weinberg study
- Assessed the availability of published data sources for all countries to be included as part of the study
- Reviewed the methodology used in the Weinberg study for the European Union nickel industry
- Collected data on the economic and social measures specifically for the Japanese nickel industry from published sources as well as PwC published and internal documents
- Developed an economic impact model for the Japanese nickel industry
- Analyzed the economic impacts (e.g., output, GDP, employment and government tax revenue) for the direct, first-use and end-use nickel industry
- Prepared a report summarizing our key findings and conclusions

## 2.4 Data Collection, Availability and Reliability

The broad scope of this study required us to use data that are consistent and published with frequency. Our industry statistics were mainly sourced from Japan’s Statistics Bureau and other Japanese government agencies. All data specific to the Japanese stainless steel industry was sourced from the 2007 edition of Vale Inco’s “World Stainless Steel Statistics”. Other nickel production data was sourced from the International Nickel Study Group (INSG) and Heinz Pariser’s “End-Use of Nickel” report.

The primary source of nickel use data used in this report is from the Heinz H. Pariser Alloy Metals and Steel Market Research publication, “End-Use of Nickel.”

As it is our mandate to cover a diverse value chain that spans several industries, it is also necessary to use a consistent time series of data. In this study, therefore, we have used

2006 as our base year for measuring the economic impact of the nickel value chain as all required data for that year has been reported. Unfortunately, in a dynamic industry like nickel mining, this means that the numbers shown in the report may not be reflective of the current market, especially given the volatility in metal prices. It is, however, our hope that the impacts measured in this report will be viewed as an indication of the magnitude of the average economic contribution of the nickel value chain to the Japanese economy, rather than as specific to a single point in time.

## 2.5 Organization of the Report

The report begins with an introduction to nickel and the nickel value chain. Definitions are provided for the categories used to measure the value chain: direct nickel industry, first-use and end-use sectors, narrow and broad value chains. Further discussion on nickel pricing and a short-term outlook follows.

Section 4 contains an overview of the Japanese nickel industry and provides information on nickel production, reserves, mining operations and export data that describe the size and characteristics of the industry.

Section 5 outlines Japan's nickel value chain and discusses the methodology used to measure the industry across the various components of the value chain. Definitions are also provided for the categories of economic impacts measured in the analysis.

Section 6 provides the results of the economic impact analysis for the direct, first-use, end-use and total economic impact. Results include output, value-added, wages and salaries, and employment. Additional analysis on human resources discusses the number of employees attributable to the industry, and salaries and wages for part of the nickel value chain. Also discussed are estimates for capital expenditures, capital employed, and estimated research and development spending generated by the industry.

Section 7 provides an overview of key factors identified as opportunities and challenges for the nickel industry in Japan.

Section 8 includes an overview of the industry's contribution to social development for both employees and communities. Several examples of policies and initiatives supported by mining companies are presented.

## 2.6 Report Limitations

This Report is not intended for general circulation, nor is it to be published in whole or in part, without PricewaterhouseCoopers LLP ("PwC") prior written consent. We do not accept responsibility for any losses arising from unauthorized or improper use of this Report.

PwC has relied upon the completeness, accuracy and fair presentation of all the information, data, advice, opinion or representations obtained from public sources and the Client (collectively, the "Information"). The findings in the Report are conditional upon

such completeness, accuracy and fair presentation of the Information. PwC has not verified independently the completeness, accuracy and fair presentation of the Information.

PwC reserves the right at its discretion to withdraw or make revisions to the Report should PwC be made aware of facts existing at the date of the report that were not known to PwC when it prepared the Report. The conclusions and recommendations are given as of the date hereof and PwC is under no obligation to advise any person of any change or matter brought to its attention after such date, which would affect the findings and conclusions.

## 3 Nickel

Nickel-containing materials are found in a multitude of applications including buildings and other infrastructure, chemical production, communications, energy supply, environmental protection (including water treatment) and food preparation.<sup>3</sup>

Nickel can be made available through either mining or recycling. Commercial nickel mining involves two types of mines; oxide ore mines and sulphide ore mines. Nickel is the fifth most common element in the earth although much less prevalent in the earth's crust. The relative scarcity of surface deposits, the high levels of energy needed to refine nickel and the high unit value of nickel mean that there is a strong commercial incentive for recycling nickel. Stainless steel producers across the globe purchase, on average, about 45% of their nickel supply from scrap sources and 55% from primary sources.

Nickel is rarely used in its purest form. Most nickel is combined with other metals to produce alloys with particular combinations of properties that cannot be achieved by pure metals. Nickel products, therefore, play important enabling roles in many technologies to provide ductility strength at high temperatures, increased corrosion resistance and other special properties.

Nickel is used extensively in the production of stainless steel, a first-use that accounts for over 60% of primary nickel use. Examples of products using stainless steel include: chemical and food-processing equipment, transportation equipment, building facings in construction and other architectural applications, and many consumer products.

Other nickel uses of note include various battery chemistries, fuel cell chemistries, petroleum and other catalysts, pigments, electro-magnetic shielding, surface finishing (plating) and a stream of innovative applications that increase efficiencies or reduce impacts. Nickel alloys other than stainless steel are particularly prominent in demanding environments such as turbines and corrosive atmospheres and shape-memory applications.

### 3.1 The Nickel Value Chain

Value chains are used to describe and analyze the range of activities required to bring products or services from inception, through production, to final use and disposal. Extended value chain frameworks are often used to provide a more holistic understanding of the socio-economic environment in which industries operate.<sup>4</sup>

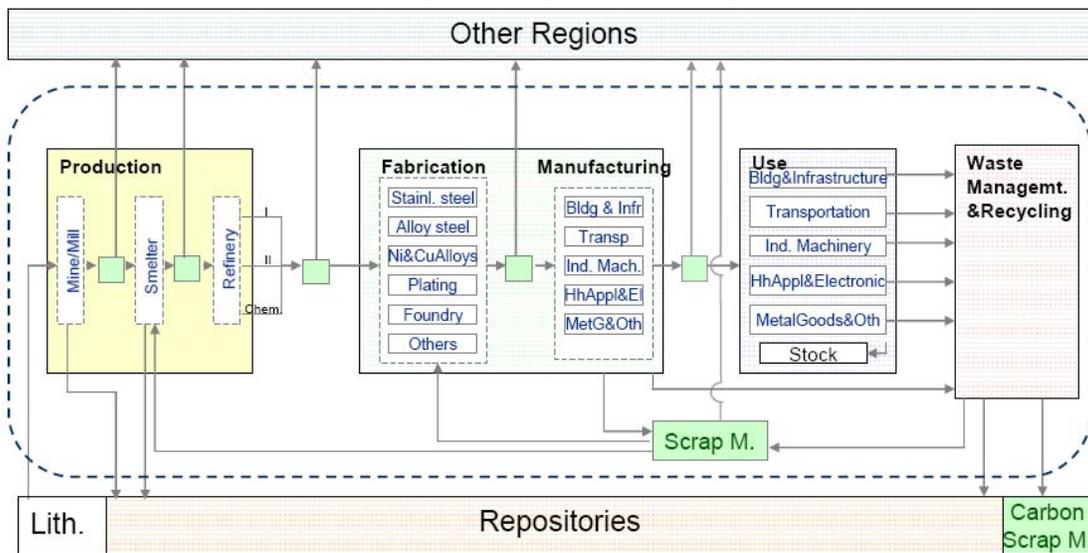
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3 The Nickel Institute, Nickel and Its Uses, [http://www.nickelinstitute.org/index.cfm/ci\\_id/16/la\\_id/1.htm](http://www.nickelinstitute.org/index.cfm/ci_id/16/la_id/1.htm), Accessed September 25, 2007.

4 A Value-Chain Analysis for the Sri Lankan Rambutan Subsector, Ismael Nicolas Barry, The International Centre for Underutilised Crops, 2006.

The diagram in Figure 3.1 presents a framework developed to describe the extended nickel value-chain. Our analysis uses this framework to estimate the economic impact of the Japanese nickel value chain.

**Figure 3.1: The Extended Value-Chain Framework**



Source: Reck, et al (2006)

Figure 5.1 shows the material flow of nickel, from the extraction of nickel ores through to the recycling of nickel from finished products. There are distinct stages or production in the material flow, representing a “value-chain” for the nickel industry.

The value chain for nickel can be thought of as including three distinct tiers. These are the “Direct Nickel Industry”, “First-Use Sectors” and “End-Use Applications”. Each is described below.

**Direct Nickel Industry** – Comprised of nickel mines, smelters and refineries. It includes the transport and logistical activities associated with the movement of nickel and the activities associated with the import of raw materials for refining and refined nickel. The direct nickel industry also includes all activities associated with the recycling of nickel-containing products.

**First-Use Sectors** – Comprised of nickel that is used as a plating material and to produce special chemical products for batteries and catalysts. The nickel-containing alloys produced during this stage are sold to product manufacturers both directly and indirectly. Those that are sold indirectly go through distributors who serve smaller customers and fabricators, metal formers and surface engineering companies, the latter of which undertake specialist services such as metal shaping, forming and sub-assembly.

**End-Use Applications** – Comprised of a number of manufacturers of components, sub-assemblies, and other products that are then used in the manufacture of finished products.

The nickel value chain can be further described in terms of a “narrow” or “broad” value chain. The “narrow” value chain focuses on those products or processes that are critically dependent on nickel. That is, for cost or performance reasons, there are not other inputs that can be substituted for nickel.

The “broad” value chain includes all applications that contain nickel. This may include applications for which alternatives to nickel are possible but less preferred. The “broad” value chain is perhaps a better measure of the current overall economic contribution of nickel as it reflects present nickel use.

### 3.2 Overview of the World Nickel Industry

As of 2006, the European Union (with Germany as the largest EU user) was the world’s largest user of nickel. China was the world’s largest single user of nickel, and Japan and the United States are second and third respectively.

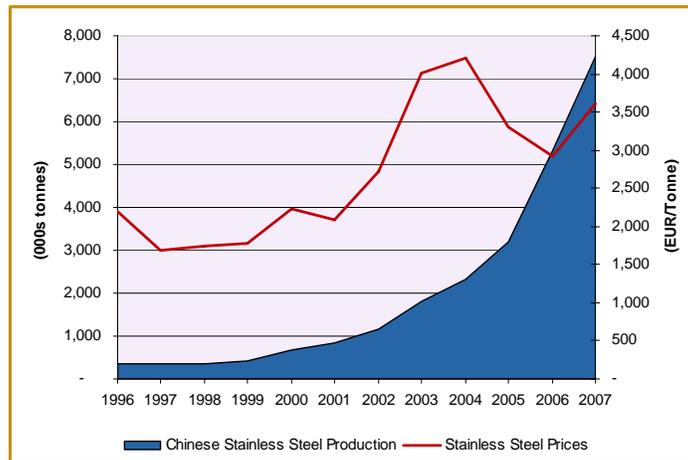
**Table 3.1: Worlds Largest Users of Nickel in 2006**

Rank	Country	% of World Nickel Use in 2006
1	China	19%
2	Japan	14%
3	United States	11%
4	Germany	9%
5	South Korea	7%

Source: Pariser (2007)

China’s growing stainless steel-producing industry has been a significant driver of the demand for nickel in recent years, and has contributed to rising nickel, and therefore stainless steel prices, as shown in Figure 3.1.

**Figure 3.2: World and Chinese Stainless Steel Production**



Source: Vale-Inco (2007)

### 3.3 World Nickel Industry Outlook

As 2008 draws to a close, it has become clear that the US economy is mired in what could be a protracted recession, induced by a collapsing housing market and turmoil in credit and financial markets. Moreover, the once popular hypothesis that the world economy had decoupled from the US (and could continue to grow robustly in spite of a US recession) has been shown to be false as the global economy stumbles toward recession.

The global slowdown has wreaked havoc in commodities markets, with the price of virtually all major industrial metals plummeting. Nickel has not been spared from this turmoil, falling as much as 84% from US\$54,200/Mt in May 2007 to as low as US\$8,810/Mt in October 2008 before rallying slightly to finish 2008 at US\$10,810.

A socio-economic analysis is not a price forecast. Nonetheless, and to provide context to the socio-economic analysis, it is appropriate to observe the relevance of the attributes of nickel to sustainable economic and human development. It is likely that the role of nickel in society will continue.

**Figure 3.3. Decline in Nickel Prices in 2008**

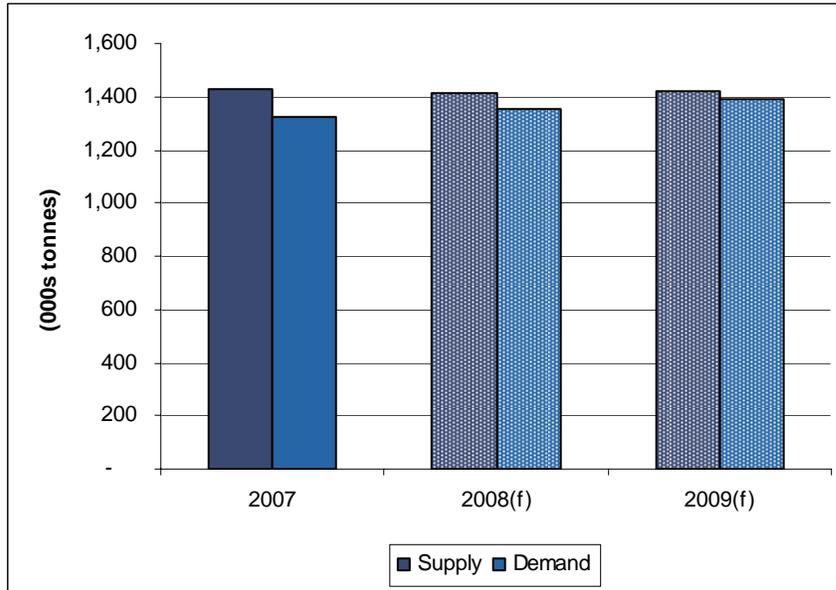


Source; Metalprices.com, London Metal Exchange Cash Price

Some of the decline in price in 2008 can be interpreted as the impact of an excess of nickel supply over demand. Demand for nickel may remain light into 2009 as the effects of the global recession lead to reduced industrial production and demand for stainless steel.

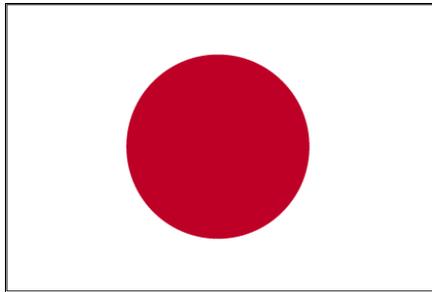
New supply of nickel has been increasing with the commissioning of new mines and world nickel refineries operating near capacity. However, production of nickel is expected to moderate in 2008 and 2009 due to dramatically lower nickel prices and rising global inventories.

**Figure 3.4: Global Nickel Supply & Demand Outlook**



Source: ABARE

## 4 Country-Specific Analysis - Japan



Annual Data	2006	% Share of World
Estimated Value-added of Nickel Value Chain (¥ billion)	¥2,775	n/a
Mine Production (tonnes)	-	-
Nickel Reserves (tonnes)	-	-
Nickel Use (tonnes)	183,000	14%
Exports of Nickel (tonnes)	46,554	n/a

Source: Heinz Pariser, PwC Calculations.

In this section, we provide a brief outline of the nickel mining, smelting and refining activities in Japan as well as discussion of nickel first-use, end-use, and trade flows.

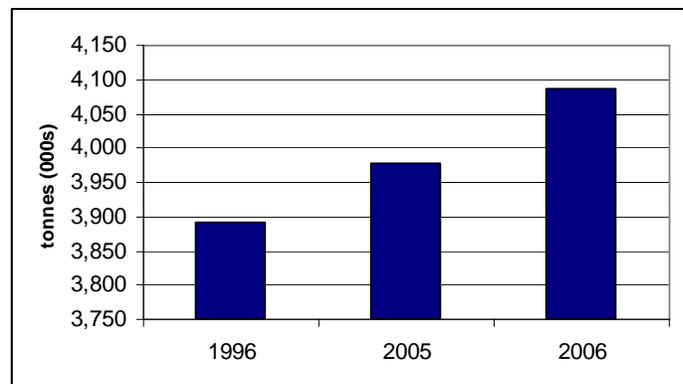
### 4.1 Overview of the Japanese Nickel Industry

Japan is a major global producer and supplier of stainless steel. Its nickel value-chain, therefore, is dominated by the first and end-use industries.

In 2006, Japanese steel-makers produced 4.1 million tonnes of stainless steel, an increase of 2.8% over 2005 and 5% over 1996. The largest producers of stainless steel in Japan are JFE Steel Corp., Nippon Steel and Sumikin Stainless Steel Corp. (NSSC), and Nisshin Steel Corp.

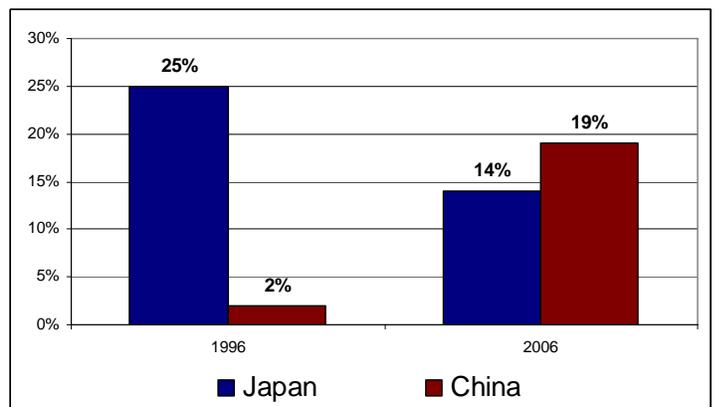
Although Japanese production of stainless steel has steadily risen since 1996, Japan has been surpassed by China as the dominant global producer. In 1996, China produced just 2% of global stainless steel. By 2006, China accounted for 19% of world stainless steel production.

Figure 4.1 Japanese Stainless Steel Production 1996-2006



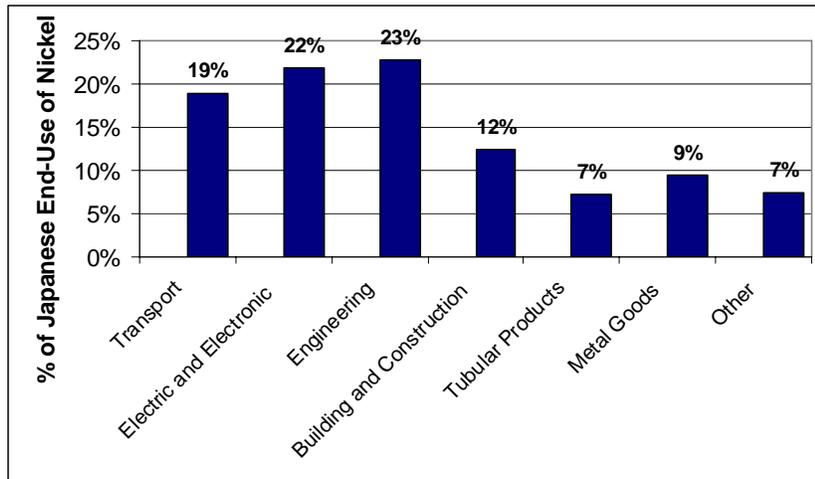
Source: Vale Inco, World Stainless Steel Statistics 2007

Figure 4.2 Japanese Share of Global Stainless Steel Production



In addition to being a major global producer of stainless steel, Japan has one of the world's largest bases of nickel end-use industries. The largest industrial end-user of nickel in Japan is engineering (chemical and petrochemical processing, tanks and heat exchangers, etc), which accounts for 23% of nickel end-use in Japan. Other large end-use industries are electrical and electronic equipment manufacturing (appliances, data processing, etc) at 22% and the transport industry at 19%.

Figure 4.3 End-Use Industry Nickel Use in Japan

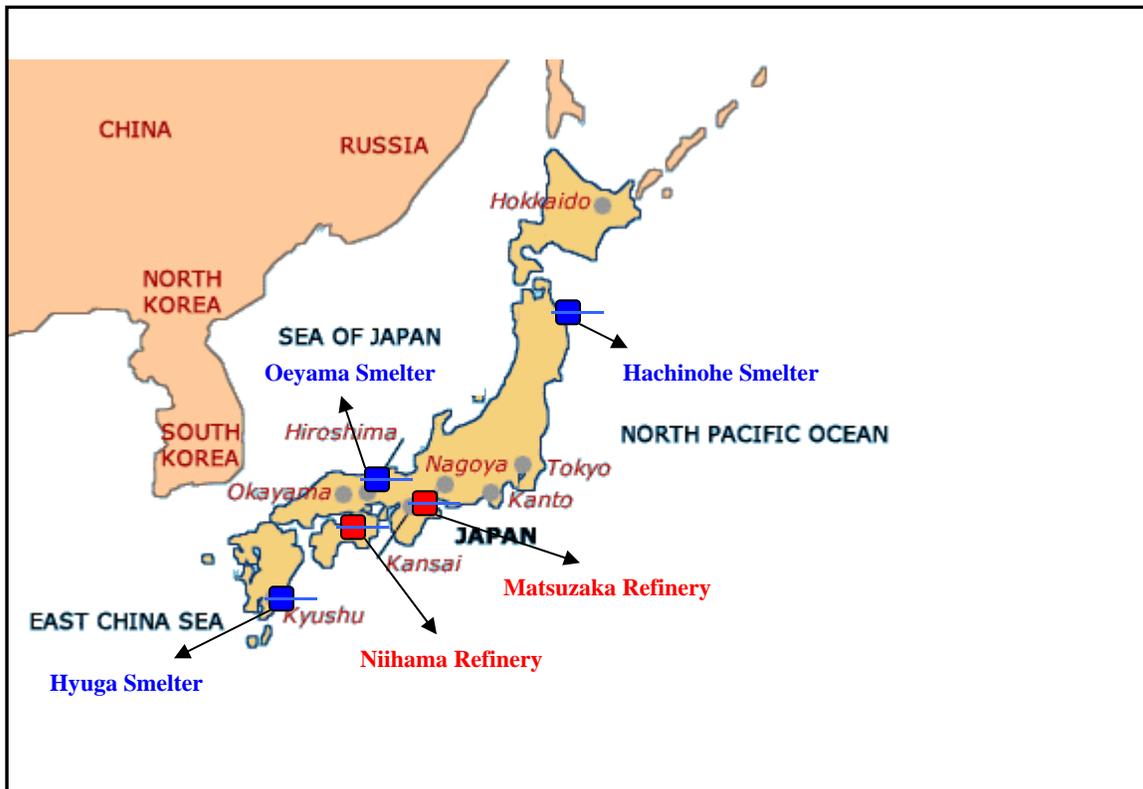


Source: Heinz Pariser, "The End Use of Nickel m1996-2006"

## 4.2 Operations in Japan

There are three nickel smelters and two nickel refineries located in Japan. These operations are shown in the map in Figure 4.4.

Figure 4.4. Map of Japanese Nickel Operations



## Smelters

Hachinohe (Pacific Metals Company)

Hyuga (Mitsui & Co., Nippon Steel Corp., Sumitomo Metal Mining Company Ltd.)

Oeyama (Nippon Yakin Kogyo Company Ltd)

## Refineries

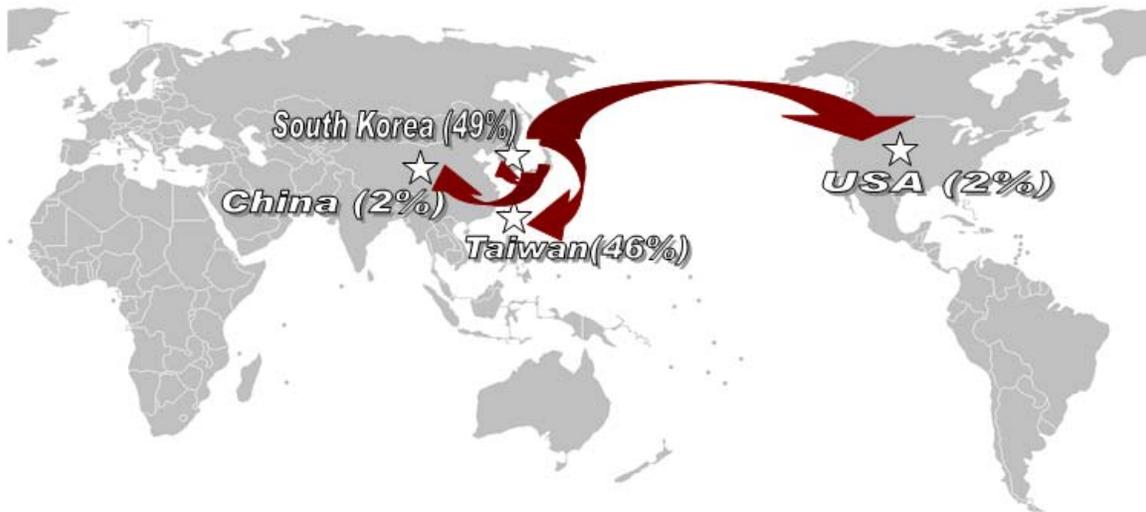
Matsuzaka (Vale Inco, Sumitomo Metal Mining Company Ltd.)

Niihama (Sumitomo Metal Mining Company Ltd.)

### 4.3 Japanese Nickel-Based Exports

Although Japan is primarily a user of nickel, it does produce some refined nickel for domestic use and export. Japanese nickel exports totaled 46,000 tonnes and ¥37.3 billion (US \$372 million) in various forms of nickel goods in 2006<sup>5</sup>. The destination of these exports is shown in Figure 4.5.

**Figure 4.5: Export Destinations for Japanese Nickel by Volume**



<sup>5</sup> Japanese nickel export statistics are from the UN Comtrade database.

## 5 The Nickel Value Chain in Japan

### 5.1 Methodology

At each stage of the value chain described in section 3.1, economic transactions take place. These transactions produce an array of economic impacts for the Japanese economy. Like the material flow of nickel, the economic flows of nickel can be traced through the value chain using what are called input-output tables (or supply and use tables). Input-output tables are compiled by national statistical agencies and describe the underlying structure of the national economy by detailing the flows of production from industry to industry. What is produced by industry X is used by industry Y for use in its own production of goods and services, which are then used or consumed by industry Z and the cycle continues.

We have measured the economic impact of these economic flows using a combination of government statistics and industry expertise. The specific methodology for each segment of the value chain is outlined below.

#### 5.1.1 Direct Nickel Industry

Japan is not a direct producer of raw nickel, and so it imported 225,000 tonnes of nickel in 2006 primarily as inputs to its stainless steel production. Approximately 152,000 tonnes of this nickel was processed in Japanese smelters or refineries for use in the first-use and end-use sectors.

We have used production data from the International Nickel Study Group and Sumitomo Metal Mining (operator of the Niihama Nickel Smelter) to estimate the value of nickel processing (smelting and refining) in the Japanese nickel industry for 2006. The direct nickel industry generates additional economic activity through “backward” linkages to industries supporting nickel processing. For the direct industry, these linkages include the transportation and logistics industry and nickel and stainless steel scrap recycling.

Production in the nickel industry will also stimulate multiplier effects through the structural linkages of the Japanese economy. For example, production in the direct nickel industry will stimulate production by firms who provide materials and services to the direct nickel industry. The effects of this production are referred to as “first-round effects” and they will in turn stimulate production by firms that provide inputs to direct nickel industry suppliers. These additional effects are known as “industrial support effects.” These multipliers were calculated using the latest input-output accounts, published by the Organization for Economic Cooperation and Development (OECD).

### **5.1.2 First-Use and End-Use**

Our estimates of the economic impacts of the first-use and end-use industries rely mainly on nickel use data compiled by Heinz Pariser. This data is widely accepted and used by the nickel industry.

Estimates for the first-use industry were made by first calculating the volume of metal products manufactured in Japan based on ratios of nickel content in stainless steel, alloys steels, foundry and plating reported by Pariser. We then estimated total sales volume based on wholesale prices for each product. Value-added, employment and other economic impacts were then calculated using industry ratios sourced from the Japanese input-output accounts.

Estimates for the end-use industry were made by mapping Pariser end-use estimates to appropriate industry codes. Industry data is not published for individual goods and as a result an approximation had to be made for nickel-based goods. This was done using the ratio of purchases of nickel-based goods to all industry intermediate inputs. Values for economic variables were then assigned to broad industry categories using relevant industry ratios.

As with the direct industry, we have also applied multiplier effects to capture first-round and industrial support effects stemming from first-use and end-use. Because much of end-use expenditure flows through first-use industries, there is a risk of double counting of impacts. We have therefore adjusted the multipliers to exclude the impacts already accounted for by the first-use industry.

## **5.2 Definitions of Economic Impacts**

### **5.2.1 Output (Sales)**

Output or sales refer to the total value of production attributable to nickel. In the case of nickel ore mining and processing it is the value of mine and smelter production, whereas in the mining services sector and other retail sectors it is equal to total sales. In addition, we have included multiplier effects stimulated by nickel mining and processing activities.

### **5.2.2 Value-added**

Value-added represents the marginal increase in value generated by an industry over and above the value of commodities it has consumed, that is, the contribution of the factors of production to raising the value of a product. It is also a measure of the contribution of an industry to Japanese Gross Domestic Product (GDP).

Our estimate of value-added attributable to the nickel industry is produced using value-added statistics compiled by Japan's Statistics Bureau as well as multipliers calculated from the Japanese input-output accounts.

### **5.2.3 Employment**

Employment is the sum of all jobs that are directly related to, or dependent on nickel. Employment estimates are derived from Japan's Statistics Bureau data, and rely principally on published employment and value-added data by industry. We have also included employment generated by multiplier effects for each segment of the nickel value chain.

### **5.2.4 Salaries and Wages**

This category encompasses total salaries and wages attributable to the nickel industry. It is estimated by multiplying the nickel employment estimates in each industry or segment of the value chain by the average salary and wages for that industry.

### **5.2.5 Capital Expenditures**

Capital expenditures are equal to the total amount of money spent on plant, machinery, and equipment, dwellings and business structures and intangible assets. Capital expenditures related to the nickel value chain are estimated by applying the industry average investment rate (as a % of value-added) to value-added attributable to nickel.

### **5.2.6 Research and Development**

Estimates for R&D expenditures are based on data from the OECD for average industry spending on R&D as a percent of GDP (value-added).

### **5.2.7 Capital Employed**

Capital employed is equal to the sum of equity capital and long-term debt and provides a measure of the total financial resources dedicated to the nickel industry. The nickel industry is global in scope and populated by large mining conglomerates that make their capital structure decisions based on their aggregate business. To estimate the capital employed that is attributable to nickel, therefore, we have relied on industry level debt-to-equity and financial leverage ratios. These estimates provide an indication of the magnitude of capital employed in the nickel value chain rather than a precise accounting of the book values of debt and equity.

### **5.2.8 Taxes**

Taxes levied in Japan on corporate income include corporate tax, corporate inhabitant tax, and enterprise tax. These three taxes add to a total tax rate of close to 45%. Japan

also levies a consumption tax of 5% on all imports and purchases. Consumption tax is an “in and out” tax; i.e., businesses will be subject to consumption tax on supplies they purchase and will withhold it on goods they sell. We have also included Japanese employer contributions to social security (i.e. payroll taxes) equal to 13.1%.

### **5.2.9 Currency**

All economic impact estimates are in Japanese Yen.

## 6 Economic Impact of the Nickel Industry in Japan

### 6.1 Economic Impact of the Direct Nickel Industry in Japan

The Direct Nickel Industry comprises nickel mines, smelters and refineries. Also included are services to mining (contract exploration and other mining services), transportation and logistics, and activities related to recycling of nickel containing products (for more on nickel recycling see Box 1).

#### **Box 1: Nickel Scrap Recycling**

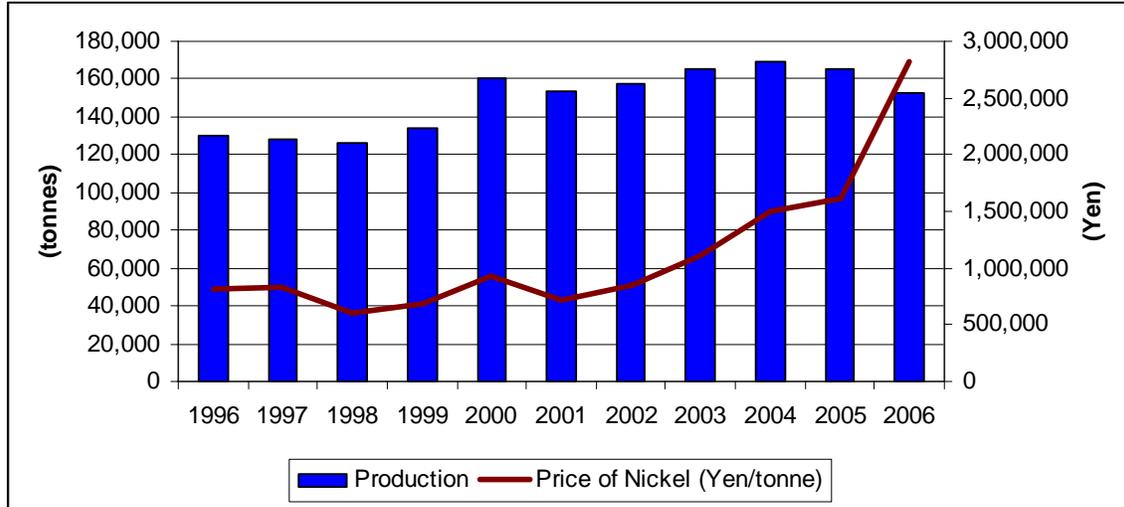
Nickel-containing scrap is generated via the production of nickel-based materials and products, and scrap generated at the end of a product's life. The latter is sometimes called post-consumer waste and includes nickel-based products such as batteries. Because scrap materials contain highly valuable nickel, there is extensive recycling and trading of nickel-based scrap materials.

The majority of scrap and nickel contained in waste products such as spent catalysts end up as input for production of stainless steel. There is a continuous demand for nickel-containing end-of-life materials regardless of the market price for nickel or stainless steel. This is because the nickel in the scrap is not degraded: it still can reflect all the attributes of nickel. In addition, melting scrap instead of melting nickel and chromium and iron to make the same stainless steel requires approximately 30% less energy. Thus the higher the scrap ratio (scrap compared to raw materials) the greater the energy savings.

As a major producer of stainless steel, Japan uses and exports stainless steel and nickel scrap. The International Nickel Study Group reports that in 2006, Japan imported 138,000 tonnes of stainless steel scrap and 5,700 tonnes of nickel waste and scrap. Any stainless steel scrap generated that is not recycled into Japanese production is exported. In 2006, Japan exported 297,000 tonnes of stainless steel scrap and 1,400 tonnes of nickel waste and scrap. The primary destination for these exports is other Asian markets, particularly China and South Korea.

In 2006, Japanese smelters and refineries produced 152,000 tonnes of refined production.<sup>6</sup> The ten-year trend in mine, smelter, and refinery production is compared against the Yen price of nickel is shown in Figure 5.1.

**Figure 5.1: Nickel Smelter, & Refinery Production vs. Average Nickel Prices (1999-2006)**



Source: International Nickel Study Group; Metal Prices.com

Table 5.1 presents the estimates for the output and value-added contributed to the Japanese economy by the direct nickel industry as well as employment and salaries and wages attributable to the direct nickel industry.

<sup>6</sup> International Nickel Study Group, “World Nickel Statistics: Special Issue”, 2007

**Table 5.1: Economic Impact of the Direct Nickel Industry in 2006**

	Nickel Ore Processing	Recycling/ Scrap	Support Industries (includes multiplier effects)	Total Direct Industry
Output (¥ billions)	¥ 191 (US \$1,640 m)	¥ 52 (US \$443 m)	¥169 (US \$1,450 m)	¥412 (US \$3,533m)
Value-added (¥ billions)	¥56 (US \$480m)	¥35 (US \$301m)	¥83 (US \$717m)	¥174 (US \$1,498m)
Employment	8,263	5,213	7,660	21,136
Salaries & Wages (¥ billions)	¥58 (US \$494m)	¥29 (US \$249m)	¥55 (US \$475m)	¥142 (US \$1,218m)

### 6.1.1 Output (Sales)

The estimated total output attributable to the Japanese direct nickel industry, including multiplier effects, is approximately ¥412 billion (US \$3.5 billion). A large part of this output is generated by nickel smelting and refining, which directly account for 43% of output in the direct nickel industry segment of the nickel value chain. Output related to recycling and selling stainless steel scrap and nickel waste is estimated at ¥52 billion (US \$442 million). The activities of the nickel industry are supported by a number of industries. We have included the impact of these industries under “support industries” in Table 6.1. The estimated output attributable to nickel in all support industries is ¥169 billion (US \$ 1.45 billion) or 41% of total output generated.

### 6.1.2 Value-added

The nickel ore mining and processing industry contributed approximately ¥56 billion (US \$480 million) of direct industry value-added. Additionally, it is estimated that support industries contribute a further ¥83 billion (US \$717 million) to industry value-added due to multiplier effects stimulated by production in the direct nickel industry. It is further estimated that recycling activities contribute ¥35 billion (US \$301 million). The total value-added supported by the direct industry is therefore approximately ¥174 billion (US \$1.5 billion).

### 6.1.3 Employment

Estimated employment in nickel smelting and refining in 2006 was approximately 8,300 and employment attributable to nickel recycling is estimated at 5,213. The estimated employment in support industries, including multiplier effects for other industries that provide services to the nickel industry is 7,660. Total employment attributable to the direct nickel industry is estimated to be approximately 21,136.

### 6.1.4 Salaries & Wages

Salaries and wages in the nickel processing industry account for ¥58 billion (US \$494 million) or 41% of total salaries and wages in the direct nickel industry. Total salaries and wages related to nickel recycling are estimated to be ¥29 billion (US \$249). Support industries contribute approximately ¥55 billion (US \$475 million), including multiplier effects<sup>7</sup>, for a total of ¥142 billion (US \$1,218 million) in salaries and wages.

## 6.2 Economic Impact of the First-Use Nickel Industry Japan

As detailed in Section 4.1, Japan is the world’s second largest producer of stainless steel, and the world’s second largest user of nickel at 13% of world nickel use.

Total use of nickel in the traditional first-use industries in Japan in 2006 was approximately 183,000 tonnes.<sup>8</sup> Table 6.2 compares Japan’s nickel use to the major nickel users around the world.

**Table 6.2: Worlds Largest Users of Nickel in 2006**

Rank	Country	% of World Nickel Use in 2006
1	China <sup>1</sup>	19%
2	<b>Japan</b>	<b>13%</b>
3	United States	11%
4	Germany	9%
5	South Korea	7%

1. Includes Hong Kong

Source: INSG (2007)

We have relied on Pariser nickel use data to estimate the economic impact of the first-use industry in Japan.

<sup>7</sup> This estimate assumes an average national annual salary of approximately ¥3.7 million is earned by individuals employed through multiplier effects.

<sup>8</sup> Heinz Pariser, “The End Uses of Nickel 1996-2006”, 2007

Pariser categorizes first-use as follows:

- Iron and steel industry – includes stainless steel and steel alloys
- Non-ferrous metal product industry – includes nickel and copper based alloys
- Plating
- Foundry
- Other

Using Pariser estimates, we calculated cost of sales and the value of production for each of the above activities. Once production value was estimated, we then applied industry ratios for the metal products industry aggregation to assign estimates of value-added, employment, capital expenditures and other measures.

To capture the impacts of stainless steel and other imports, intermediaries or distributors of stainless steel have also been included in the first-use industry.

The multiplier or support industry impacts of the Japanese first-use industry are largely due to the broad structural linkages of the stainless steel and metal manufacturing industry in Japan with the broader Japanese economy. The first-use industries, therefore, are estimated to support a broad array of employment, output and value-added.

The economic impact of the first-use industry is presented in Table 5.3 below.

**Table 5.3: Economic Impact of the First-Use Nickel Industry in 2006**

	First-Use Industry	Support Industries (Multiplier Effects)	Total
Output (¥ billions)	¥ 1,732 (US \$14,885m)	¥ 2,557 (US \$21,981 m )	¥4,289 (US \$36,866m )
Value-added (¥ billions)	¥508 (US \$4,365m)	¥938 (US \$8,058 m )	¥1,446 (US \$12,423m )
Employment	28,930	58,884	87,814
Salaries & Wages (¥ billions)	¥225 (US \$1,933 m)	¥434 (US \$3,728m )	¥659 (US \$5,661m )

### 6.2.1 Output (Sales)

Direct output in the Japanese first-use industry amounted to ¥1,732billion (US \$14.9 billion) in 2006, with an additional ¥2,557 billion (US \$22.0 billion) in support industry

impacts. The total output from the first-use industry is estimated at ¥4,289 billion (US \$36.9 billion).

### 6.2.2 Value-added

The first-use industry contributed ¥508 billion (US \$4.4 billion) directly in GDP or value-added to the Japanese economy and stimulated a further ¥938 billion (US \$8.1 billion). Total contribution to GDP was ¥1,446 billion (US \$12.4 billion).

### 6.2.3 Employment

Activities in the Japanese first-use industry are estimated to employ 28,930 persons directly, and 58,884 persons indirectly through multiplier effects. Total employment generated by first-use industries is estimated at just under 88,000.

### 6.2.4 Salaries & Wages

The employment generated directly by the first-use industry has associated salaries and wages equal to ¥225 billion (US \$1,933 million). Approximately 66% or ¥434 billion (US \$3.7 billion) of wages and salaries are generated indirectly for a total of ¥659 billion (US \$5.7 billion) in total salaries and wages.

## 6.3 Economic Impact of the End-Use Nickel Industry in Japan

Our analysis of the end-use industry in Japan follows the categorization used by Parisier. The major nickel using industries in Japan include:

- **Transport** – includes automotive and accessories, railway, aircraft and aerospace, bicycles, containers, and shipbuilding
- **Electrical & Electronic** – includes home appliances (washing machines, dish washers, refrigerators), and data processing or consumer electronics
- **Engineering** – includes vessels, tanks, heat exchangers, chemical and petrochemical equipment, food processing, packaging, pulp and paper, and textile and laundry
- **Building & Construction** – includes lifts, escalators, chimney liners, sinks and bath tubs, window frames and panels
- **Tubular Products** – includes seamless tubes, welded tubes, and flanges and fittings
- **Metal Goods** – includes cutlery, catering, fasteners, stranded wire, cables and ropes, and coinage

The estimated economic impact of end-use producers is based on the magnitude of nickel used by the above listed sectors. To the extent that some of the products are nickel dependent, that is, that nickel is the integral input to production, the estimates here may understate the total value-added contributed by the end-use industry.

For each industry, the total expenditure on nickel goods and services is grossed up by average industry mark-ups.<sup>9</sup> Value-added and other measures of interest are then allocated according to industry ratios.

The results of this analysis are presented in Table 5.4.

**Table 5.4: Economic Impact of the End-Use Nickel Industry in 2006**

	End-Use Industries	Support Industries (Multiplier Effects)*	Total
Output (¥ billions)	¥ 1,507 (US \$12,953m)	¥ 1,160 (US \$9,972 m )	¥2,667 (US \$22,925m )
Value-added (¥ billions)	¥ 600 (US \$5,157m)	¥555 (US \$4,773 m )	¥1,155 (US \$9,930m )
Employment	54,098	47,332	101,430
Salaries & Wages (¥ billions)	¥468 (US \$4,026m)	¥349 (US \$2,996 m )	¥817 (US \$7,022 )

\*Note: These estimates exclude the backward linkages already accounted for in first-use industries.

### 6.3.1 Output (Sales)

Total output from end-use industries in Japan is equal to ¥2,667 billion (US \$22.9 billion). Approximately ¥1,507 billion (US \$113 billion) or 57% of end-use output is contributed directly, while ¥1,160 billion (US \$10.0 billion) is stimulated through multiplier effects.

### 6.3.2 Value-added

The total value-added contribution from end-use industries is over ¥1,155 billion (US \$9.9 billion). End-use activities generate about ¥600billion (US \$5.2 billion) in Japanese GDP and stimulate a further ¥555 billion (US \$4.8 billion) indirectly.

<sup>9</sup> The average industry mark-up is calculated as Sales/Cost of Goods & Services.

### 6.3.3 Employment

Given the enormous size of the Japanese auto and consumer electronic industries, the end-use industries generate an impressive number of jobs. Total employment in the end-use industry is estimated at 101,000 with approximately 54,000 persons employed directly by the end-use industry and a further 47,000 employed in support industries.

### 6.3.4 Salaries & Wages

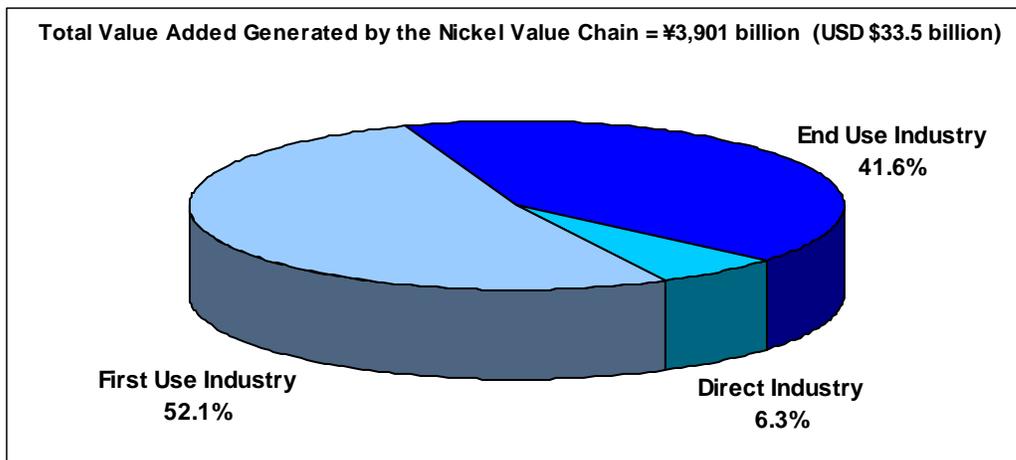
The employment generated by the end-use industry has associated salaries and wages of approximately ¥817 billion (US \$7.0 billion). The end-use industry is estimated to contribute ¥468 billion (US \$4.0 billion) directly while support industries are estimated to contribute ¥349 billion (US \$3.0 billion).

## 6.4 Total Economic Impact of the Nickel Value Chain

Summing the economic impacts across the entire nickel value chain, the total estimated value-added attributable to the Japanese economy by nickel is ¥2,775 billion (US \$23.8 billion), based on total output of ¥7,367 billion (US \$63.3 billion). The value-added produced by the nickel value chain in Japan corresponds with approximately 0.50% of Japanese GDP. The economic activities of the nickel value chain were responsible for the employment of approximately 210,000 individuals (0.40% of total Japanese employment), earning ¥1,617 billion (US \$13.9 billion) in annual salaries and wages.

The impact of the nickel value chain is dominated by the first-use and end-use industries, which accounted for a combined 94% of the value-added generated by the nickel value chain. The distribution of impacts is shown in Figure 5.2.

**Figure 5.2: Distribution of Value-added across the Nickel Value Chain**



In the following sections we have outlined in detail other economic and social impacts of the value chain, including employment, salaries and wages, capital activity, research and development, and social development.

## 6.5 Human Resources

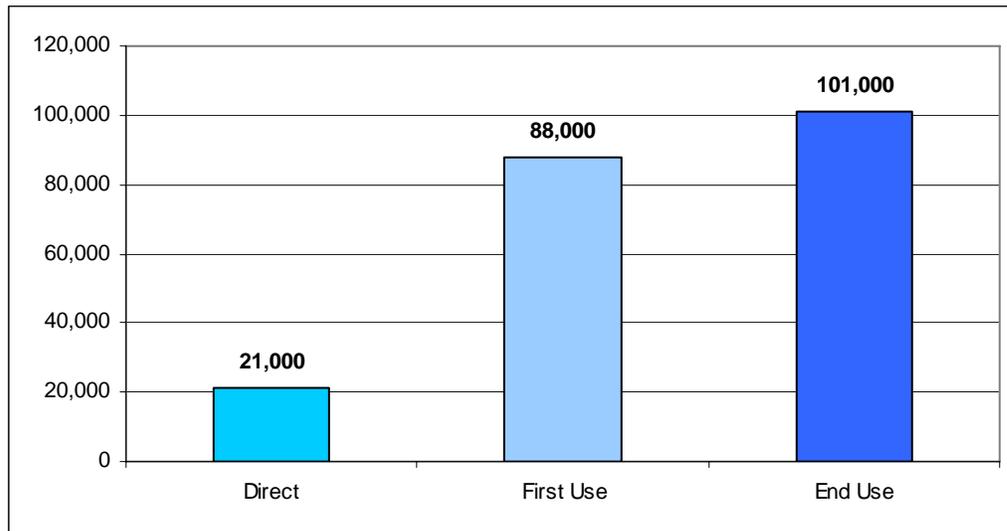
The following section provides a profile of employment in the direct, first-use, and end-use nickel industries with a focus on the following categories:

- Number of employees
- Average wages

### Number of Employees

Figure 5.3 illustrates the estimated employment attributable to the Japanese nickel value chain. Included in the estimates are employment in the direct, first-use, and end-use industries, as well as employment created indirectly through multiplier effects. The end-use nickel industry is by far the largest employer, with over 101,000 people employed. Employment in the first-use industry is estimated at 88,000 and the direct nickel industry is estimated to employ approximately 21,000. Total employment attributable to the nickel value chain is estimated to be close to 210,000 or roughly 0.41% of all employment in Japan

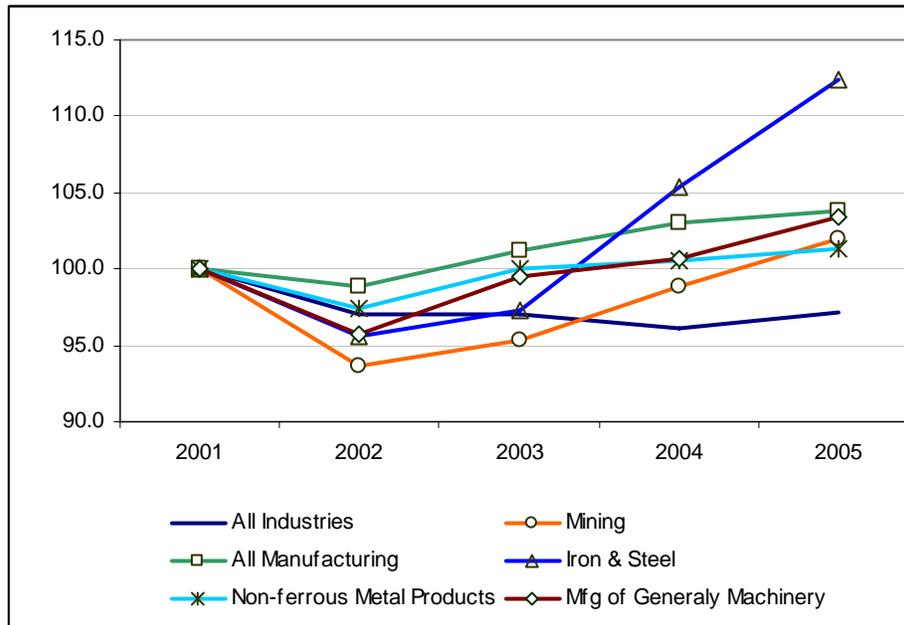
**Figure 5.3: Employment across the Nickel Value Chain, 2006**



### Salaries and Wages

Figure 5.4 provides a comparison of salary trends across the nickel value chain in Japan.

**Figure 5.4 Average Annual Salaries across the Nickel Value Chain (2001-2005)**



Source Ministry of Health, Labour and Welfare

Salaries in Japan have generally stagnated along with the broader Japanese economy for many years. Annual salaries in manufacturing, which includes most first-use and end-use industries, increased by 3.8% from 2001 to 2005 compared with a decline of 2.8% for all industries in Japan. Earnings in the Japanese iron and steel sector were particularly strong, increasing 12.4% from 2001-2005. Overall, average annual salaries in the manufacturing sector in 2006 were approximately ¥8.8 million per year (US \$75,800).<sup>10</sup>

Total wages and salaries attributable to the nickel value chain are estimated to be ¥1,617billion (US \$13.9 billion)

## 6.6 Taxes

Our estimates of tax revenues do not include corporate income taxes generated by multiplier effects because the impacts are distributed across a diversity of industries and would therefore be difficult to calculate with a satisfactory degree of accuracy. The estimates do, however, include payroll taxes from wages and salaries produced by multiplier effects.

Taxes included in our calculations are shown in Table 5.5.

<sup>10</sup> Based on contractual cash earnings – does not include bonuses or “special” cash earnings.

**Table 5.5 Taxes in the Japanese Nickel Industry**

Tax Type	Description
Corporate Income Tax	Corporate Tax Rate (30.00%); Inhabitant Tax (5.19%); Enterprise Tax (9.60%). Total Tax Rate of 44.79%.
Payroll Taxes	Japanese employer contributions to social security and payroll taxes in 2006 were 13.1% of wage earnings (Source: OECD).
Consumption Taxes	5% levied on imports and purchases of goods.

The largest contributor to tax revenues in the nickel value chain is the end-use nickel industry, which paid approximately ¥175 billion (US \$1.5 billion). The first-use industry generated approximately ¥102 billion (US \$878 million) and the direct industry contributed a further ¥14 billion (US \$122 million) for a total of ¥239 billion (US \$2.1 billion) generated by the nickel value chain.

## 6.7 Capital Activity

Capital expenditures reflect the value of fixed assets (including acquisitions) purchased by the nickel industry. Estimates of capital expenditures made by the Japanese nickel industry across all uses are presented in the table below. These estimates are based on industry investment rates of value-added attributable to the nickel value chain. One should not take these estimates as precise, but rather they are illustrative of the magnitude of spending in the nickel value chain. These estimates do not include multiplier effects.

**Table 5.6: Capital Expenditures, 2006**

Industry	Capital Expenditures	% of Total
Direct (¥ billions)	¥ 14 (US \$118m)	16%
First-Use (¥ billions)	¥ 43 (US \$367m)	51%
End-Use (¥ billions)	¥ 28 (US \$241m)	33%

Source: PwC calculations

The first and end-use industries account for an overwhelming majority of capital expenditures in the nickel value chain at ¥ 71 billion (US \$608 million) or 84% of total estimated capital expenditures in the nickel value chain. It is further estimated that the direct industry, primarily nickel processing, contributes a further ¥ 14 billion (US \$120 million) in capital expenditures. Total capital expenditures in the nickel value chain are estimated to be ¥ 84 billion (US \$726 million).

Capital employed in the industry measures the ability of the industry to leverage debt and equity to support further investment. In the following table, estimates of capital employed by all uses of the nickel industry are shown. Given the high level of consolidation of the industry, and the global and diversified nature of many of the prominent firms, it is difficult to isolate capital employed with any precision as it relates to nickel operations. The estimates provided, therefore, should be viewed as approximations to the magnitude of capital employed rather than an exact accounting of debt and equity. These estimates do not include multiplier effects.

**Table 5.7: Capital Employed, 2006**

Industry	Capital Employed	% of Total
Direct (¥ billions)	¥ 162 (US \$1,400m)	9%
First-Use (¥ billions)	¥ 536 (US \$4,600m)	31%
End-Use (¥ billions)	¥ 1,037 (US \$8,919m)	60%

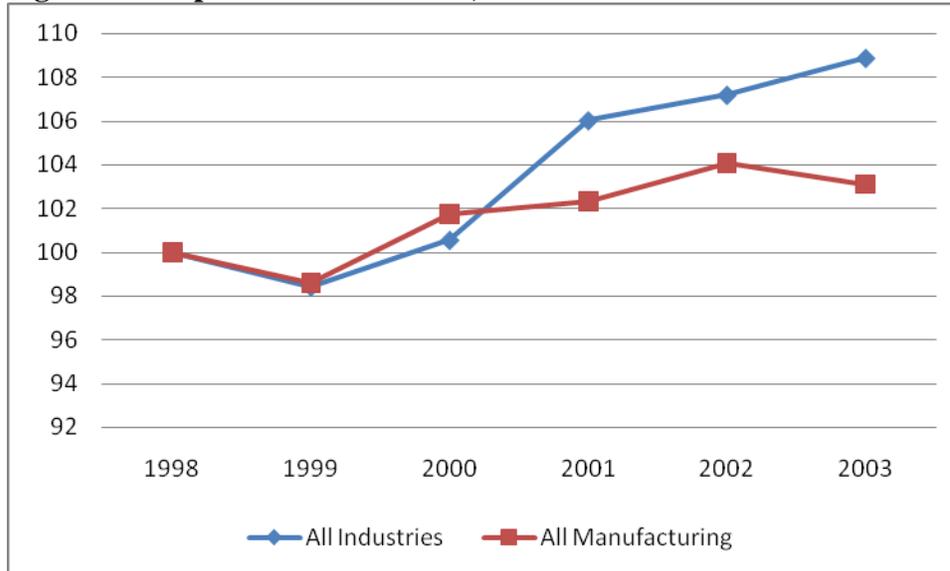
Source: PwC calculations

The end-use industry is estimated to employ a majority of capital (debt and equity) in the nickel industry at 60%. Total capital employed in the nickel chain is estimated to be ¥ 1,700 billion (US \$14.9 billion).

## 6.8 Research and Development

Data available from the Organization for Economic Cooperation and Development (OECD) show the overall trend in R&D expenditures in manufacturing increased gradually from 1998 to 2003, though at a lower rate than the industry average.

**Figure 5.6: Japanese R&D Trends, 1998-2003**



Source: OECD

R&D expenditures in the nickel value chain have been estimated using the national average of R&D intensity (R&D per dollar of GDP) in Japan. Table 5.8 displays the composition of R&D spending in the nickel value chain. These estimates do not include multiplier effects.

**Table 5.8: Estimated R&D Spending in the Nickel Value Chain**

Industry	R&D Expenditures	% of Total
Direct (¥ billions)	¥ 3.0 (US \$26m)	10%
First-Use (¥ billions)	¥ 16 (US \$140m)	50%
End-Use (¥ billions)	¥ 113.1 (US \$113m)	40%

Source: PwC calculations

It is estimated that the nickel value chain is responsible for approximately be ¥ 32 billion (US \$278 million) of research and development expenditures in Japan.

## 7 Opportunities and Challenges for the Industry

Our analysis indicates that a variety of economic, social, and legal factors influence Japan's nickel and stainless steel companies and reveal a number of opportunities and challenges. These factors originate both domestically and internationally, impacting the nickel value chain in Japan.

Industry influencing factors were identified primarily by reviewing relevant company annual reports, corporate websites, material from industry associations, and other research. This section focuses primarily on the smelting, refining, and stainless steel producing components of the nickel value chain, as these activities have the greatest socio-economic impact within Japan.

### 7.1 Opportunities & Challenges

#### Opportunities

**High Stainless Steel Demand:** An overall growth in global steel demand has provided significant opportunities for the Japanese stainless steel industry, particularly the value-added, specialty, and high tech steels that the Japanese industry specializes in. Increased demand for stainless steel also translates to increased demand for nickel, a primary component of finished stainless steel products.

**Investment in Research and Development:** Japan is a world leader in stainless steel technology and continues to make significant investments in engineering and research. Most large Japanese stainless steel companies fund and support their own research institutes, which specialize in developing high tech metals products and processes. Developing technologies include new ultra durable steel, nano steel, energy efficiency, temperature resistance properties, and recycling. These developing technologies continue to provide opportunities for the Japanese stainless steel and nickel smelting industry.

#### Challenges

**Competition with Emerging Markets:** Emerging markets (particularly China) have seen rapid increases in their stainless steel production capacity. This creates competition with established steel producers, including Japan, South Korea, and the United States. Competition with China is being lessened by the investment in joint-ventures with Chinese stainless steel making companies. In this way, Japanese companies are able to enter the market while ensuring the customer receives the highest quality product.

**Energy Prices:** Stainless steel production and nickel smelting are highly energy intensive industries and rising energy prices are creating significant production cost challenges worldwide. Energy efficiency and waste minimization have become central issues for Japanese companies operating in this sector.

**Environmental Issues and Climate Change:** Environmental issues, and particularly acid rain/greenhouse gas emissions, are a major challenge for the stainless steel and nickel smelting industries in Japan. Stainless steel and nickel smelting operations continue to be among the largest emitters of airborne pollutants in Japan.

**High Material Prices:** Overall (long term) increases in base ore/metal prices for iron, chrome, nickel, and other inputs presents an ongoing challenge to the global smelting and stainless steel industries. The challenge for nickel producers is the trend towards material substitution in stainless steel products. Instability in metal prices has lead Japanese stainless steel makers to develop alternate products that require either less or no nickel content in stainless steel products.

**Involvement with Controversial Mining:** Japanese smelters, stainless steel mills, and mining companies have been criticized due to their involvement with controversial mining projects in South East Asia. A large portion of the nickel feed supplied to Japanese smelters and stainless steel mills comes from mining projects that are associated with human rights and environmental controversies in nations such as Burma and New Caledonia.

**Labour Shortages:** Japan has an aging population and is the nation most affected by the ‘baby boomer’ phenomenon, causing net population decline. This, coupled with strict immigration laws and lower levels of youth interest in the trades and heavy industries, has created a growing labour shortage in Japan. Experts expect immediate and long term skilled labour shortages to continue in Japan, putting stress on the domestic economy while driving wages higher.

**Securing Stable Inputs:** Most stainless steel mills and smelters operate continuously and require consistent inputs to maintain profitability. Ensuring a stable and low cost supply of metal inputs has been difficult in some cases due to growing global demand. Price fluctuations (particularly rapid price increases) are often associated with supply shortages.

## 8 Industry Contribution to Social Development

Over the last two decades there has been increasing pressure on corporations from government, the public, investors, and activists to respond to demands for improved social performance. As a result, nickel smelting and stainless steel corporations have implemented policies that ensure employee health and wellness, protect the environment, and maximize benefits for communities and Japanese society. In recent years, nickel smelting and stainless steel companies operating in Japan have implemented strong Corporate Social Responsibility (CSR) policies to address these issues.

In the following sections, we describe the contributions these companies have made to social development through their employee, community, and cultural support activities. Common social impact management strategies are listed below and discussed in more detail in the following sections.

Social impact and accountability practices with regard to employees:

- Occupational health and safety.
- Employee training.
- Diverse employment and reemployment of seniors.
- Work-life balance programs.
- Improved environmental conditions on the operating site and in surrounding communities.

Social impact and accountability practices with regard to communities:

- Long-term community relations.
- Support for community values, the arts, and cultural heritage.
- Support for education and skills development in the community.
- Environmental protection.

### 8.1 Company initiatives for employees and contractors

**Occupational Health and Safety:** All companies make Occupational Health and Safety (OH&S) a priority, undertaking management, training, and safety programs that are effective at protecting worker health and safety. This has resulted in strong health and safety records of nickel smelting and stainless steel companies in Japan.

**OH&S Reporting:** All nickel smelting and stainless steel producers regularly measure and report on key performance indicators related to their OH&S management, and in many cases senior managers are responsible for OH&S performance. Under Japanese laws companies are required to report any major OH&S related accidents or infractions.

**OH&S Training:** All nickel smelting and steel companies provide OH&S training to their staff in order to protect their staff and to ensure that they have the necessary skills and knowledge to meet OH&S goals.

**Promoting a Healthy Workplace and Work-Life Balance:** Nickel smelting and stainless steel companies in Japan are committed to protecting employee physical and mental health and they encourage workers to pursue a healthy work-life balance. Childcare programs, employee recreation, competitive benefits, and vacation time are provided to employees. These companies have made visible efforts to combat the ‘overworking’ phenomenon that is common in Japan.

**Providing Employee Training:** Training of current and prospective employees is a priority for nickel smelting and steel companies, in part due to the growing shortage of skilled labour in Japan. These companies provide ongoing training to employees, focusing on skill development, higher level skill acquisition, and specialization.

**Re-employment of Seniors and Employment of the Disabled:** Japanese nickel smelting and stainless steel companies are active participants in government-led employment programs that are designed to facilitate the employment of qualified people over the age of 60 and individuals who are disabled. Nickel smelting and stainless steel companies have a variety of programs in place that accommodate the needs of these employees. At a major stainless steel company, for example, a seniors’ mentoring program employs experienced engineers and technical personnel over the age of sixty (the national retirement age) as training staff who mentor younger employees. At another company, administrative buildings have been retrofitted to allow access for disabled staff members.

## 8.2 Company initiatives for communities

Nickel smelting and steel companies in Japan are actively involved in their local communities through a variety of community outreach programs and policies. Through these initiatives and the economic opportunities created by these industries, companies are able to support Japanese communities, culture, and the environment. Common approaches undertaken by nickel smelting and stainless steel companies include the following:

- **Arts, Culture, and Sports:** Stainless steel companies and nickel smelters are heavily involved in funding arts, cultural preservation, and sports programs in Japanese communities. They give grants, funding, events, and employee participation programs that provide significant cultural value. As an example, a major metal company listed dozens of high school baseball, soccer, volleyball, and ping pong tournaments that it supported, as well as community races and marathons, cultural festivals, and beach clean ups. For each of these events the company provided funding, staff volunteers, expertise, and equipment.

- **Business and Employment Opportunities:** Large stainless steel and nickel smelting companies are major employers in Japan, providing higher paying jobs that are firmly rooted in the domestic economy. These companies also provide considerable opportunities for other Japanese businesses, forming active economic relationships with thousands of goods and services firms in the technical, legal, financial, accounting, environmental, and other sectors.
- **Community Support Programs:** Japanese nickel smelting and stainless steel companies are actively involved in local communities, supporting local charities, community festivals, and health projects. They also actively encourage employees to volunteer at local charities and events with very high rates of employee participation (over 50% in some cases). As an example, one company actively encourages staff to participate in annual community clean up events in areas surrounding several of their facilities. These events engage employees, citizens, and the community in collective environmental action and beautification.
- **Disaster Response Network:** Most large stainless steel and nickel smelters are part of Japan's national disaster response network. When disasters strike (such as Tsunamis or earthquakes) companies provide emergency funding, expertise, staff, equipment, and materials that are utilized as part of the national disaster response effort.
- **Education Programs:** Nickel smelting and stainless steel companies in Japan make significant investments in education at all levels by providing facility school tours and hands on learning for elementary aged students, scholarships for university students, and competitive apprenticeship and research positions for graduate students. For example, one major stainless steel company has created its own education foundation that provides university grants and scholarships for technical studies, Asian history projects, and cultural research. At the elementary and high school level, the company holds numerous creative writing projects each year with scholarships and publication placements for winners.
- **Environmental Stewardship:** Environmental protection and stewardship is a top priority for nickel smelting and stainless steel companies and new technological developments/ management approaches have enabled these companies to drastically improve their environmental performance over the last few decades. Top priorities include water quality protection, recycling and waste disposal, energy efficiency, and (especially) acid rain/climate change emissions. Members of the Japan Iron and Steel Federation have acted progressively towards the climate change issue and have firmly established themselves as the global industry leader in this regard. Individual companies, and the industry as a whole, have committed themselves to an 'energy diet', efficiency programs, voluntary emissions targets, and are purchasing UN carbon credits to offset their emissions. In addition, Japanese nickel smelters and steel manufacturers are actively involved in the development of environmental technologies such as ship ballast

water treatment systems, biomass reactors/boilers, and recycling technology. Several major companies have also developed green procurement policies.

- **Stakeholder Involvement:** Many nickel smelting and stainless steel companies employ stakeholder involvement and consultation practices as part of the planning, development, and operation of their facilities. Stakeholder and community consultation helps to optimize the social benefits of development and is pursued in order to aid companies with planning community outreach, business, and environmental activities. For example, one company holds open-dialogue stakeholder engagement meetings at all of its major facilities, offices, and international offices each year in order to discuss issues related to employee/customer satisfaction, sustainability, and social improvement. Senior managers at each site are expected to attend and contribute to the consultation process.

## 9 Conclusions

Japan is the world's second largest economy and one of the most significant users of nickel, and so it follows that the economic impacts of the nickel value chain in Japan are sizeable.

Economic impacts across the Japanese nickel value chain are estimated to be ¥2,774 billion (US \$23.8 billion) in value-added. This corresponds with approximately 0.50% of Japanese GDP, an amount roughly approximate to the contribution of the Japanese tobacco industry. It is further estimated that the nickel value chain supports 210,000 jobs in Japan with associated salaries and wages of ¥720 billion (US \$6.2 billion).

In addition, companies operating within the nickel value chain invest in the Japanese economy through investing in environmental sustainability, providing grants to researchers and universities to promote scientific research, and supporting education through donation of materials, grants for special cultural and industry studies, and supporting community sporting and cultural activities.

Opportunities for stainless steel producers include investing in research and development to improve existing product characteristics and new product development. This research is driven by the dedication Japanese companies have to providing their customers with the highest quality products. Investment in research and development is one way to ensure customer needs are met and generate ongoing demand for stainless steel products.

Significant, ongoing challenges for the industry include the instability of global nickel prices and the subsequent impact on cost-competitiveness with markets such as China. Of some importance for the continuity of the industry is the ability to overcome expected immediate and long term skilled labour shortages. To lessen the impact of an aging population, Japanese stainless steel companies are demonstrating flexible and adaptive human resource policies. Lastly, while the industry has made voluntary commitments to reduce carbon emissions, there remains the ongoing impact stainless steel and nickel smelting operations have on the environment.

## Appendix A. List of Sources

### **Economic Statistics and Research Reports**

Australian Bureau of Agriculture and Resource Economics (ABARE), “Australian Commodities,” 2007

Brook Hunt, “The Long-Term Outlook for Nickel”, 3<sup>rd</sup> Quarter Data Volume 2007

Fujioka, Chisa (2007) “In Japan, seniors with an edge: More firms place a value on experience.”, Reuters. Retrieved October 22, 2008 from <http://www.iht.com/articles/2007/01/01/business/yen.php>>

Heinz H. Pariser, “End-Use of Nickel: 1997-2006”, Alloy Metals and Steel Market Research, July 2007

International Nickel Study Group, “World Nickel Statistics,” November 2007

Ministry of Internal Affairs and Communication, Statistics Bureau – Input-Output Accounts

Organization for Economic Cooperation and Development, Japanese Input-Output Accounts

Organization for Economic Cooperation and Development, STAN Database

Reck, Barbara, K., Müller, Daniel, B., Rostkowski, Katherine, and Graedel, T.E., “Anthropogenic nickel cycle: Insights into use, trade and recycling,” *Environmental Science & Technology*, published on Web March 25, 2008.

Reck, Barbara, K., et al, Supporting information for the research article “Anthropogenic nickel cycle: Insights into use, trade and recycling,” Center for Industrial Ecology, School of Forestry & Environmental Studies, Yale University, New Have, 2008.

United Nations Commodity Trade Statistics Database (Comtrade)

United States Geological Survey, “Nickel Statistics and Information,” 2007

Weinberg Group LLC, “The Socio-economic impact of the nickel industry in the EU: A baseline analysis,” 2004

### **Japanese Nickel Value Chain Company Reports**

Daido Steel Co. – Environmental Report 2004, Annual Report 2008

JFE Group Ltd. – Annual Report 2007, 2008

Kobe Steel – Corporate Responsibility Report 2007 (online)

Hitachi Metals – Corporate Social Responsibility Report 2008

Mitsui & Co. Ltd. – Corporate Social Responsibility Report 2007

Nippon Steel Corporation – Corporate Sustainability Report 2007

Nisshin Steel – Annual Report 2006, Corporate Brochure 2008

Sanyo Special Steel – Annual Report 2008

Sumitomo Metal Mining Co. Ltd – Annual Report 2007

Vale Inco Japan – Corporate Responsibility Report 2007

### **Corporate Websites**

Daido Steel - <http://www.daido.co.jp/english/index.html>

JFE Group (JFE Mineral and JFE Steel) – <[http://www.jfe-mineral.co.jp/e\\_mineral/](http://www.jfe-mineral.co.jp/e_mineral/)>  
<<http://www.jfe-steel.co.jp/en/>>

Kobe Steel - <http://www.kobelco.co.jp/english/environment/2008/index.html>

Hitachi Metals - <http://www.hitachi-metals.co.jp/e/>

Mitsui & Co. Ltd. - <http://www.mitsui.co.jp/en/csr/report/index.html>

Nippon Steel Corporation - <http://www.nsc.co.jp/en/index.html>

Nippon Yakin Kogyo Co Ltd. - [http://www.nyk.co.jp/index\\_e.html](http://www.nyk.co.jp/index_e.html)

Nisshin Steel - <http://www.nisshin-steel.co.jp/nisshin-steel/english/environ/environ.htm>

Sanyo Special Steel - <http://www.sanyo-steel.co.jp/english/>

Sumitomo Metal Mining Co. Ltd - <http://www.smm.co.jp/E/>

Vale Inco Japan - <http://www.inco.com/global/>