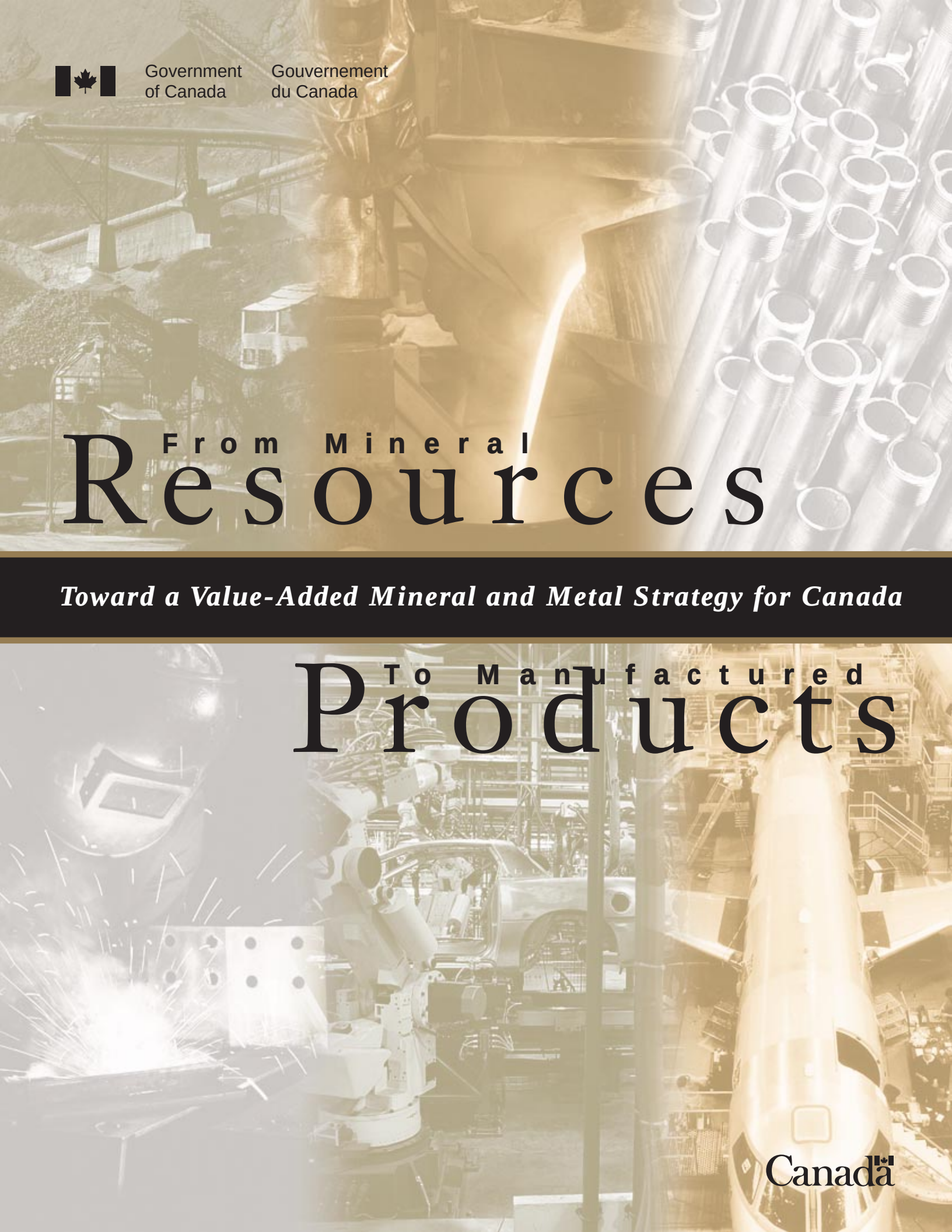


Government of Canada
Gouvernement du Canada

From Mineral Resources To Manufactured Products

Toward a Value-Added Mineral and Metal Strategy for Canada

Canada

From Mineral Resources to Manufactured Products:

Toward a Value-Added Mineral and Metal Strategy for Canada

Additional copies of this publication are available in
limited quantities at no charge from:

Minerals and Metals Sector
Natural Resources Canada
Ottawa, Ontario K1A 0E4
Facsimile: (613) 952-7501

Cette publication est aussi disponible en français, sous le titre
De la ressource minérale au produit manufacturé :
Vers une stratégie canadienne de la valeur ajoutée dans l'industrie des minéraux et des métaux

This publication is printed
on recycled paper.

PRINTED IN CANADA

PREFACE

This issues paper is designed as a vehicle to stimulate additional dialogue between the Government and the mineral and metal processing (MMP) sector on issues concerning value-added processing. The analysis and proposals contained herein are meant to act as a stimulus for discussion. They do not represent official government policy. They are being put forward simply to act as a starting point for discussion with the MMP sector.

This paper provides a very broad overview of the sector, illustrating its importance to employment in Canada and some dynamic trends. It also describes some of the challenges to growth of value-added activities within the direct chain of production or in ancillary spin-off industries. Finally, it suggests several routes for government-industry collaboration that may lead to an increase in MMP value-added activities.

CONTENTS

1.0

INTRODUCTION

Canada's mineral and metal processing (MMP) sector is one of the major contributors to the Canadian economy.

From the mining and processing of ore through parts manufacturing and final assembly into sophisticated consumer products, the sector makes a vital contribution to wealth generation and employment in both urban and rural regions of the country. Hundreds of rural communities owe their existence to MMP activities. Scores of them are single-industry cities and towns whose viability depends on one MMP enterprise. MMP firms often provide the only non-government source of salaried employment in those communities. In many cases, they also account for the bulk of local tax revenues.

The Government of Canada recognizes the importance of the MMP sector. *Securing Our Future Together: Preparing Canada for the 21st Century* is the Liberal policy platform for the Government's current term. *Securing Our Future Together* commits the Government to working with this sector to remove barriers and capitalize on opportunities for value-added growth and development:

> **"The new Liberal government will review the constraints facing value-added production in Canada to meet the needs of an evolving manufacturing sector more effectively . . .**
>
> **A new Liberal government will take a similar integrated approach** [to that taken in agriculture] **in other resource sectors to promote value-added production . . .** (and) **will work with industry and other governments to promote exports in areas such as . . . enhanced mineral and metal product manufacturing and mining, smelting, and refining technology."**

Immediately following its re-election, the Government took steps to implement its value-added policy. Industry Canada and Natural Resources Canada (NRCan) arranged a series of consultations with representatives of companies and organizations in the MMP sector. The consultations

helped to identify challenges that the sector is facing. The two departments also pulled together key statistics and competitive information to shed further light on sector challenges and opportunities.

Before embarking on the main themes of this paper, it is useful to define what is meant by "value added." In economic terms, the value added imparted by an operation can be described as the difference between the value of the outputs and the value of the inputs. The cumulative total of these differences for a whole economy is called the Gross Domestic Product (GDP). Another commonly held view is that "value added" refers to the increase in material price resulting from processing or manufacturing processes. Hence, an electronic circuit is worth considerably more per unit weight than the minerals and metals of which it was made, or a crafted bronze statue is worth more than the metal alloy from which it was cast. This paper takes a fairly broad view of what is intended by "value added," and assumes that it refers to any economic, environmental or social benefit that results from the further processing and manufacturing of minerals and metals. Therefore, the goal is not only to increase the GDP associated directly with mineral and metal processing, but also to increase the employment and other benefits that accrue from processing and manufacturing with minerals and metals, and from the many supplier industries, such as engineering, design, environmental technologies, equipment supply and others, that depend on the MMP sector for their survival.

2.0

THE MINERAL AND METAL SECTOR

2.1 MMP Structure and Linkages

The mineral and metal processing (MMP) sector is enormously complex, encompassing many diverse industries, companies, products, processes and technologies (Table 1, Figure 1). It includes industries in the natural resources and manufacturing sectors. For the purposes of gathering data, a working concept of the mineral and metal processing sector has been developed and divided into five broad stages, each comprising several sub-sectors that are linked to Statistics Canada Standard Industrial Classification (SIC) codes:

Table 1. Mineral and Metal Processing Sector — Main Stages and Sub-Sectors

A Mining & Quarrying	B Smelting & Refining	C Semi-Fabricated Parts	D Fabricated Parts & Simple Products	E Product Assembly
Metal mines Nonmetal mines Quarries and sand pits Coal mines	Primary steel Nonferrous smelting/refining	Rolled, cast, forged, and extruded products Wire and wire products Nonmetallic mineral products	Motor vehicle parts Fabricated metal products (structural metal parts, coatings, hardware, dies, molds, hand tools, plumbing) Wire and cable for energy and communications	Office furniture Agricultural implements Other machinery and equipment Aircraft (parts & assembly) Motor vehicles Trucks, bus bodies and trailers Railroad rolling stock Shipbuilding and repair Miscellaneous transportation equipment Small appliances Large appliances Batteries Jewellery and precious metals
Recycling	Recycling	Recycling	Recycling	Recycling

What the companies listed in Table 1 have in common — what connects them in an identifiable group — is that their processing or production activities require a significant component of mineral or metal refining, fabrication, assembly, and recycling (Figure 1). Companies engaged in primary production are more likely to focus exclusively on minerals and

Nonmetallic Minerals — One Sector's Story

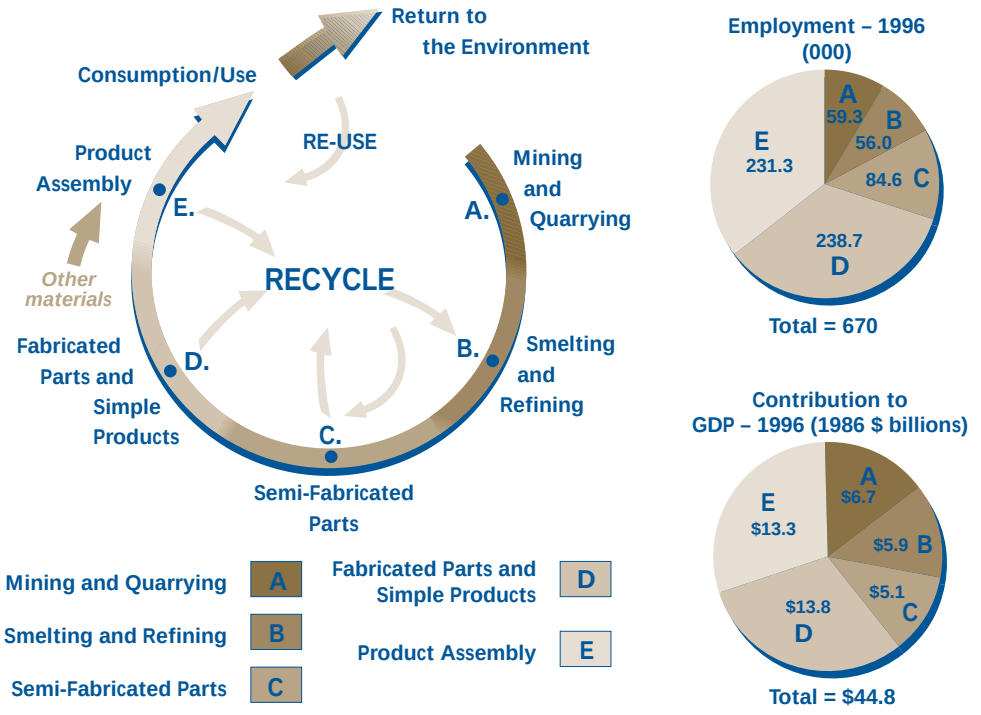
The nonmetallic mineral sector represents a vast and varied group of industries from the highly diverse mineral-producing sector to more than 100 end-use industries that include the prominent construction sector along with specialized important manufacturing sectors.

The mineral-producing sector is an important contributor to the economy; it provides more than 50 000 jobs, and generates more than $3 billion to the economy. This sector contributes to the economic welfare of more than 400 rural communities across Canada.

Only 10% of Canada's total mineral production is considered to be value added. The potential exists to increase this ratio by 5 to 10 percentage points, reflecting a possible increase in the domestic production value of close to $100 million. According to Natural Resources Canada, sectors of possible growth include silica products, fused minerals (magnesia, zirconia, etc.), high-grade lime, semi-finished natural graphite products and synthetic diamonds (produced from high-purity graphite), cut and polished diamonds and semi-precious stones (e.g., amethyst, jade and garnet), asbestos-containing parts, and enhanced sulphur and potash specialty nutrients.

Among other factors, advanced materials technology, stringent environmental regulations, and elaborate product specifications in the fabrication of semi-finished and finished products (automobile, aerospace) provide opportunities for the value-added manufacturing of nonmetallic products in Canada.

Figure 1. ***The Mineral and Metal Continuum***



A schematic depiction of the life cycle of mineral and metal-based processing and product manufacture, from mining to product assembly and ultimately to re-use, recycling or disposal. The specific industries that have been included in each stage are listed in Table 1. The pie charts show the direct contribution to GDP and employment associated with each stage.

metals, while those engaged in manufacturing will incorporate other materials into their processes or products. Table 1 is far from being an exhaustive list of all products that contain minerals and metals, since this would include almost all of manufacturing. In particular, certain key sectors that rely heavily on nonmetallic minerals, such as construction, paints, chemicals and pharmaceuticals, have been excluded. These sub-sectors have been omitted because the mineral content of the final product is often a critical, but minor, contribution to the final product, and their inclusion would distort the data beyond the point of credibility. Nevertheless, these sub-sectors present significant opportunities for value added, and will not be ignored in the development of a value-added strategy. Most Stage E industries use a significant fraction of other materials, such as plastics and fabrics. They are included here because it is not possible to achieve any understanding of the upstream stages without considering the performance of the end-use industries.

To illustrate how the MMP sector functions, a simplified example of final demand in the automotive industry is provided below. However, many other industries could also be used as an example.

The automotive example begins with a tonne of iron ore mined in Labrador that is upgraded from 30% iron to 65% iron. It is pelletized in Quebec and is then sent to an integrated steel mill in Ontario. There it is processed into 300 kg of steel ingot.

That steel is shipped to a nearby casting plant where it is formed into a rough part for an automobile. The casting is then transferred to another factory where it is machined into a finished part. That part is shipped back to Quebec, where it is installed on a car that is sold to an auto dealer in Alberta. A number of years later, the vehicle wears out and is shipped to a plant in Saskatchewan to be recycled into scrap. A steelworks in Regina melts the scrap and produces new steel to be made into new products.

In the above example, each company on the continuum applies labour and technology to the (mineral or metal) materials it processes. Thus, each company "adds value" to those materials. As a result, at each stage in the processing chain, the finished product is worth more than the value of the raw steel input materials. One measure of the importance of the MMP sector is the employment and GDP associated with each industry in the **direct chain of production**.

However, it is very important to note that each company in the MMP sector also stimulates production and employment through its **linkages to other industries** in the economy, i.e., through its material and service suppliers (Figure 2). This generates further employment at those firms and at the companies that supply them. The so-called indirect employment impact will vary depending on the company or industry sector in question. Sometimes the indirect impacts will exceed the direct employment impacts.

The Government's objective is to work with MMP industries and companies to identify and reduce barriers to value-added processing and production in Canada, and to exploit opportunities to increase the economic and social benefits to Canadians.

Example of Economic Linkages — The Mining Industry

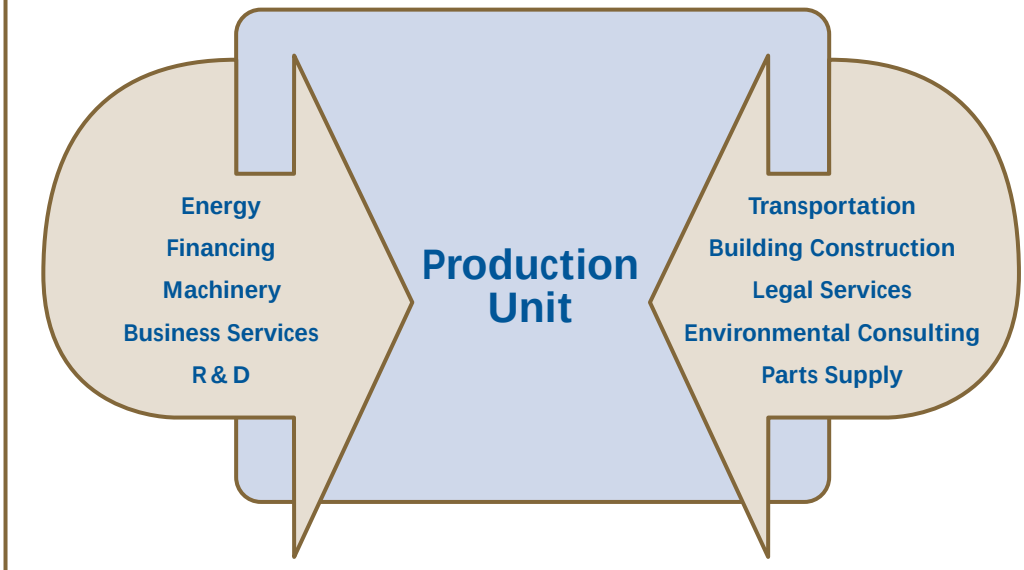
The data depicted for the direct economic impact in the mineral and metal continuum can be misleadingly small. Through their linkages to the rest of the economy, each of the major stages in the continuum contributes far more than the data shown in Figure 1 and elsewhere in this report. The following paragraphs illustrate this point for Stage A — the mining industry.

Based on the most recent available (1992) Statistics Canada input-output data, the mining industry has strong links to providers of electric power, operational supplies, engineering and consulting services related to mineral extraction, machinery and equipment, trust, finance, real estate and business services, petroleum, coal and chemicals, and repair and construction services.

Through these linkages with other sectors, it is estimated that Canada's mining industry in 1992 generated an additional $3.7 billion of GDP, and an additional 62 000 jobs not captured in the direct employment statistics. There are approximately 600 firms closely tied to the mining industry, 90% of which are SMEs.

cont'd on page 6

Figure 2. ***Value Added Through Economic Linkages***



The figure illustrates the fact that for every stage in the mineral and metal continuum, there are linkages to the rest of the economy through the supplier network. The indirect employment in supply and services to the main production stage can be substantial, and for some stages in the mineral and metal continuum, is larger than the direct employment. The possibility of growth and export development in the supplier industries represents an opportunity for value-added benefits.

2.2 Economic Contribution of the MMP Sector

2.2.1 Employment and Gross Domestic Product

The mineral and metal processing sector has a far-reaching impact on Canada's economy and society. Consider that companies in the sector provided direct employment for 670 000 people in 1996 (Figure 1), and indirect employment for hundreds of thousands more. Mineral and metal processing firms in total employ more people than companies engaged in agriculture, construction, transportation and storage, or communications.

Employment in the MMP sector is on par with that in wholesale trade, finance, insurance and real estate, and government services. Overall, it is estimated that well over one million jobs depend on the performance of the MMP sector.

The MMP sector has a huge impact on Canada's economy. In 1996, the sector contributed the equivalent of nearly $44.8 billion to GDP (in 1986 dollars), which was over 8% of the country's total GDP in the year.[1] Moreover, MMP companies and their employees contribute billions of dollars annually in the form of municipal, provincial and federal taxes. As such, they underwrite a large part of the cost of the public services that are so important to Canadians.

Since the MMP sector in total is very complex, including literally thousands of firms ranging in size from a few employees to tens of thousands of

1 Total GDP in 1996 was $550 billion (in 1986 dollars).

cont'd from page 5

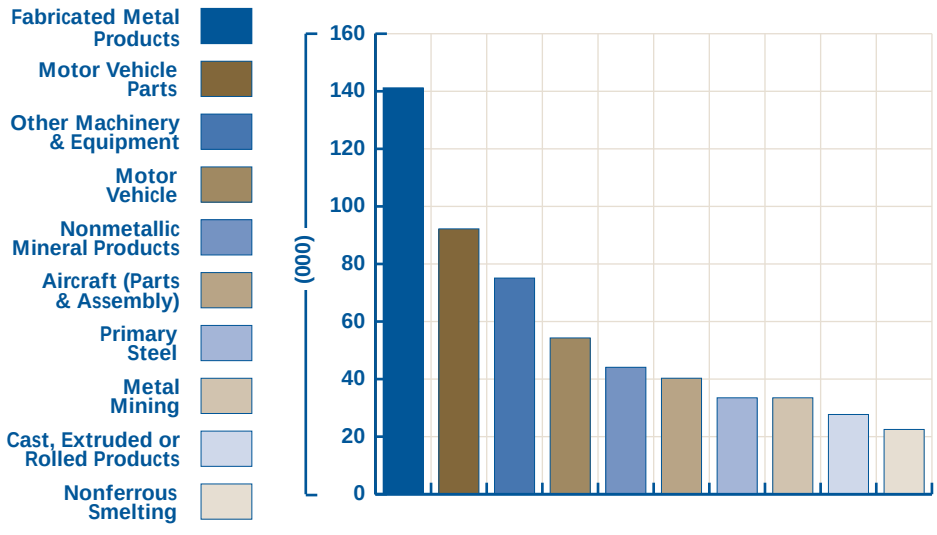
Canada has become the world's centre for mine financing, raising $8.8 billion on capital markets for domestic and foreign mine financing in 1996. Moreover, in 1997, the shares of more than 300 mining companies traded on the Toronto Stock Exchange and accounted for 27% of the trading volume, second only to the financial services sector.

The mining industry also finances research in value-added products. In fact, seven mining and smelting firms were listed among Canada's top 100 R&D spenders in 1995. For example, through in-house research or in partnership with academia and government research laboratories, the mining industry has been involved in research programs on automated drilling, heavy equipment and robotics, rechargeable batteries, specialty mineral powders and coatings, galvanized metals for automotive and construction applications, reduced diesel emissions, underground communications, and metals and tailings recycling.

Furthermore, research on exploration technologies has led to the development of knowledge-based industries in geomatics and mapping. Environmental research on subjects such as acid mine drainage, aquatic effects, and metals in the environment has enabled Canada to become a world leader in the understanding of environmental impacts and remediation technologies. A 1995 study showed that 17 000 people were employed in minerals- and metals-related environmental consulting firms that generated $2 billion in sales.

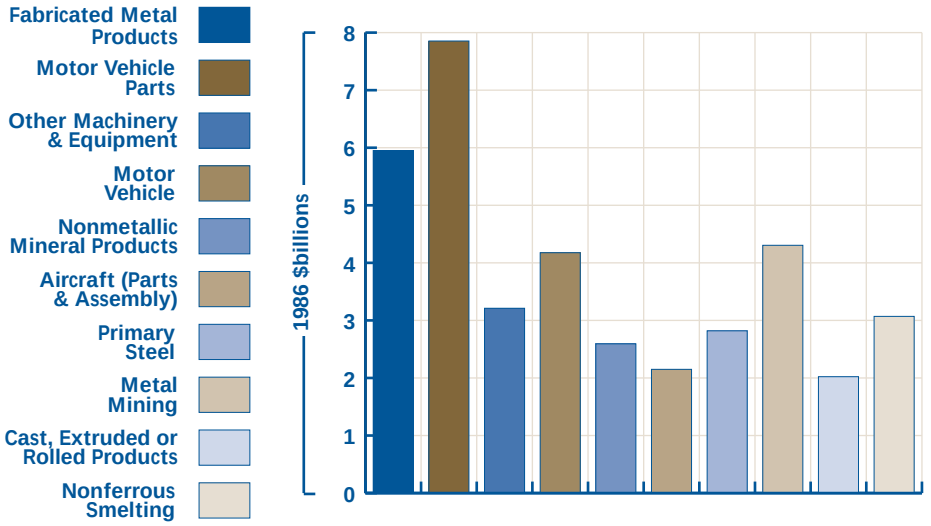
All in all, the benefits to Canada of having a major production industry like mining far exceed the direct benefits captured in statistical data.

Figure 3. ***Employment, 1996***
Top Ten Sub-Sectors — Minerals and Metals



Employment Data for the Top Ten Sub-Sectors in the Mineral and Metal Continuum. Note the importance of two sub-assembly industries: fabricated metal products and motor vehicle parts. (Source: Statistics Canada)

Figure 4. *Contribution to GDP, 1996*
Key Sub-Sectors — Minerals and Metals



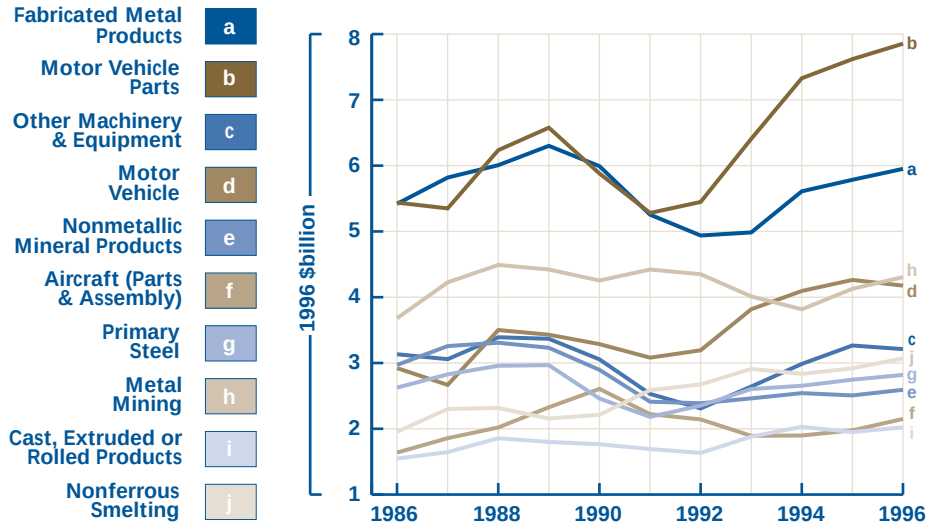
1996 Contribution to Gross Domestic Product Associated with the Top Ten Sub-Sectors by Employment (Figure 3). (Source: Statistics Canada)

employees involved in the manufacture of a wide range of products, few useful insights about value added can be drawn from examining data that are summed for the whole sector, or even the five stages. For this purpose, it is useful to examine the performance of the major sub-sectors within the mineral and metal sector. Figures 3 and 4 depict the employment and GDP contribution for the "Top Ten" sub-sectors in 1996.

These figures illustrate the importance of two Stage D industries: the fabricated metal products industry and the motor vehicle parts industry, which are the two largest sub-sectors both in terms of direct employment and their contribution to GDP. Other key sub-sectors are the machinery, motor vehicle assembly, nonmetallic mineral products, aircraft parts and assembly, primary steel, metal mining, cast, extruded or rolled products, and nonferrous smelting industries. Each of these sub-sectors is distinctly different, although there are strong linkages between some of them, such as primary steel, motor vehicle parts and motor vehicle assembly. For the remainder of this paper, data are presented on a sub-sectoral basis to give the reader more insightful information on value added in the mineral and metal processing sector.

As important as the MMP sector is to Canada's economy, growth trends over the last decade have been uneven. From 1986 to 1996, the total output of Canada's economy increased by 22% from $452 billion to $551 billion. During the same period, output from the manufacturing industries increased by about 18% from $88 billion to $102 billion, and the mineral and metal processing sector as a whole grew by 22% from $38 billion to $45 billion. However, a closer look at the performance of key MMP sub-sectors reveals the cyclical nature of the industry, particularly the impact of the recession

Figure 5. ***Gross Domestic Product, 1986-1996 (Key Sub-Sectors)***



Gross Domestic Product of Key Sub-Sectors in the Mineral and Metal Continuum from 1986 to 1996. The impact of the recession in the early 1990s is evident. (Source: Statistics Canada)

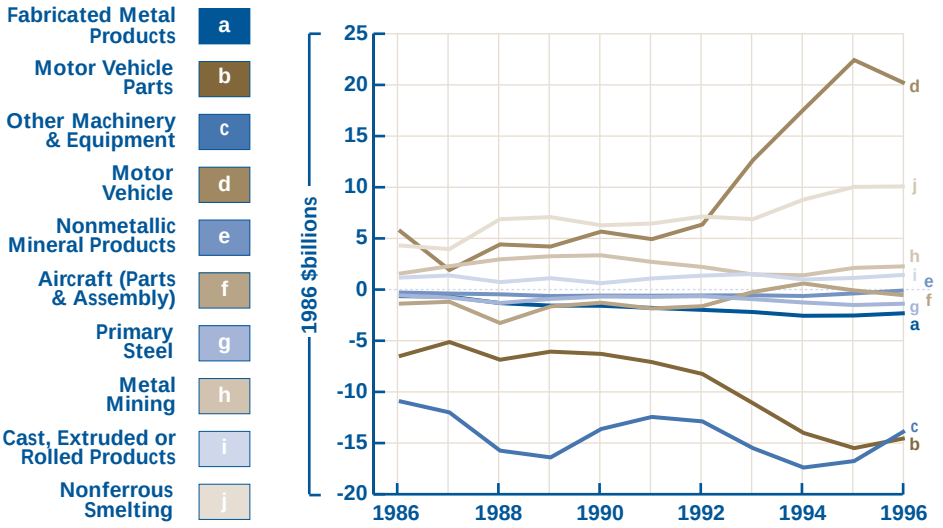
in the early 1990s (Figure 5). Of these sub-sectors, nonferrous smelting seemed to be unaffected by the recession. Most sub-sectors had recovered from the recession by 1995, with the automotive sector showing strong growth from the 1992 trough. However, the fabricated metal products, nonmetallic mineral products, primary steel and aircraft industries had not fully recovered by 1996 to their pre-recession output from the best years of the late 1980s.

2.2.2 International Trade

From a trade perspective, Canada's actual competitive situation is not straightforward. Of the leading MMP industry sectors, Canada has a large negative balance of trade in machinery and equipment, and motor vehicle parts, with more modest negative trade balances for primary steel and fabricated metal products (Figure 6). While most Canadians would not be surprised that Canada is a net importer of machinery and equipment, they may be surprised to learn that we are also a net importer of primary steel. On the other hand, the motor vehicle assembly industry enjoys a healthy, positive balance of trade, as do the nonferrous smelting and metal mining industries. Overall, the sector had a razor-thin trade surplus of only $4 billion in 1996 on total exports of $122 billion and imports of $118 billion.

Balance of trade data can be misleading because they are not normalized to total output. Another way of looking at trade data is to examine the ratio of imports to exports (Figure 7). In this case, the strong performance of the nonferrous smelting industry is highlighted, since Canada exports nearly four times as much as it imports of products from the nonferrous smelting industry. The performance of the primary steel industry, in contrast, is quite different. Imports are four to five times larger than exports for this sub-sector, indicating that demand for steel outstrips domestic capacity. The motor vehicle industry is always interesting. Canada exports more than twice as many vehicles as it imports, but needs to import a significant number of parts (twice as many as are exported)

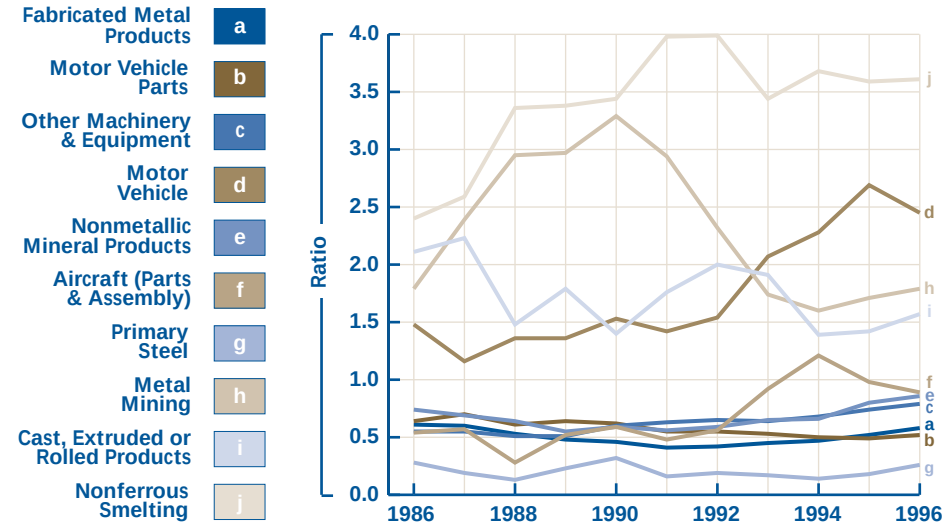
Figure 6. ***Trade Balance (Exports Minus Imports), 1986-1996 Key Sub-Sectors***



Balance of Trade Data (Exports minus Imports) for Key Sub-Sectors from 1986 to 1996. Note the rapid growth in exports for the motor vehicle industry, with a corresponding growth in imports for the motor vehicle parts industry. (Source: Statistics Canada)

in order to feed the assembly industry. A similar relationship exists for the aircraft industry; the majority of alloys that are used in Canada's vigorous aircraft manufacturing industry are imported. For this industry, the trend is the reverse of what most Canadians expect. For the types of aircraft in which Canada specializes, the raw materials are imported and the final product is exported.

Figure 7. ***Trade Ratios (Exports Divided by Imports), 1986-1996 Key Sub-Sectors***



Trade Ratios (Exports divided by Imports) for Key Sub-Sectors in the Mineral and Metal Continuum from 1986 to 1996. This illustration graphically shows what fraction of domestic demand can be met by the industry in question. (Source: Statistics Canada)

Canada's largest trading partner, for both the source of imports and the destination for exports, is the United States. The MMP sector is heavily export-oriented, and operates in what is largely an integrated North American market. The Canada-U.S. Free Trade Agreement and the North American Free Trade Agreement have increased the rate of integration of the North American market. The United States is a source of competition as well as a market for Canadian firms; therefore, the comparative business climate between Canada and the United States will have a large effect on the competitiveness of Canadian firms in mineral and metal processing and production. For this reason, the exchange rate, transportation costs, labour costs, the influence of government programs, and other factors will play a significant role. This is further discussed in subsequent sections.

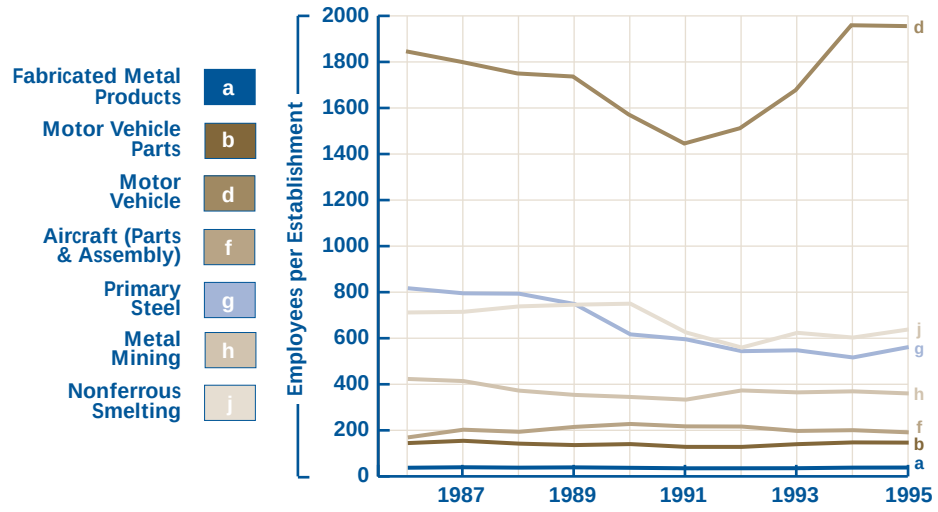
One objective of a value-added strategy is to help the mineral and metal processing industries boost their capacity to satisfy a higher portion of the domestic market's requirements and to broaden their trade base.

2.2.3 Industry Structure

Another important characteristic is industry structure, including the size and number of firms in the sector. The data depicted in Figure 8 for several key sub-sectors show the average size of establishments from 1986 to 1995.

It is clear that there is a large disparity in the size of firms in various sectors. The motor vehicle assembly industry has the largest establishments of up to 1800 employees. The nonferrous smelting and primary steel industries have establishments with the next largest size of about 600 employees. At the other end of the scale, establishments in the fabricated metal products industry are very small with about 27 employees on average. The same is true for the nonmetallic mineral products sub-sector (data not depicted), and for the machinery and equipment industry, which average about 50 employees per establishment (also not depicted). In the motor vehicle parts industry, establishments are somewhat larger with about 150 employees. Therefore, the bulk of the employment in minerals and metals is associated with small- and medium-sized firms (refer to Figure 3).

Figure 8. ***Employees per Establishment, 1986-1995 Key Sub-Sectors***



Average Size of Establishments for Key Sub-Sectors from 1986 to 1995. Establishments in the fabricated metal products and motor vehicle parts industries are small (less than 150); the same is true for the machinery and equipment and the nonmetallic mineral products industries (data not shown — refer to text). (Source: Statistics Canada)

In many industries worldwide, globalization and international trade are leading to the creation of larger business enterprises. At the same time, many firms have become more productive by shedding labour and reducing their overall employment levels. For Canada, there is little evidence that firms in the mineral and metal processing sub-sectors are growing in size. In fact, two sub-sectors that showed good productivity growth (the primary steel and nonferrous smelting industries) have declined in average establishment size.

2.2.4 Capital Investment Trends

Capital investment is an important factor underlying productivity, and is essentially a measure of the extent to which firms are updating or expanding their production capacity. Capital investment in the MMP sector tends to vary on 10-year-long cycles. When investment is normalized to shipments, it is possible to compare different sub-sectors. Although these data are not depicted, capital investment as a percentage of shipments is highest for metal mining and nonferrous smelting, two sub-sectors that showed a healthy rate of productivity growth. Capital investment in metal mining tends to be continuous at about 12-15% of shipments; in nonferrous smelting, it peaked strongly in 1990 reaching a very high level of over 30% of shipments in that year. On a cyclical basis, there have been high levels of investment by the motor vehicle assemblers on an absolute basis that, however, only amount to about 7% of shipments. Investment by the primary steel industry also peaked around 1990 at about 7% of shipments. In contrast, investment by the fabricated metal products producers has been modest at less than 3% of shipments, whereas investment by the motor vehicle parts producers is somewhat higher, having peaked in 1994 at nearly 9%. Capital investment by the aircraft and parts industry is not high (about 3%), reflecting the fact that this has not been a particularly capital-intensive industry. In general, there is some correlation between investment patterns and productivity growth. For industries where productivity is very important to competitiveness, the availability of capital investment funds would be critical.

2.3 Value Added, Innovation and Productivity

In an increasingly global economy, the MMP sector can anticipate growing international trade as well as increased competition in materials, parts, products, services and labour. In general, this is positive for Canada because, overall, Canada has productive industries that compare favourably with their counterparts abroad.

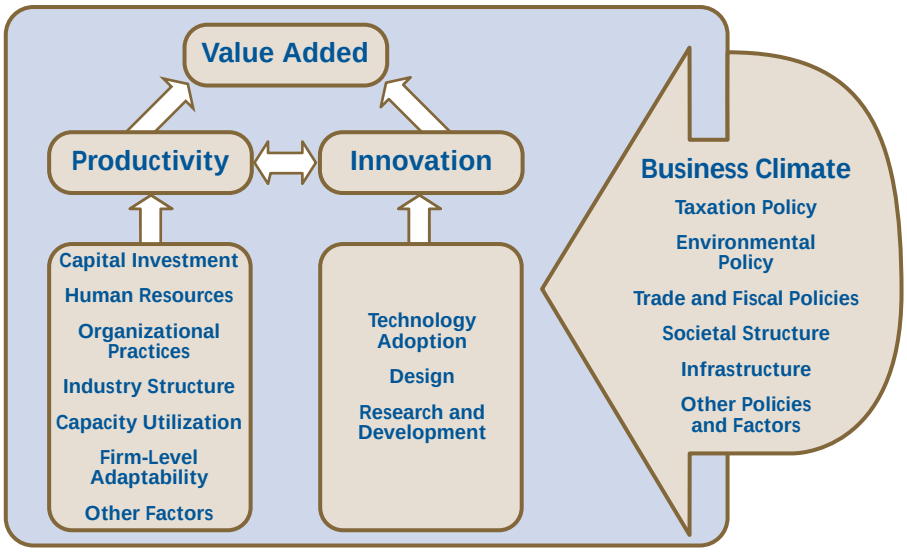
Ultimately, a country will only perform economically as well as its companies and industries. The industry's performance level is directly related to its competitive advantage, which is affected by many factors. Over time, the relative influence of these factors can change. Some factors (e.g., metal prices or exchange rates) can vary over comparatively short cycles. Other factors, such as ore reserves or firm-level productivity, may vary over longer time scales. Furthermore, many factors that determine competitive advantage, such as international commodity prices, are beyond the influence of any one company or industry. However, a number of other factors (e.g., capital investment or technological innovation) are directly within their control.

Industries earn their economic position through successful competition. Ultimately, the challenge for any firm is to maximize its performance with respect to the competitive factors that are under its direct control. The main challenge for governments is to ensure the existence of a favourable business climate and a suitable infrastructure for companies and industries to develop and grow. Governments can also directly influence the viability of specific industries through incentive programs, trade missions, procurement practices and other strategies.

Moving Up the Value Chain

Algoma Steel operates in a mature market where price competition is fierce. In an effort to differentiate its products and move up the value chain, Algoma teamed with a federal research laboratory (CANMET) to develop an innovative new product. Algoma's objective was to extend markets for its tubular steel products beyond its traditional oil and gas customers. The result of the joint research work was a high-strength micro-alloyed seamless steel tube. Micro-alloyed steel permits complete in-line processing of a weldable product. In this way, it eliminates a number of costly downstream processing steps normally required to manufacture steel made with conventional alloys. The new technique saves processing money and will allow Algoma to develop two new commercial products, hydraulic cylinders and axles.

Figure 9. ***Elements of Value Added***



Elements of Value Added: Illustration of the Factors that Underpin How Industries Perform Relative to their Competition. The factors shown under "productivity" and "innovation" are more under the direct control of individual firms than the factors influencing the business climate in which they operate.

Whether at the level of an individual firm, an industry or a nation, increasing value-added activities demands increasing competitiveness. What, then, is the source of competitiveness, and how can it be increased?

At the company level, a value-added strategy based on increased competitiveness rests on two pillars: productivity and innovation. The business climate in which companies operate is a separate determining factor, some aspects of which are more readily influenced by governments than by individual firms (Figure 9).

Productivity is a measure of how efficient a company or industry is at adding value to its products or processes. Productivity refers to whether a firm is "doing things right." Innovation is the capacity of a firm or industry to develop new products and processes, and to improve the productivity of labour or capital. The level of innovation can affect whether a firm is "doing the right thing."

Ultimately, the companies in the mineral and metal processing sector that prosper will be those that have the right combination of productivity and innovation to allow them to compete in the current business climate. Conversely, the companies that struggle will be those that lack either the productivity or the innovation required to produce efficiently or to develop goods or services that have a distinct advantage because of unique qualities. High productivity and a high level of innovation sometimes go hand in hand. These are critical factors that underlie a firm's ability to add value to its products, processes or services.

2.4 MMP Sector Productivity and Innovation Performance

How has the MMP sector performed with respect to productivity and innovation? The following section is concerned with how the MMP sector has performed on measures of productivity and innovation, with some emphasis on comparisons with the performance of competitor sectors in the United States.

2.4.1 Productivity

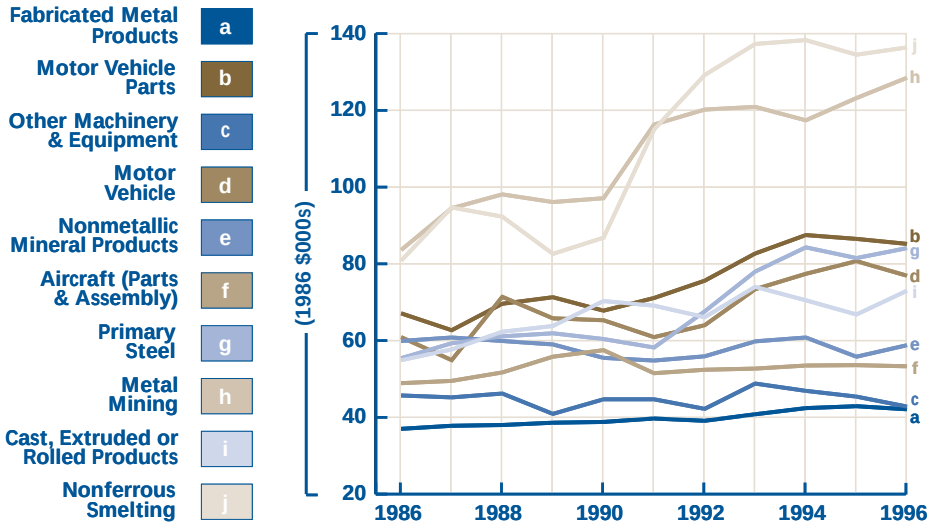
Although there are several measures of productivity, the one used in this analysis is labour productivity or contribution to GDP per employee. Statistics Canada data for productivity trends for some MMP sub-sectors

are shown in Figure 10. Over the ten-year period from 1986 to 1996, labour productivity increased strongly in the nonferrous smelting (69%), metal mining (54%) and primary steel (52%) industries, and did moderately well in the cast, extruded or rolled products (33%), motor vehicle parts (27%) and motor vehicle assembly (27%) industries. Productivity increases have been low or negative in other sub-sectors such as fabricated metal products (14%), aircraft parts and assembly (9%), nonmetallic mineral products (-2%), and other machinery and equipment (-6%).

It should be remembered that not all industries depend on productivity growth for competitiveness. For some industries, product differentiation (i.e., a product with a unique characteristic that is not easily copied) is more important.

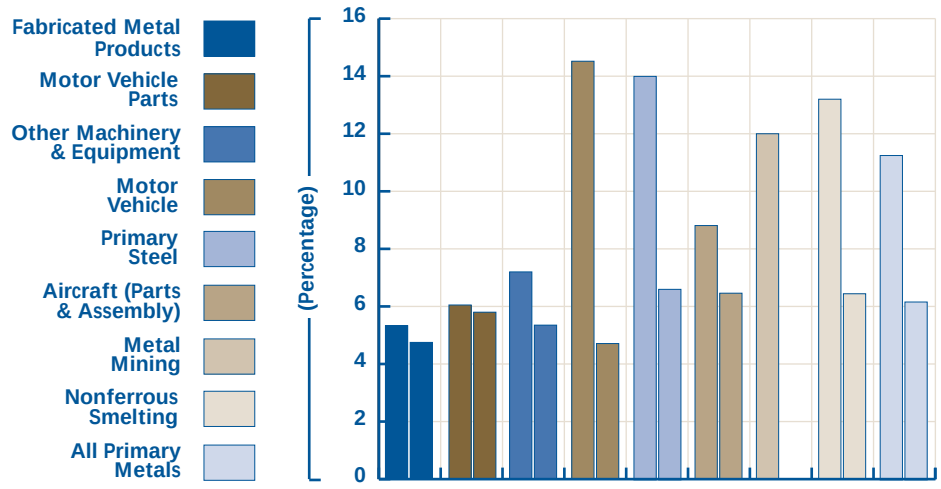
It is especially important that productivity growth keeps pace with the competition, especially in the United States, in order for Canadian firms to retain their competitive position. Reliable productivity comparisons should be based on "total factor productivity," which accounts for all aspects of productivity including plant capacity. However, data for total factor productivity do not exist at the level of detail that is required to examine sub-sectors in the mineral and metal continuum; therefore, the more readily available measure of "labour productivity" expressed as value added per employee is examined (i.e., using the rigorous Statistics Canada definition of "value added"). Has the productivity of Canadian firms been growing at the same rate as their U.S. counterparts? The comparative data for labour productivity growth rates in Canada and the United States from 1990 to 1995 are shown in Figure 11. The data reveal that Canadian firms have had similar or stronger rates of labour productivity growth in comparison to their U.S. competitors. In particular, productivity growth rates in the motor vehicle manufacturing, nonferrous smelting, primary steel, and metal mining industries have been better than 10% per year over that period. Labour productivity growth in the high-employment sub-sectors (motor vehicle parts and fabricated metal products) has been slower, but not unlike similar U.S. industries. By 1995, Canadian labour productivity, when measured in this

Figure 10. ***Contribution to GDP per Employee — Labour Productivity, 1986-1996 Key Sub-Sectors***



Productivity (as Contribution to GDP per Employee) for Key Sub-Sectors from 1986 to 1996. The sub-sectors with the lowest levels of productivity and productivity growth tend to be those that are dominated by small- and medium-sized enterprises.

Figure 11. ***Growth Rate of Value Added per Employee — 1990-1995 (Canadian data = left bar, U.S. data = right bar in each pair)***



Productivity (as Value Added per Employee) Growth Rate for Selected Industries in Canada and the United States from 1990 to 1995. Growth rate data were calculated using the currency of origin to avoid distortions based on the changing exchange rate between the Canadian and U.S. currencies. (No U.S. data were available for mining.) (Source: Statistics Canada)

way, was roughly equivalent in most sectors to the productivity of similar sectors in the United States, suggesting that the "productivity gap" that existed at the beginning of the decade had been reduced.

Not all studies have reached this conclusion. In a 1995 policy research paper,[2] "total factor productivity" was examined for the Canadian economy as a whole. That study concluded that, on the whole, Canada failed to show productivity growth in comparison to its competitors up to 1994. Its poor overall performance was attributed to several different factors:

> **". . . the relatively poor productivity performance in Canada . . .** (resulted from) **. . . slower and weaker adjustment to the two energy price shocks and the exchange rate shocks, slower rate of capital accumulation** [from 1990 onward]**, slower rate of growth in R&D spending, slower rate of adoption of best practice technologies, weaker adjustment to the knowledge-based economy and relatively weak competition in both product and factor markets . . . In simple terms, the poor productivity performance of the Canadian economy could be linked to a lack of *adjustment* and *innovation*.**

It is possible that a detailed, total factor productivity analysis of the mineral and metal processing sector would reveal weaknesses that the straightforward labour productivity analysis shown in Figure 11 has not exposed. If the evidence appears to be conflicting, then a more extensive sector-by-sector total factor productivity analysis could form part of the value-added strategy.

2.4.2 Innovation

How has the MMP sector fared with respect to investment in innovation? Innovation is difficult to measure in an absolute sense. It can result either in new products, leading to product differentiation, or in new processes, usually leading to higher productivity.

2 *Growth, Human Development and Social Cohesion*, Policy Research Committee Draft Interim Report, Ottawa, October 4, 1996, p. 173.

It is generally accepted that research and development (R&D) expenditures are an approximate indicator of innovation. As with productivity, it is not absolute levels of innovation that are important, but rather innovation in comparison to competition.

The average R&D expenditure for Canadian manufacturing as a whole was 1.19% of shipments in 1995. Within the mineral and metal continuum, the aircraft parts and assembly industry stands alone as having fairly high levels of R&D spending in excess of 10% of shipments. The machinery and equipment industry invested about 1.3% of shipments on R&D, and the nonferrous smelting industry invested roughly the same proportion (1.6%), while metal mining invested 0.7% of shipments. All other key sub-sectors for which data are available spend, on average, less than 0.5% of shipments on research. While this in itself is a little discouraging, a comparison with similar industries in the United States gives further cause for concern. Figure 12 shows Statistics Canada and U.S. National Science Foundation data for R&D expenditure intensities for those mineral and metal sub-sectors in 1995 where data are available. While Canadian R&D expenditures in the aircraft industry and in the primary metal sector substantially exceed those in the United States, other important sectors such as motor vehicle (parts and assembly combined), machinery, and nonmetallic mineral products have much lower R&D spending levels in Canada than in the United States. The overall R&D intensity for the manufacturing sector in the United States was 1.4% in 1995.

In reality, it is quite difficult to measure and interpret differences in R&D spending for whole sectors. For example, the data in Figure 12 for Canada and the United States are defined slightly differently. The U.S. data include

The Recycling Industry in Canada

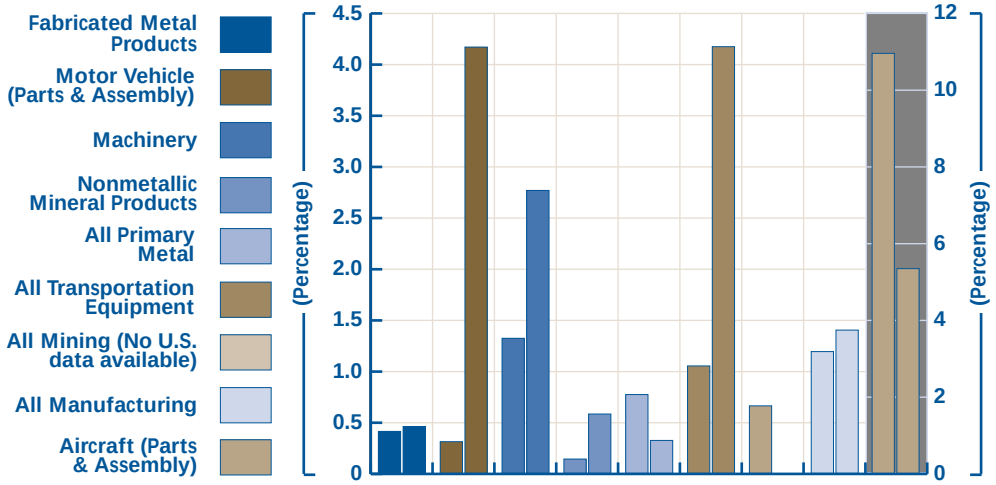
Although there is at present no Standard Industrial Classification code for this industry, Canada enjoys the benefits of a relatively mature and efficient metal-recycling sector. The metal-recycling industry in Canada comprises over 1000 companies employing more than 15 000 persons and offers commercial metal-recycling services to virtually all geographic regions of the country. It is estimated that this sector annually recycles in excess of 10 million tonnes of metal and metal-bearing materials valued at roughly $3 billion.

As of 1996, Canada's international trade in recyclable metals and metal-bearing materials is estimated at 2 million tonnes of imports valued at $1.4 billion and 3 million tonnes of exports valued at $1.3 billion. Interestingly, ferrous metals represent 70% of the total tonnage of this international trade while nonferrous metals represent 75% of the total dollar value of this trade.

While Canada conducts trade in recyclable metals with more than 100 countries, 91% of all imports and 93% of all exports are with the United States. Roughly 96% of all of Canada's trade in recyclable metals is conducted within the Organization for Economic Co-operation and Development group of countries.

cont'd on page 16

Figure 12. *R&D Intensity (Expenditures Divided by Shipments), 1995*
(Canadian data = left bar, U.S. data = right bar in each pair)



R&D Intensity (Expenditures Divided by Shipments)
Data for Selected Industries in Canada and the United States in 1995.
Canadian spending outstripped U.S. spending in the aircraft and parts industry (which is plotted on the right-hand axis) and in the primary metal sector. In other key sectors, such as motor vehicle (parts and assembly combined), machinery, and nonmetallic mineral products, R&D spending in the United States is two to ten times greater than in Canada. (No U.S. data were available for mining.)
(Source: Statistics Canada and U.S. National Science Foundation)

spending by industry and organizations other than the federal government. The Canadian data include only spending by industry. Other factors come into play, not the least of which is the degree of foreign ownership and the impact of government programs in other nations. It is known, for example, that research spending by the motor vehicle assembly industry in Canada is low because its research centres are located in the United States near home offices. This has not impacted negatively on the competitiveness of Canadian assembly operations since there is no hesitation on the part of foreign owners to utilize recent technology in Canadian plants, which have an excellent reputation for productivity. Nevertheless, the impact on the Canadian motor vehicle parts industry is perhaps more subtle. There is concern that the Canadian motor vehicle parts industry has not developed its relative share of the higher-technology automotive parts and sub-systems, such as transmission components, electronics and exterior skin stampings. Does the absence of R&D spending in Canada by the big motor vehicle assembly companies influence the extent to which Canadian parts suppliers receive development contracts when new technologies are being disseminated to suppliers? Could this in turn impact on the long-term growth of the parts sector in Canada? Although the data shown here are not conclusive, they do suggest that Canadian firms in certain key mineral and metal sub-sectors (associated with high levels of employment) may be failing to move into the higher-technology end of the product chain within their industry. Research to determine the answers to these questions with respect to motor vehicle parts and other sub-sectors could form part of a federal strategy to increase value added in Canada.

cont'd from page 15

In common with other key value-added sectors in the mineral and metal processing chain, the metal-recycling industry consists predominantly of a large number of very small, technically unsophisticated companies. Materials, once collected, are crudely segregated by the small collectors and are subsequently sold to larger, more integrated metal-recycling firms. The larger recycling enterprises consolidate these materials with their own domestic and imported industrial supply sources. Once processed, segregated and packaged, these metal commodities are sold domestically and internationally for consumption by metallurgical industries, semi-manufacturing operations and for direct use by consumer product manufacturers.

Many value-added opportunities exist in the recycling of materials arising from the post-consumer sectors. Employment documentation resulting from a U.S.-based regional study indicates that on a per-ton basis, recycling operations create more than ten times as many jobs as disposal operations. Development of this field is relatively new and the potential for significant job creation and value-added activities is high. Since more and more materials are being diverted from final landfill disposal operations, there is an increasing need for upgraded collection and sorting systems, better processing technologies and improved operational facilities to segregate and recycle these former waste materials into raw material products destined for commercial use.

On the basis of the limited data shown here, Canadians have been relatively successful in improving productivity since the recession in the late 1980s and early 1990s, but investments in future product development have been weaker, except for the primary metals and aircraft industries.

2.5 Summary of Industry Profiles

To summarize, the mineral and metal continuum is comprised of a tremendous diversity of firms that produce a wide array of products. Firms in the upstream (mining and smelting) stages tend to be large companies that are capable of making significant capital and R&D investments. These firms have shown good labour productivity growth over the past decade, which has allowed them to remain competitive but has resulted in an overall loss of direct employment. Their dependency on the domestic Canadian market for the sale of their products is minimal as most of their production is exported. It appears that the bulk of employment associated with minerals and metals resides in small- and medium-sized firms in the semi-fabricated parts, fabricated parts and products, and nonmetallic mineral products sub-sectors in the middle of the continuum. These firms experience much more difficulty in finding the resources to make significant capital or R&D investments. These small firms depend on the large firms in the downstream product-assembly end of the continuum for their survival. Canadian companies are quite successful in the downstream end of the continuum, such as in motor vehicle and aircraft assembly, which tends to be dominated by large and often foreign-owned firms.

3.0

VALUE-ADDED CHALLENGES — THE INDUSTRY PERSPECTIVE

In December 1997, Industry Canada and Natural Resources Canada sponsored three MMP industry consultations. Participants were asked to respond to a number of questions:

What factors are affecting your future competitiveness?

- Enabling factors/helpers?
- Hindering factors/obstacles?

What are you doing to:

- Maximize the enabling factors?
- Minimize the hindering factors?
  - What has worked?
  - What didn't?

How can we work together to resolve these competitiveness issues?

The following is a synopsis of the results of the consultations.

3.1 Positive Factors

Companies and organizations that took part in the consultations indicated that a number of competitive factors are working in their favour. A low Canadian dollar, free trade, and the large North American market are spurring exports. Access to high-quality raw materials and inexpensive energy is good. Low interest rates and balanced government budgets have reduced the cost of capital. In some industries, consolidation of the supplier base has increased sales levels. Canadian universities have good research capabilities that are well linked to the needs of industry in some sectors. A good communications infrastructure makes it easy to do business. Canada has a well-educated, flexible work force with a good work

ethic. Working relations between industry and federal and provincial governments appear to be improving. Canada also enjoys a good reputation abroad, and the Team Canada model is helping to promote Canadian firms. The country also has a bilingual, sometimes multilingual, work force, which makes it easier to do business in other countries. Finally, because Canada adheres to the metric and ISO systems, Canadian products and companies are saleable in most of the world.

Clearly, there is much in the current business climate that favours the growth of companies in the MMP sector. At the same time, though, industry participants were not reluctant to identify factors that they believed were affecting their competitiveness in a negative way.

Miners Breathe Easier

Mining has inherent risks, and any advance in health and safety is welcome. In Ontario alone, some 3000 miners were forced to take refuge as a result of 14 separate mine fire emergencies in 1993. In these types of circumstances, miners usually take refuge in special sealed enclosures that are supplied with oxygen via compressed air lines. Rimer Alco North America Ltd. realized that the next advance in refuge technology would be a self-contained station that was not reliant on outside air lines that could be cut in the event of a rock fall. Rimer Alco has now developed a refuge system that removes the carbon dioxide exhaled by miners and recycles it to provide them with a constant supply of oxygen. Its Refuge One Air Centre *has been recognized internationally by* R&D Magazine *as one of 1995's 100 most technologically significant new products, and in Canada by the OHS Awards of Excellence Program as the 1995 winner of the Innovative Product or Service Award. International sales of the refuge station are booming and, as a result, miners around the world are breathing easier.*

3.2 Potential Barriers

In spite of the many favourable aspects of doing business in Canada, companies identified a number of challenges facing their sector. In some cases, participants in the consultations also pointed to actions they are taking to address the challenges. The following is a summary of the challenges and industry's responses.

3.2.1 Business Climate

Industry is not uniformly positive about the business climate in Canada. A number of firms pointed to the high level of payroll, income and property taxes. Some complained about a lack of financing available to SMEs.[3] The low Canadian dollar can be a double-edged sword; although it makes Canadian products more price competitive, it can result in reduced income and increases the cost of importing specialty materials and equipment from abroad. Some firms are negatively affected by transportation costs and a relatively small, dispersed market. Others believe that Canada lacks an efficient port infrastructure. Although low by world standards, energy costs have been rising steadily. The globalization of markets has introduced more competition for manufacturers of commodity products. The small size of Canadian firms, compared to their U.S. counterparts, also makes it harder for some to sell offshore. Some firms believe that lingering uncertainty related to national unity has put a damper on foreign investment in Canada.

3.2.2 Trade

The MMP sector is clearly concerned with some aspects of Canada's trade situation. Globalization is forcing (smaller) Canadian firms to compete with (larger) firms abroad. Subsidized imports and outright dumping have adversely affected some industries (e.g., the steel industry). Some organizations believe the MMP sector has developed an over-reliance on the U.S. market to the exclusion of other opportunities. In some parts of the world, local content rules make it difficult to sell Canadian goods. There was also a feeling that Canadian trade representatives abroad are not providing sufficient support for overseas marketing.

The companies also reported on initiatives they are taking to address trade challenges. They are participating in international trade missions to develop markets outside of North America. In the past four years, one firm has increased its non-U.S. business from zero to 50% of sales. Another firm worked with Canadian and U.S. Customs to streamline border-crossing procedures in order to meet "just-in-time" delivery schedules. Some firms are cooperating to form industry alliances to stimulate exports by collecting trade information and carrying out market studies. Others are working with trade specialists in government to gather

3 Small- and medium-sized enterprises.

market and other information of interest to companies. One firm has entered into joint ventures with foreign companies in order to tap into offshore markets.

3.2.3 Regulations and Government Programs

Many in industry believe they are subject to domestic over-regulation. One example given was a municipal hydro development levy for a greenfield industrial development. Cumbersome and overlapping federal, provincial and municipal environmental regulations are a source of concern to some in industry. Many firms believe that non-tariff barriers in other countries, such as the "Buy America" program, make it difficult for them to win business abroad. In addition, some firms find that customs and immigration practices sometimes override the intent of trade agreements and make it difficult to move goods and personnel.

One company complained about fees imposed by the federal government on materials entering Canada for recycling. Another firm was concerned about the implications of the hazardous waste provisions of the Basel Convention. Some participants in the consultations argued for the need for a sound scientific approach to setting environmental regulations. Firms want Industry Canada and Natural Resources Canada to be actively involved in the development of environmental policies.

A number of participants in the consultations are concerned with what they feel are overlapping, and in some cases redundant, standards within industry, for example, with respect to container sizes or product fasteners. Non-recognition of some Canadian standards was also cited as a problem in some instances. In addition, the non-alignment of some Canadian and international standards has caused problems for some sectors.

Industry is concerned with what it perceives to be a lack of program and policy coordination between and within governments. It is also concerned with what it views as lengthy delays in government decision-making. Some participants in the consultations complained that provincial government programs and policies sometimes create an uneven playing field between provinces. A lack of continuity and difficulty in accessing government programs was another source of complaint.

Many firms have found that becoming ISO registered has been advantageous to domestic and international sales. Some companies are working on committees to develop national and international standards, and to promote mutual standards recognition. By sub-contracting work to European and U.S. companies, one firm has produced products to both metric and ISO standards.

3.2.4 Human Resources

Industry voiced many concerns about its human resource situation. Even though general human resource conditions are positive, there is a high level of dissatisfaction with some aspects of training and the labour market. Some firms are experiencing a critical shortage of certain categories of skilled workers, especially tool and die makers, and computer-aided design (CAD) and environmental technicians, where knowledge requirements have increased dramatically. Many firms have recognized they have an aging work force, but have

Influence of International Regulatory Framework

While there are many commercial opportunities in the recycling sector, these and other benefits of recycling cannot be realized without a supportive regulatory regime.

Although Canada's trade activity in recyclable metals has been increasing over the past five years, the industry has identified several important factors that limit its future growth potential in domestic and international markets. Ironically, one of these is the negative impact of legislation that was intended to help protect the environment.

In 1989, as a consequence of the Basel Convention on the Transboundary Movements of Hazardous Wastes and their Disposal, Canada redefined the term "waste" to include recyclable materials. The impact of this has been that the international movement of any recyclable metal that has a hazard characteristic must be managed as though it was hazardous waste destined for final disposal. Since many valuable metals have hazardous characteristics, these recyclable metals now fall under the definition of "hazardous wastes" and are subject to several restrictive measures.

For example, prior to the import or export of any hazardous recyclable resource, Canadian industry must follow a number of expensive procedures, such as operating in a prior informed consent regime, utilizing hazardous waste licenced carriers for transportation, and obtaining a minimum of $1 million in environmental liability insurance. Moreover, several international treaties do not recognize these recyclable materials as valuable resources and are imposing restrictive bans on their transboundary movement. These regulatory actions, combined with the negative stigma associated with the term "waste" as applied to recyclable resources, may actually be hampering efforts to increase the recycling of metals, not only limiting commercial opportunities, but also the obvious environmental benefits of recycling metals.

no concrete plans to deal with succession and replacement. Certain types of skills training and apprenticeship programs are not available locally, which exacerbates the skill shortages.

Many in industry believe that the prestige of blue-collar jobs has declined, and that talented young people no longer seek them out. They believe that skilled manual trades have an image problem despite good employment and salary prospects, and the increasing technical challenge of these jobs. They feel that such careers are no longer promoted in high schools. There is also concern in some sectors that reduced funding for university research may lead to a shortage of graduate students with a knowledge of leading-edge technologies.

Faced with what they consider are significant human resource problems, MMP companies are taking action. Some have established scholarships and co-op training arrangements with colleges. Others have initiated efforts to promote careers to high school students. Companies in some industries have established apprenticeship programs, although smaller firms sometimes have difficulty making use of these.

Some MMP sectors have taken the initiative to develop stronger alliances with universities and colleges to enhance education and skills training. These include co-op programs, support of university research Chairs, and centres of excellence. One firm has established an employee bulletin board to facilitate internal and external recruitment of employees. Some companies hire summer students, while others participate in Bring a Child to Work days in order to promote careers in their industry.

3.2.5 Technology and Innovation

Some MMP organizations are concerned about the inability of SMEs to finance research and development on a scale that is competitive with large firms. In some sectors, they believe there is an over-reliance on government support to provide resources for research. Some feel that there is an over-reliance on foreign technology. A number of comments pointed to what industry perceives to be the lack of a long-term, coordinated strategy by provincial and federal governments to promote R&D. Meanwhile, there is a distinct need to develop new technologies to deal with environmental, product and process challenges and opportunities. Many believe that industry lacks sufficient knowledge of government and university programs that support research, including the Scientific Research and Experimental Development (SR&ED) tax credit program.

MMP companies are responding to their technology and innovation challenges. Some companies have worked with Revenue Canada to re-define aspects of SR&ED tax credit eligibility. A number of firms have banded together to establish a consortium of foundries. The consortium is collaborating with NRCan's Canada Centre for Mineral and Energy Technology (CANMET) to solve shared problems. Companies in the aluminum sector are working together to sponsor university research of interest to them. In other sectors, companies are cooperating to establish specialized research centres to address their needs.

Chopping Wires for Profit

Philip Services Ltd., an Ontario-based company, identified an opportunity to add value from a former waste material. Philip Services operates one of North America's largest wire-chopping lines at its granulation facilities in Hamilton. It sources copper and aluminum insulated wires from industrial sources across North America. Through an investment in R&D, Philip Services developed a technology to separate polyethylene from polypropylene plastics.

The plastic covering on wires can represent from 5% to 70% of the gross weight of the raw material. This plastic portion, together with any contained fibre, is removed from the copper or aluminum wire by granulation. The copper and aluminum metal is marketed internationally and the plastic/fibre "chopping line residue" has traditionally been sent to landfill for final disposal.

While there is significant economic value contained in both of the plastic resin materials, the specifications required for further use are quite strict. Typically, a 99.7% resin purity is required for any major industrial application.

Philip Services developed a separation technology that can effectively achieve this purity level. The company has now created a new market for what was formerly a waste material. The "chopping line residue" arising from most granulating lines will contain between 3% and 5% of unrecoverable copper content together with the associated plastic residue. Philip Services can now effectively recover the remaining copper metal and the plastic polymers for sale into commercial use.

4.0

STRATEGIES FOR VALUE ADDED

Throughout the 1980s and 1990s, productivity gains in the MMP sector have been uneven. Overall, Canada continues to show a negative balance of trade in some areas, indicating that there are opportunities for growth. The preceding sections of this report have outlined a number of challenges confronting the mineral and metal processing sector. A process for responding to some of those challenges is outlined below.

4.1 A Partnership for Industry

The Government of Canada is committed to work in partnership with industry and other governments to review the constraints to value-added processing. This report is an initial response to that commitment and, through it, the Government is proposing the development of a much-needed value-added strategy. NRCan and Industry Canada are cooperating in this initiative, which will involve other departments, provincial and territorial governments, academia and industry, to develop an understanding of the barriers to value added in Canada, and to propose specific activities that will reduce these barriers or help Canadian firms surmount them and take advantage of emerging opportunities in a knowledge-based, global economy. Furthermore, NRCan and Industry Canada recognize that they have an important advocacy role to play in order to ensure that the mineral and metal processing sector is fairly represented where its interests are at stake.

Recycling Adds Value

Recycling industrial waste is paying handsomely for Kuntz Electroplating Inc. This Kitchener-based company plates bumpers and wheels for the automotive industry. The sludge that is created during the electroplating process contains around 15% nickel. Until 1990, Kuntz was paying $65-$75 per tonne to dispose of the sludge in a secure landfill. Now it is selling its sludge to Inco for re-smelting. Not only does Kuntz avoid the landfill charge, but the company actually earns a small return for the sludge. The real winner is the environment. Value added through recycling is the way of the future.

Major action themes have emerged from the government/industry consultations that have been held to date. Specific recommendations for in-depth research are being made and, in areas where clear action can be taken, plans will be developed over the coming year. It is not too late to influence these plans. Your input to the formulation of these action plans is welcomed and encouraged.

Of the several themes that were identified in the government/industry consultations, the following seemed to predominate and warrant a focussed effort. These themes are:

- Trade Development;
- Human Resources;
- Environmental Challenges;
- Innovation, Science and Technology; and
- Comparative Economic/Business Climate.

It is proposed that multi-stakeholder teams be established to address the key themes. The objective of each team would be to build on the insights developed in earlier consultations, and to propose specific initiatives to improve the industry's situation in each of the theme areas. In addition, these teams will serve as ongoing "advisory bodies" to help implement, monitor and continually adapt those initiatives that are undertaken.

To give readers an idea of the type of initiatives that might be undertaken, each of the theme areas are discussed briefly.

4.1.1 Trade Development

Canadians in the mineral and metal processing sector depend heavily on trade with the United States. Although there are opportunities to develop export markets in other countries, many of them are small and uncertain about how to expand their exports. The **Trade Team** would include participants from industry and the financial sector, the provinces, and several federal departments, notably Industry Canada, Natural Resources Canada, Foreign Affairs and International Trade, the Export Development Corporation, and Investments Partnerships Canada. Possible actions could include examining tariff and non-tariff trade barriers, helping MMP firms increase their use of government instruments for expanding their export base, developing team approaches to enhance exports, and sharing knowledge on best practices in industry.

4.1.2 Human Resources

A theme that emerged consistently in all consultations was the need for skilled labour, including the full range of skills from shop floor work, tool and die making, metal working, computer simulation and design, and sound management practices. Some employers feel that new employees are not acquiring in school the best range of skills for the work world. There is also considerable anxiety in industry over the declining social status of blue-collar jobs in general, which are perceived to be "old technology," but in fact are becoming increasingly technically demanding. In the long term, this threatens to constrain the supply of young people preparing for MMP careers. Furthermore, MMP companies need to give serious thought to how they can improve productivity and output, and encourage innovation through better management skills.

To make a real difference in this area, a **Human Resources Team** will need a cooperative effort from industry, labour, academia, the provinces, Human Resources Development Canada, Industry Canada, and Natural Resources Canada. Potential initiatives in this study area could include an in-depth analysis of labour needs compared to current educational capacity, how to raise awareness of the quality of careers in the

mineral and metal processing sector, and recommending the development of specific training or apprenticeship programs.

4.1.3 Environmental Challenges

A wide range of topics could be studied under this theme, including the impact of the domestic regulatory framework and specific initiatives to deal with climate change, increase recycling, and reduce effluent emissions from mineral and metal processing and manufacturing activities. This theme has strong overlap with the innovation, science and technology initiative. The **Environment Team** would include participants from industry, the provinces and territories, non-governmental organizations, Environment Canada, Natural Resources Canada, and Industry Canada. Examples of actions that could be undertaken are: an examination of the influence and effectiveness of current domestic regulations and conventions; coordination with the Climate Change Action Plan; support to the recycling industry; actions to encourage more recycling in general; and the development of technological research and implementation programs.

4.1.4 Innovation, Science and Technology

One of the key challenges to the mineral and metal processing sector in the next decade will be to better utilize science and technology to overcome competitive obstacles, increase innovation and improve productivity. By doing so, the industry will be better equipped to respond to emerging opportunities in the global market. Innovation — adopting best practice technologies, and developing and designing new products and processes — is a fundamental aspect of an MMP value-added strategy. MMP sector investment in Canadian research and development tends to be low relative to the United States. To attempt to better coordinate expenditures of scarce research dollars, the **Technology Team** would include representatives from industry, Natural Resources Canada (CANMET), Technology Partnerships Canada, the National Research Council, Industry Canada, academia, and the provinces and territories. Initiatives under this theme could be: the coordination of programs to develop expertise in key areas, the development of a virtual R&D network on Strategis, and improved dissemination of information on, and access to, government S&T programs.

4.1.5 Comparative Economic/Business Climate

This theme deals with the underlying economic climate in Canada and its influence on value-added activities in the mineral and metal processing sector. Some areas under the control of Canadian governments, such as fiscal and taxation policy, labour regulations, trade agreements and the like, could be studied, as well as other factors under the control of foreign governments that would influence the comparative advantage of doing business in Canada in comparison with competitor nations. Additional issues such as exchange rates, climate, geography, social attitudes, availability of investment financing, degree of foreign ownership, distance to market, etc., could also be reviewed.

The challenge for governments in Canada is to optimize those factors under their control for the greater benefit of Canada as a whole, and to seek to minimize the negative impact of factors outside their direct control. A **Business Climate Team** would include representatives from industry,

Turning Steel into Lead

Nova Pb Inc., located in Ste-Catherine, Quebec, a suburb of Montréal, is Canada's largest secondary lead smelter. Nova produces approximately 80 000 tonnes of lead per year.

Nova requires a source of iron to use as a reducing agent in the smelting of lead. More specifically, the role of iron is to capture the sulphur from the feed. With the use of both spent oil filter casings and soda ash, Nova has been able to achieve 99.999% sulphur dioxide control. The company has an on-site capacity to process and consume over 16 million spent oil filters per year. This program benefits the environment in two ways: first, it diverts an important volume of hazardous waste from landfill; and secondly, it recovers the residual calorific value from both the oil and the cartridge within the waste oil filter. In combination with the waste oil from filters and other waste liquids with high BTU values, over 50% of Nova's BTU requirements for the rotary kiln during 1998 will be sourced from liquid waste materials, significantly reducing the use of natural gas.

In terms of the carbon unit sources, which are also required in the smelting process, trials are currently under way to replace a significant portion of metallurgical coke with spent tires and waste industrial rubber.

Nova has also installed state-of-the-art battery breaking equipment to allow recovery of the 5% co-polymer polypropylene plastic exterior of used battery cases. Over 99.9% of all the plastic from spent automotive battery cases is recovered and marketed for re-use in commercial plastic products, including new battery cases. Further value-added opportunities still exist to re-granulate the recovered plastic.

In summary, instead of being simply a secondary lead smelter that recycles dead batteries, Nova has become a resource recovery facility that recycles several waste streams generated by the transportation industry.

Natural Resources Canada, Industry Canada, the Department of Finance, and the provinces and territories. Initiatives in this area could include: research on the factors that influence the development of value-added products in the mineral and metal processing sector, and tabling recommendations to improve the impact of factors under the control of governments.

4.1.6 The Need For Action

Decisions made in the next few years will influence the long-term viability and future prospects for the industries in the mineral and metal continuum. Over the past decade, the sector has gone through some difficult times and has responded to many of the challenges it faced. Along with expanded trade has come greater competition. The pace of technological change is relentless. Human resources are under pressure. Traditional customer-supplier arrangements are changing. Investment requirements are frequently high. Environmental concerns are ever-present and growing. There have been some notable successes, but the challenge to increase productivity and innovation has not diminished. Furthermore, it must be acknowledged that the economic contributions of this sector, with its diverse small- and medium-sized firms in the Stage C and D industries, have tended not to receive the attention from government that is warranted by their high level of employment.

The time is now ripe for industry, government and other stakeholders to launch a new initiative — a value-added strategy — that will help the sector exploit tomorrow's opportunities. Each industry sector, together with government, must recommend initiatives that are tailored to help it address the challenges and exploit the opportunities.

The MMP sector needs a strong advocacy voice within government. A new strategy will mark a turning point. Both Industry Canada and Natural Resources Canada have undertaken to more effectively promote the sector.

Too much of Canada's economy depends on the success of the MMP sector to let this opportunity pass. The time to act is now.

Better Battery Technology

Cominco Ltd. is a Vancouver-based integrated mining and metals company whose principal activities are mineral exploration, mining, smelting and refining. Working with a federal laboratory (CANMET), the company's Battery Technology Division developed a technique to continuously cast highly corrosion-resistant lead-alloy strip used for making battery plate electrodes. The collaboration effort progressed from a lab technique to the development and rapid commercialization of a strip production process. Termed the "Multi-Alloy Strip Caster," this equipment has been sold to major battery manufacturers around the world for the production of automotive starting batteries. The new caster provides high output of a quality product at a cost substantially less than competing systems. Due in part to this new technology, Cominco is now the world's leading supplier of automated production lines for manufacturing lead-acid battery plate electrodes. The Multi-Alloy Strip Caster is the product of a very successful collaborative effort between a federal government lab and private industry.

5.0

JOIN THE DIALOGUE

The Government of Canada wants your organization to participate in this dialogue. Do you have an idea that would support value-added activities in the MMP sector? Do you want to provide input to one of the "Work Teams" described above? Let us know. Here's who to contact:

Jenny Jackman
Mineral Technology Branch — CANMET
Minerals and Metals Sector
Natural Resource Canada
568 Booth Street
Ottawa, Ontario
K1A 0G1
Tel.: (613) 996-8997
Fax: (613) 992-8735
E-mail: jjackman@nrcan.gc.ca

Charles Ethier
Metals and Minerals Processing Branch
Industry Sector
Industry Canada
235 Queen Street
Ottawa, Ontario
K1A 0H5
Tel.: (613) 954-3176
Fax: (613) 954-3079
E-mail: chuck.ethier@ic.gc.ca

NOTES