Coping with the Price Fluctuation of Raw Materials

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What is Rare Metal?

- The term, rare metal, is not an academically defined one, and there is no consensus on which element it pertains.
- Rare metal is often used to refer to the 47 metal elements.
- Sometimes the 17 rare earth element are counted as one kind, and the total is counted as 31.

Rare Metal Elements

<table>
<thead>
<tr>
<th>Period</th>
<th>Group</th>
<th>Elements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>H</td>
<td>30 rare metal elements excluding rare earths</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Li, Be</td>
<td>17 rare earth elements included in rare metals</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>Na, Mg</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>K, Ca, Sc</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>37</td>
<td>Rb, Sr, Y</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>55</td>
<td>Cs, Ba, lanthanoid</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>87</td>
<td>Fr, Ra, actinoid</td>
<td></td>
</tr>
</tbody>
</table>

Source: National Institute of Advanced Industrial Science and Technology (AIST), Japan
Industrial Vitamins

- Rare metals are known as "industrial vitamins" due to their ability to improve the quality and performance of products with the use of only small quantities.
- For example, environmental cars and LCD panels contain lots of rare metals. (Indium is indispensable as an element of ITO of LCD panel)

An Example of Rare Metals Used in Environmental Automobiles

Source: AIST

Indium in Equipment such as LCD Panels

Source: techon.nikkeibp.co.jp
Rare Metal and New Growth Industries

- Renewable energy and IT convergence products are emerging as new growth industries on the back of low carbon green growth and a trend towards light product development and green transportation.
- All these new growth engine industries essentially need rare metals.

### Rare Metals That Related to New Growth Engine Industries

<table>
<thead>
<tr>
<th>New Growth Engine Industry</th>
<th>Sub-Businesses/Technologies</th>
<th>Rare Metal Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>New/Renewable Energy</td>
<td>Solar Cells, Fuel Cells</td>
<td>Endium, gallium, molybdenum, selenium and platinum group elements</td>
</tr>
<tr>
<td>LED Applications</td>
<td>LED Lights, Eco LEDs</td>
<td>Endium, gallium, rare-earth elements and molybdenum</td>
</tr>
<tr>
<td>Green Transportation System</td>
<td>Green Cars, Secondary Cell for Electric Vehicles</td>
<td>Rare-earth elements, magnesium, lithium, cobalt and manganese</td>
</tr>
<tr>
<td>IT Convergence System</td>
<td>System semiconductors</td>
<td>Endium, germanium, niobium, strontium and rare-earth elements</td>
</tr>
<tr>
<td>Nano-Convergence of Advanced Materials</td>
<td>Lightweight Magnesium Materials</td>
<td>Magnesium, silicon, bismuth, banadium and cobalt</td>
</tr>
<tr>
<td>Bio pharmaceutical/Medical Treatment</td>
<td>High-Tech Diagnostic Imaging Equipment</td>
<td>Titanium, tungsten, tantalum, bismuth and manganese</td>
</tr>
</tbody>
</table>

Source: Ministry of Knowledge Economy and Samsung Economic Research Institute.
Every rare metal used in growth industries is important, but there are various kinds, and the supply/demand characteristics for each differ.

SERI based its selection of rare metals where demand is expected to increase in Korea while supply conditions are highly likely to be unstable.

Significant instability is expected in Korea’s supply of 8 rare metals: Niobium, bismuth, vanadium, cobalt, germanium, indium, manganese, and Molybdenum.

Demand for Rare Metals and Supply Standardization Index

Note: The dotted red line is an average of the standardization index and used as the basis to judge relative highs and lows. Source: Samsung Economic Research Institute
Possibility of Supply Instability in Rare Metals

- On the supply side, competition to secure a stable supply of rare metals has intensified due to small reserves and the tendency for these reserves to be concentrated in a few countries.
  - For example, the corruption perceptions index and the economic freedom level of DR Congo, which has 51.2% of the world’s cobalt deposits Rank 162nd and 169th in the world, respectively.
- There is a greater possibility of future supply disruptions because market mechanism may not function in the face of rarity, maldistribution and a lack of suitable substitutes.

### National Risk of Countries with Reservoirs of Rare Metals

<table>
<thead>
<tr>
<th>Rare Metals</th>
<th>Country</th>
<th>Proportion of World Reservoirs</th>
<th>Corruption Perceptions Index (ranking)</th>
<th>Economic Freedom Level (ranking)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barium</td>
<td>China</td>
<td>38.5</td>
<td>79</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>Russia</td>
<td>38.5</td>
<td>146</td>
<td>143</td>
</tr>
<tr>
<td>Cobalt</td>
<td>Democratic Republic of Congo</td>
<td>51.5</td>
<td>162</td>
<td>169</td>
</tr>
<tr>
<td></td>
<td>Cuba</td>
<td>7.6</td>
<td>61</td>
<td>177</td>
</tr>
<tr>
<td>Manganese</td>
<td>Ukraine</td>
<td>25.9</td>
<td>146</td>
<td>162</td>
</tr>
<tr>
<td></td>
<td>South Africa</td>
<td>24.1</td>
<td>55</td>
<td>72</td>
</tr>
<tr>
<td>Rare-Earth Elements</td>
<td>China</td>
<td>36.4</td>
<td>79</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>CIS</td>
<td>19.2</td>
<td>120</td>
<td>82</td>
</tr>
</tbody>
</table>

Note: The corruption perception index includes 180 countries and the economic freedom level includes 179 countries. Kazakhstan is represented by the Commonwealth of Independent States (CIS).
Policy measures to Secure Rare Metals and Stable Supply

- To secure rare metals and stable supplies, internal and external policies should be implemented simultaneously.
- The government should come up with the following responses:

### Policy to Secure Rare Metals and Stable Supply

<table>
<thead>
<tr>
<th>Obtainment of Overseas Resources (External)</th>
<th>Stable Supply (Internal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Strategic ODA</td>
<td>Add to Stockpiles in Advance</td>
</tr>
<tr>
<td>Increase support for Latin America and Africa</td>
<td>Inclusion of niobium and bismuth to list of new stockpiles</td>
</tr>
<tr>
<td>Increase in Investment in Overseas Resources</td>
<td>Diversification of Import Sources</td>
</tr>
<tr>
<td>More investments by KIC and national pension funds into major resource companies</td>
<td>Diversification of top 10 rare metal imports</td>
</tr>
<tr>
<td>FTAs with Countries Retaining Rare Metals</td>
<td>More Recycling and Technological Development</td>
</tr>
<tr>
<td>Australia, Canada and Brazil</td>
<td>Development of technologies for high-purity extracts and alternative materials</td>
</tr>
</tbody>
</table>

Source: Samsung Economic Research Institute
Urban Mining

• Urban mining simply means scavenging through the scrap metal in old electronic products in search of such gems as iridium and gold, and it is a growth industry around the world as metal prices skyrocket.
• A ton of ore from a gold mine produces just 5 grams (0.18 ounce) of gold on average, whereas a ton of discarded mobile phones can yield 150 grams (5.3 ounce) or more.
• The same volume of discarded mobile phones also contains around 100 kg (220 lb) of copper and 3 kg (6.6 lb) of silver.
Coping with price fluctuation

• If your country is almost 100% dependent on imports for raw materials like Korea, there is few measure to cope with the price fluctuation.

• The companies in the highly import-dependent country for raw materials expose price variation risk, which is a kind of exogenous variable to them.

• Only thing they can choose is to use the futures markets and to take opposite positions (hedge the price).
  ➢ However, owners/CEOs are reluctant to use the futures markets.

• Another thing they can do is to buy more and to stockpile for future usage.
  ➢ However, stocking up on commodities will cost you a lot.

• So, you may read the trend of raw material prices in advance and buy early if the trend that you expect is upward, or wait and buy later if the trend is downward.
Government’s support to secure resources

• Government’s support is important to secure raw materials because there is a huge competition in the raw material business and sometimes the power of major resource companies is as big as that of countries.
  ➢ Government support for overseas investments should be strengthened.

• Government should provide SMEs with an insurance scheme coping with raw material price fluctuation to help them have stable prices.
  ➢ The insurance scheme may help local companies better cope with sharp gains in global raw material prices.
  ➢ The insurance should benefit SMEs that import resources the most.

• Stockpiling is a powerful method to cope with domestic price fluctuation and to secure the supply of raw materials.
  ➢ The government can increase its release of stockpiled raw materials and provide emergency funds for SMEs to tide over the worsening shortages of raw material supplies.
Vertical Integration

- Companies, especially those in new growth industries, should **vertically integrate** by internalizing the procurement of required materials.
  - As the possibility of supply disruptions grows, the number of business models that invest in vertical integration of the value chain is forecast to increase gradually.

Value chain - Rechargeable battery industry

- **Mineral suppliers:**
  - Carbon/ Graphite
  - Nickel
  - Manganese
  - Lithium

- **Basic materials:**
  - Anode
  - Cathode
  - Separator
  - Electrolyte
  - Copperfoil
  - Polymer pouch
  - MH

- **Cell manufacturers**

- **Manufacturers of cell phones, laptops, automobiles etc.**

Source: Rechargeable Battery Industry, Eugene Investment & Securities, Feb 2009; Pipal Research analysis
Upstream management

• To establish a basis for the stable supply of raw materials, the up-stream of the value chain should be emphasized, thereby enabling early detection of possible supply difficulties.
• In addition, networks related to purchasing should be developed so as to reduce risk.

Illustrative Example: value chain of Rechargeable Battery

- Umicore, a key cathode material supplier, purchases cobalt from both mining and trading companies located in DR Congo, and undertakes production of cathode material in its facilities located in Korea and China
  - Umicore then supplies the cathode material to cell manufacturers like Samsung SDI and LG Chemicals for making batteries, which are then used in cell phones of Samsung, Nokia, Motorola and LG

Source: DanWatch; Pipal Research analysis
Building an information system

• To this end, an information system that enables the early detection of supply and price instability should be established.

• There are a lot of free data regarding supply-demand conditions of raw materials
  - Compiling the data and collecting information on raw materials
  - Building a data gathering system and own decision making system
1. Importance of Rare Metal

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Variables to build an information system

- **Goal:** Predict a trend of raw material prices and buy early if the trend is expected to be upward, or wait and buy latter if downward trend is expected.

- **Variable1:** Checking out demand-supply conditions and global economy
  - Commodity price will move faster before economy is bottoming out or turning down
  - % increase/decrease, quarterly (monthly) YoY data

- **Variable2:** Checking global money movement
  - If there exists massive liquidity like these days, raw material prices will surely go up
  - Commodity is regarded as unsafe asset

- **Variable3:** Checking other forecasting values and trends
  - Compare your decision with big name institutions’ projections
  - Remember your goal is to read the trend of price in advance, not to forecast the price itself
Information on Oil and Gas (Cont’d)

- BP, EIA, IEA would be your main sources to obtain all the information on oil and gas
- BP website and Statistical Review will provide you with world energy data

BP  http://www.bp.com/productlanding.do?categoryId=6929&contentId=7044622
Information on Oil and Gas (Cont’d)

- EIA (US Energy Information Administration)
- EIA short-term Outlook will be a good source to help you make your own decision

EIA
http://www.eia.doe.gov/oiaf/forecasting.html
Information on Oil and Gas (Cont’d)

- IEA (International Energy Agency)
- You need to subscribe MOD with some costs but there are lots of data and reports including the monthly Oil Market Report

EIA

http://www.iea.org/stats/index.asp
Information on Metals

- USGS (US Geological Survey) would be your main source to obtain all the information on reserve and production of mineral resources (metals).
- We can learn world reserves and productions of metals.

[Link to USGS website]

http://minerals.usgs.gov/minerals/

[Image of USGS Minerals Information webpage]

MINERAL COMMODITY SUMMARIES 2010

[List of minerals including: Ablative, Alumina, Antimony, Arsenic, Asbestos, Barite, Bauxite, Beryllium, Bismuth, Boron, Bromine, Cadmium, Cement, Chromite, Chromite, Clayes, Cobalt, Copper, Diamond, Diatomite, Feldspar]
Information on Metals (Cont’d)

- LME (London Metal Exchange) and WBMS (World Bureau of Metal Statistics) would be your main source to obtain all the information on metals.
- IBs like Goldman Sachs and Macquarie will provide you with well-prepared information. But you should be a client.
  - However, if you Google well, you can get free reports written by IBs.

LME: http://www.lme.com/
WBMS: http://www.world-bureau.com/
Information on trading volumes

- US CFTC (Commodity Futures Trading Commission)
- We can get the market information on CME trading commodities including trading volumes, and noncommercial positions

CFTC  http://www.cftc.gov/MarketReports/CommitmentsofTraders/index.htm
Check on the value of dollar

- Despite recent weak relationship between dollar value and commodity prices, the value of dollar is the major variable affecting the direction of commodity price.
- Check USD/Euro and dollar index
  - You may have a source to get these data (from most portals)
  - If USD/Euro goes up and dollar index goes down, meaning dollar depreciates, commodity prices will likely rise.

<table>
<thead>
<tr>
<th>Major Factors in Major Raw Material Price Hikes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common factors</td>
</tr>
<tr>
<td>Speculation money (1st)</td>
</tr>
<tr>
<td>Dollar's depreciation (3rd)</td>
</tr>
<tr>
<td>Supply and demand imbalance (4th)</td>
</tr>
<tr>
<td>Special factors</td>
</tr>
<tr>
<td>Geopolitical risks (2nd)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses are contribution rankings.
Source: Samsung Economic Research Institute
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Summary

What we looked at

Rare metal

- Rare metals are called “industrial vitamins”
- New growth engine industries need rare metals more than old ones
- There is a greater possibility of future supply disruptions

Cope with price fluctuation

- Few Method to cope with the price fluctuation
- Government support should provide the insurance scheme and stockpiled raw materials to cope with price fluctuation
- Establish an information system for early detection

Data Sources

- BP, IEA, EIA for oil and gas
- USGS, LME, WBMS for metals
- CFTC for money inflows
Conclusions

- Manufacturing companies which are highly dependent on secured supply of raw materials should build an information system for early detection of price fluctuation.
- They should also consider vertical integration that internalizes the raw materials and intermediary materials in all the production stages.
- As new growth industries increase in size, various business opportunities should be sought as they are created in the rare-metals-related areas of materials and recycling.
- In particular, these industries should seek business opportunities in urban mine businesses that are expected to grow via higher metal prices and government support.
- Even if raw materials are secured, companies will run into difficulties if it does not have the technology to produce intermediary materials.
Thank You
Questions?

For Further Questions
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