

THE IRON ORE AND STEEL SECTOR IN MONGOLIA

Current state and future prospects

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The availability of specific economic and employment data for Mongolia is limited. While the brochure has been compiled with meticulous care and to the best of the authors' knowledge, neither the authors nor GIZ assume any liability that all facts are entirely correct, up-to-date and complete. As far as research paradigms and recommendations are concerned, the report is based on research findings and data compilations that reflect current views but are subject to risks and changing framework conditions. This brochure should be conceived as a contribution to the ongoing discourse over Mongolia's economic policy.

0. KEY SUMMARY

0. 1. CURRENT STATE: UNTAPPED POTENTIAL

Reserves: Estimated at 2 billion tons, which is more than threefold the current proven deposit.

Licenses: Only 24 of 38 companies that hold licenses to exploit iron ore deposits are operating at the moment.

Economic relevance: Iron ore is the third biggest contributor to Mongolian exports, following coal and copper. Iron ore worth 650 million USD was exported from Mongolia in 2013, equal to 15% of total exports. The direct value added by the iron ore sector was about 2% of Mongolia's gross domestic product (GDP) in 2013, i.e. 230.4 million USD.

Value-adding: Processing iron ore to wet concentrate increases the exporter's profit to 30 USD per ton, export of processed iron pellets raises the exporters profit's to more than 60 USD per ton, compared to 5 USD per ton for raw iron ore.

Employment: The jobs in the mining sector represent a share of approximately 4.5% of total employment. A growth by 6,200 workers in the mining sector over the next three years is expected. The implementation of large scale mining projects is estimated to necessitate 12,200 additional workers in the extraction sector and 9,000 additional workers in the mining processing sector. Currently, the iron and steel industry employs an estimated number of 2,500 people.

Indirect employment: In Mongolia, one job in the iron and steel industry creates at least 5 additional jobs in the domestic supplying and processing industry. In other countries this ratio is much higher (e.g. 1:25 in Germany). Mongolia lacks processing industries that could multiply employment effects.

Domestic steel production: The economic significance of the Mongolian steel industry is currently low. Only 9.2% of domestic steel demand is provided by domestic production. The current production of steel products in Mongolia utilizes only about 50% of the available production capacities. Mongolian steel plants operate with outdated technology at extremely low volumes. China can produce the annual Mongolian steel production with one of its approximately 3,000 blast furnaces in less than five days. The only major domestic steel producer, DMP, has generated no profit since the plant was built. DMP operates at 50-60% of its capacity.

Infrastructure: The existing railroad capacity (north to south) is limited to 10 million t/p.a

0.2. FUTURE PERSPECTIVE

Iron ore exports: China's consumption of Mongolian iron ore is expected to reach its peak by 2021. Local observers predict that China's steel plants will stop buying Mongolian iron ore in 2025. Major Mongolian iron ore mining projects are scheduled to stop operations after 2022, so that mining production will decline, if no new projects are developed. Hence, the size of the Mongolian iron ore industry may be marginal compared to other mineral resources mined in the country by 2030.

Employment: Jobs in the iron and steel industry currently total around 2,500 official employees, although total employment in the industry (including informal employees and those not registered for social insurance) is estimated to be closer to 4000,

Investment gap: Iron ore producers need additional 18.8 billion USD of capital investment in the next 15 years in order to develop and continue its operations.

Sainshand Industrial Complex: The Sainshand steel plant could (directly) generate an income for more than 2,300 people. In order to start the Sainshand steel project, more than 3 billion USD of further investments are necessary, as additional costs of up to 1 billion USD are estimated to occur when the plant starts operations. The business case of the steel plant has been put into question by experts.

DMP upgrading: It is estimated that investments of 5-6 million USD in total will be needed for the development of the DRI plant. Observing the performance so far, that even with an increased capacity, DMP will struggle to compete with international quality and price standards.

Infrastructure: The government of Mongolia plans to extend the railway network by 5683.5 km in the next 2.5 years and to expand the carrying capacity to 30 million t/p.a. New railroads are necessary for transportation of future iron and steel projects.

0.3. RECOMMENDATIONS

Increase the competitiveness of exports: Because of the increasing global iron ore supply, prices for Mongolian iron ore may not remain at current levels in the medium-term. In order to secure future markets, it is recommended to

reduce costs per unit (e.g. by improving infrastructure, using appropriate technology, optimizing management of mines and plants).

Enhance the share of processed ore: It is recommended to enhance the share of high quality concentrate in Mongolian iron ore exports. This will contribute to increasing demand for Mongolian iron as well as to securing reasonable prices for these products

Mongolian steel sector policies: The steel projects currently under development are aimed at increasing the production of steel pre-products. The domestic production of finished steel products is not a viable option for the future of the Mongolian steel industry. However, steel pre-products can constitute a contribution to employment growth and to diversifying the domestic economy. In order for this to be achieved, the linkages with other industries, notably domestic small-scale supplying and processing industries, should be intensified.

Public investment projects: Several iron and steel projects are considered to be in the interest of the Mongolian state. As a consequence, the Sainshand steel plant, the Darkhan Metallurgical Plant and other projects require significant public investment. It is recommended that the business case of these projects is considered thoroughly in terms of costs and benefits at the company level and at the national level. Moreover, project planning and implementation should be done in accordance with international best practices. This is to prevent further long-term costs for the Mongolian state and to focus on priority projects with proven economic sustainability.

Investments will be needed: In order to provide investment capital and the necessary technical knowledge and entrepreneurial expertise, foreign direct investment should be attracted. The investment climate for foreign investors needs further improvement.

Expanding the capacity of the railway in quality and quantity: For future projects in the iron and steel sector additional railroads are needed. For coking coal for the Sainshand project, for example, 400 km of new railroad tracks must be built. The planned railway development by the Mongolian Government concerning 5683.5 km of new railways and expansion of the network's carrying capacity to 30 million t/p.a. is particularly important for the development of the iron and steel industry. The realization of these plans will be essential in order to become more cost-effective and

competitive. Furthermore, the construction of railway itself will stimulate the domestic demand for steel products and services and thereby create new jobs and secure existing ones. For example, the production of steel products in Darkhan, such as, in particular, construction steel will be boosted.

Preface

Commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) supports Mongolian decision makers in promoting sustainable economic development. The Integrated Mineral Resource Initiative (IMRI) assists Mongolia in developing economic policies and strategies for growth based on the mineral resources sector. It is IMRI's aim to enhance the capacities of its partners for fact-based, sustainable economic policy strategies and decisions. In the light of this approach, IMRI supports its partners in analyzing the opportunities and costs of developing selected sectors and value chains, including the iron and steel value chain.

Mongolia is abundantly endowed with various mineral resources, including iron ore and coal deposits. It is the declared objective of Mongolian decision-makers to transform such wealth into inclusive growth. Yet, a solution has not been found to trigger that transformation.

Many observers and policy-makers see a significant potential to develop the iron and steel industry in order to make a major contribution to domestic value addition, to local employment, and to Mongolia's exports. Large-scale projects such as the Sainshand Industrial Complex are based on this vision.

Yet, the reality of the iron and steel industry is more complicated. Due to fragmented and outdated data, little of the discussion so far has been based on facts. The authors of this booklet intend to contribute to a more solid foundation for decisions regarding Mongolia's future public and private iron and steel projects.

The report at hand summarizes the results of several activities by the GIZ program "Integrated Mineral Resource Initiative" (IMRI) related to the iron and steel value chain in Mongolia. Inputs to this report were provided by Professor Dr. Wuppermann, industrial engineer and senior consultant with 40 years of experience in the steel industry, by Mr. Zorig, senior national expert and former Vice-Chairman of Mongolia's National Development and Innovation Committee, and Mr. Erdenebulgan, economist and researcher at the Economic Research Institute of Mongolia (ERI).

The collection of data for the report began in October 2012. Conclusions were derived from data collected from official statistics, online sources, and from interviews with 65 competent partners in relevant government ministries as well as state-owned and private companies operating in the sector. The report also drew from data provided by Mongolia's Economic Research Institute (ERI) and the Economic Policy and Competitiveness Research Center (EPCRC), as well as existing literature.

1. INTRODUCTION

Up until today, the majority of Mongolian mining products are exported to China without any advanced processing. The current iron and steel sector is characterized by high costs, small volumes and low quality, an industry which is only partially competitive at world markets. Regarding the potential of the underdeveloped industry - and the not tapped, not yet fully exploited countrywide resources, the claim for further exploration is a valid one.

However, exploiting the full potential of the industry remains limited due to infrastructure constraints, macroeconomic volatility and a less favorable investment environment. Further, it is important to get a thorough understanding of the impact that a development of the iron and steel sector may have on macroeconomic imbalances and social inequalities, as well as on productivity and competitiveness of other domestic industries. The development of Mongolia's mineral resource industries must be coherent with the country's broader development agenda.

Therefore, the report at hand highlights opportunities of developing the Mongolian iron and steel industry. It looks at different steps of the iron and steel value chain by analyzing information available for the mining of iron ore and subsequent steps of processing. Given its history and current importance for the processing of iron ore, the Darkhan region plays a special role in this regard and is, therefore, addressed in more detail. Additionally, the potential for further cooperation with German companies in the iron and steel sector in order to stimulate more technology transfers between Germany and Mongolia is elaborated.

2. THE IRON AND STEEL VALUE CHAIN

A value chain is a series of steps that are necessary to transform basic raw materials into pre-products and, ultimately, into final products. A value chain involves all workflows and processes which are associated with the production of the product. Besides the subsequent manufacturing and service steps, a value chain also consists of research and development, input suppliers, information flows (such as customer preferences and standards for logistics), transfer of knowledge, learning processes, power structures and finance. The value chain concept has been extended in the past years, involving not only individual companies but also the entire process of distribution networks and supply chains. A value chain may be analyzed from a company, regional, national, or global perspective. This report takes the national and regional view.

The iron and steel value chain includes the production steps from extracting iron ore from the ground to the retailing of final steel products. After its extraction from the ground in mines, iron ore must be processed to become suitable for producing steel. The rock which contains the iron ore is ground and the ore is extracted by using magnetic rollers. Subsequently, the fine-grained iron ore is transformed into coarsegrained clumps for processing in the blast furnace. At the same time, coal is purified in a coke furnace, thus, creating an almost pure form of carbon. In a subsequent step, a mass of iron ore and coal is heated in a blast furnace to produce molten iron or pig iron, from which steel is produced. Afterwards, molten pig iron goes through different casters and is formed into steel blooms, slabs and billets. Through hot and cold rolling processes these primary steel products are transformed into a range of different finished steel products. Slabs, for example, are shaped into flat products and blooms are formed into girders (see figure above). The produced finished steel products are shown below.

Due to its strength and its properties of formability, steel is one of the most versatile engineering materials - and valued material for the construction of bridges and buildings, for automotive and machine parts, for generating power, and for other engineering purposes. Therefore, the steel industry is a key supplier to other industries. According to Prof. Dr. Wuppermann, a multiplier of 25:1 is realistic for developed economies to determine

employment effects on other industries. Hence, the steel industry is estimated to provide an income to 50 million people in the world.

3. THE IRON ORE INDUSTRY IN MONGOLIA

3.1. IRON ORE PRODUCTION

With 600 million tons of proven iron ore reserves, Mongolia accounts for just 0.5% of global reserves (Mining leaders 2014). For this reason, in terms of its proven iron ore deposits, Mongolia is not a global player. Yet, vast regions of the country remain systematically untested for their mineral resource deposits, and current estimates place the figure at 2 billion tons of iron ore (MMJ 2012), which would be more than threefold the current volume. Throughout the country, there are a total of 38 companies that hold licenses to exploit iron ore deposits. However, only 24 of these are operating at present (Mongolian Views 2014). The iron ore deposits are located in different regions.

Currently, nine small scale magnetite iron ore projects exist in Mongolia with estimated total iron ore deposits of 1.250 million tons. Six of these projects are operational and export low grade ore (3.74 million t/p.a.) and concentrate (3 million t/p.a.) to China (ERI). Mongolia's largest iron ore mine Eruu Gol extracts ore from a deposit covering more than 50% of the known iron ore reserves. Its six pits provide access to reserves of 304 million tons. The other large-producing mines, Tumurtei and Tayan Nuur, have deposits of 230 million tons and 130 million tons respectively.

3.2. IRON ORE EXPORTS

Iron ore is the third biggest contributor to Mongolian exports, following coal and copper. In 2013, iron ore exports climaxed at 15.3% share of total export revenues, the number has since fallen to 8.1% of the total in 20U (year to date, 8 months to August).

According to figures from the National Statistical Office, since 2010 iron ore exports have grown at an annualized rate of 23.6%, and despite a peak in prices during 2013, continue to remain strong in 2014 (full table below). Taxes from iron ore constitute 10.3% (2013) of Mongolia's total mining tax revenue and 2.0% (2013) of the state's budget revenues (ERI 2014).

In 2013, 6.7 million tons of iron ore were exported to China, Mongolia's most crucial trading partner. According to the estimates of Mongolian Customs, it was the sole destination for Mongolia's iron ore exports in 2013, and has so far received 99% of iron ore exports in the 8 months to August 2014. In total, China is the destination of about 90% of Mongolian exports.

Despite of an overall slowing growth of the Chinese steel industry, demand for iron ore remained strong in 2014. The latter is mainly due to the rising cost of mining ore domestically, and the growth of the steel industry in inland China. However rising availability and competition in the global iron market is expected to create further downward pressure on prices; as demonstrated by a 21% price decrease in 2014 (to August).

3.3. DIRECT AND INDIRECT VALUE ADDED

The current profit of Mongolian exporters per ton of iron ore is estimated at 5 USD after deducting costs for extraction, transportation and royalty payments. The low price is mainly owed to the low content of metal in the ores. Different techniques may be applied to significantly increase the iron content and thus achieve higher prices at the market. One may distinguish between the dry magnetite method used for concentrating iron ore with high content and the wet-magnetite method used for concentrating iron ore with low content.

Iron ore concentrated by wet magnetite method allows for a sales price of roughly 45 USD higher (Mongolian Views 2014).

Low grade iron ore concentrate beneficiated via dry magnetite method may achieve prices of 56-59 USD per ton.

By contrast, wet concentrate with more than 65% iron content is worth 100-105 USD per ton. The export price of processed iron pellets is 140 USD per ton. As a result, processing iron ore to wet concentrate increases the exporter's profit to 30 USD per ton, compared to 5 USD per ton for raw iron ore.

According to economists from the Mongolian Economic Research Institute (ERI 2014), the direct value added from the iron ore sector was 2% of Mongolia's gross domestic product (GDP) in 2013, i.e. about 230.4 million

USD. If the sector's indirect impact through suppliers and job creation is considered, the total impact reaches 3.5% of GDP (2013) according to ERI.

4. THE STEEL INDUSTRY IN MONGOLIA

4.1. STEEL PRODUCTION

There are a total of 20 steel plants operating in Mongolia. Five plants are registered, the remaining ones are informal. All are relatively small compared to international standards. There are four steel plants that produce products for the construction sector:

- The previously state owned (now operated by the private enterprise QSC LLC under a concession agreement) "Darkhan Metallurgical Plant" (DMP), with a capacity of 100,000 t/p.a. DMP was built in 1990 and is located at the heart of Darkhan-Uul province (see chapter 7.1). In 2010 DMP signed a 10 year investment agreement with QSC LLC for the purpose of financing supply and installation of mining and wet beneficiation equipment. The agreement stipulates that 70% of the extracted ores are to be used by DMP and 30% by the investor. About USD 100 million were invested by 2014.
- The 100 % privately owned Blue Steel (since 2005) and Beren Steel (since 2010) both part of the Beren Group, a conglomerate of food, agriculture, light and heavy industry, mining, foreign and domestic trade, construction and real estate.
- Dul Tushig, a Mongolian-Chinese joint venture that commenced in 2007 and is currently operating with around 300 employees. It has an annual production capacity of 45,000 tons of steel rods. Since 2009 Dul Tushig has been producing steel balls at small-scale.
- Eredenet Mining Corporation and Orra metal produce with a capacity of less than 10,000 t/p.a.

Mongolian steel plants do not meet price and quality of steel products in comparison to plants in Russia and China. China, for example, produced 779 million tons of crude steel in 2013 (World Steel Association 2014). In the same year Mongolia produced 0.035 million tons.

Almost half of the world's steel is made in China, by an estimated 3000 steel mills. More than 90% of crude steel in China is produced by steelworks using blast furnaces and basic oxygen converters (World Steel Association 2010). Typical blast furnaces are capable of producing up to 13,000 tons of steel each day (Akers 2014).

By comparison, the largest of Mongolia's 20 steel plants has a theoretical capacity of 100,000 t/p.a. and a utilization rate of around 50-60%. China is therefore able to produce the annual Mongolian steel production with one of its blast furnaces in less than five days. Due to economies of scale, steel plants in China produce at much lower costs per unit. By contrast, Mongolian steel plants operate with outdated technology at much lower capacities and much higher unit costs.

4.2. STEEL CONSUMPTION IN MONGOLIA

Mongolia's steel production remains well below its consumption. In 2013, total steel use in Mongolia (imports plus domestic production) amounted to about 382,000 tons. With a population of 3 million, this equals an average steel consumption of 127 kg per capita (EPCRC).

Mongolia's use of steel has been rising sharply in recent years, largely driven by an increased development of mine sites, as well as a booming construction sector. Between 2010 and 2011, Mongolia's total steel consumption increased by 143%, and since 2011, has grown at an annual rate of 3.04%. If this rate of growth were to continue in the coming years, steel consumption is expected to reach 190 kg/capita by 2020.

This rising use of steel cannot be covered by existing Mongolian steel production. According to the World Steel Association 2013 yearbook, Mongolian steel production remained at around t/p.a., whereas the total steel consumption exceeded more than 400,000 tons in 2014. Only around 8.7% of domestic demand was covered by domestic production in 2014.

Between 2010 and 2013, the tonnage of steel imports more than doubled. The trend continued well through 20U, with total tonnage for the first eight months of 20U already exceeding that of the full year of 2013. Notable changes over this period include the significant increase in banded steel bars

and enriched steel hollow bars, as well as the increase in imported railway steel - from about 8,000 tons in 2012 to tons in 2013 - attributable to ongoing railway projects such as the "Bogdkhan Railroad" project, that requires building a 170km railroad between 2012 and 2016 (Infomongolia 2012).

The construction sector has shown an increase in contribution to the GDP by 36% between 2011 and 2013, and a 120% increase since 2010 (M.A.D. 2013). Such growth was, among others, induced by government monetary and quasi-fiscal stimulus programs. The annual change in GDP corresponds to the changes in import volumes, with a climax in 2011, when GDP amounted to 17.5% (World Bank Group 2014). Comparing the GDP annual growth and the progression of the amount of imported products, for most of the individual products the same trend can be observed (see figure below).

Yet, the processing and manufacturing industry is in its infancy and lags far behind international standards. The World Steel Association estimates, that the current world average of 225.2 kg/capita may be reached by 2023, and Europe's average of 274.2 kg/capita by 2026 respectively (World Steel Association 2014).

The steel and iron products are mainly used in four industrial sectors in Mongolia:

Construction

Products such as rebar (reinforcing bars), round bars, wires, and beams are used for building development, support facilities, infrastructure development, and other projects of urban development.

Mining and heavy industry

Products such as steel grinding balls, excavator bucket teeth, other spare parts, hammer crusher parts, impact crusher plates, and ball mill parts are used for mining and heavy industry purposes, for the development of new plants, and as spare parts.

Infrastructure

Products such as steel pipes, high voltage line wires, structural steel, and rails are used for infrastructure development, e.g. new railroads and power lines, potable water and sewage systems, bridges and roads.

Flat products

There is little demand for flat products such as Pre-finished flat steel, packaging steel, electro-plated steel, narrow strip steel, or electrical. Flat products are typically used for industrial purposes and manufacturing.

5. ANALYSIS OF THE IRON ORE AND STEEL INDUSTRY IN MONGOLIA

5.1. EMPLOYMENT

As illustrated earlier, in the current state, the iron and steel industry contributes an important share to GDP, exports, and state revenues. In an ideal setting, iron ore mining can be the trigger for significant indirect effects in upstream (supplying) as well as downstream (processing) industries.

For the current state of the iron and steel industry, official employment is estimated at around 2,500 and total employment at 4,000 by the EPCRC. This comprises 2,300 employees in iron ore mining and processing (57%); and 1,700 employees in steel production and processing (43%) respectively.

Employment data by the NSO show that in 2013, 213 mining companies employed approximately 46,500 people, a mere 4.56% of total employment (NSO 2014). Prior to the 2009 / 2010 financial crisis, the share of employees in terms of total Mongolian workforce was estimated to be at around 4.46%. The Mongolian mining industry proved to be volatile in terms of world-price-related business cycles. Employment in general, but in particular in the mining industries plunged to 3.46% in 2009 and 3.30% in 2010 respectively. With the commencing boom in mining, employment numbers recovered, yet it was not before 2013, that the share of employees in the mining sector regained its pre-economic crisis level.

Numbers show that the recent boom in the Mongolian mining sector is, to a limited extent, reflected at the labor market. The share of employees in the mining sector falls short of expectations and comparatively little direct employment opportunities were able to be created. Mongolia's industrial sector is underdeveloped, the absolute numbers are low and the sector's full potential is not tapped.

Despite an economic slowdown in the industry, some observers envisage considerably more employment potential in the mineral resources sector for the future. The Mongolian Ministry of Economic Development (MED) anticipates growth by 6,200 workers in the mining sector over the next three years (MMJ 2014: 100). The NSO estimates an annual growth of 13% of employment in the mining companies (MMJ 2014: 100). According to Mr. Zorig, the implementation of large mining projects will necessitate 12,200 additional workers in the extraction sector and 9,000 additional workers in the mining processing sector. Studies show that demand for labor in the infrastructure and industrial processing sectors is expected to reach close to 40,000 workers in the next four to five years. Such numbers must be considered optimistic.

The assessment of job creation should also consider indirect effects. Therefore, in addition to direct employment effects, further jobs in the supplying industry are estimated at a total number of 17,500 employees. This includes around 15,000 jobs in services (e.g. transportation), 1,800 jobs in manufacturing (e.g. clothing), and 700 jobs in mining and primary industries (EPCRC 2014).

It remains to be noted, that a growth in employment numbers in the mining sector does not necessarily reflect growth in net employment. The commodities sector is known to absorb labor from other sectors by increasing labor demand and wage levels. This phenomenon has been termed "**Resource Movement Effect**". Thus, growth in the iron ore and other mineral resources sectors can cause a redistribution of labor instead of real growth in employment. The creation of jobs in the iron ore and other mining industry must, therefore, be carefully weighed against its effects on other industries.

5.2. OUTLOOK ON IRON ORE PRODUCTION AND DEMAND

Further exploration for iron ore deposits will likely happen. Despite the realization of possible iron ore processing projects, local supply is unlikely to be further developed in an environment of increasing international supply and a predicted decrease of prices of those supplies.

Decreasing Chinese demand and no significant developments in domestic demand will make a development of the iron ore and steel sector less likely. China's consumption of Mongolian iron ore is expected to reach its peak by 2021 and it is, predicted by local sources, to entirely stop purchasing Mongolian iron ore as soon as 2025. China's designated plans to build modern housing for 400 million people within five years may be an indicator supporting such assumptions (MMJ 2014: 95).

As a consequence, the size of the Mongolian iron ore industry may be marginal compared to other mineral resources mined in the country in the future. Such a trend would correspond with the scheduled end of major mining operations such as Eruu Gol (16.5% of iron ore production) in 2023 (ERI 2014).

5.3. THE IRON AND STEEL INDUSTRY'S LONG-TERM IMPACT ON THE MONGOLIAN ECONOMY

Research suggests that the iron ore and steel sector will only have a marginal impact on Mongolia's economy in the future.

The iron and steel industry has only a relatively small contribution to the total domestic

value adding. It is estimated by ERI that the iron ore sector will account only 4% of Mon

golia's total value adding between 2014 and 2030 or a total of 1.2 billion USD on average annually between 2014 and 2030.

ERI anticipates a marginal role of the iron and steel industry for Mongolia's exports. Under the assumption of the development of so called 'mega projects' such as Tavan Tolgoi and Oyu Tulgoi, ERI anticipated major development of key resources such as met coal, copper and thermal coal.

While the size of gold and iron ore is predicted to be growing in the midterm (2020), ERI sees a diminishing iron ore sector by 2030. At its peak, ERI predicts a total contribution of about 5% for iron ore to the Mongolian economy, and therefore marginal in the long-term.

While direct effects of the iron ore and steel industry will remain relatively low in the near future, policy-makers should be aware of indirect effects which

can be expected. Such indirect effects on the economy can be observed in sectors such as agriculture, electricity, construction, manufacturing, services, and transportation. These industries profit from operations in the iron and steel industry. In correspondence with growth in other key sectors, indirect effects may potentially increase over time and create higher overall demand in related sectors (multiplier effect).

6. DEVELOPMENT INITIATIVES IN THE MONGOLIAN IRON AND STEEL INDUSTRY

6.1. PUBLIC SECTOR INITIATIVES

There are several governmental programs for the development of the mining industry and particularly for the iron and steel industry in Mongolia. The implementation of these programs is at various stages.

The Government of Mongolia is increasingly aware of the role of iron ore for the country's economy, particularly its share of exports and its contribution to budget revenues. Thus, the Government has declared the iron and steel industry strategically important. The development of the Mongolian metallurgical industry and domestic production of some imported goods have been identified as priority goals. The Government approved a "Construction Materials Production Support Program" on 15 December 2012 (Resolution No.171), which aims to stabilize property prices by supporting domestic production of construction materials, and to implement the goal to meet the demand for cement, reinforcing steel and other construction materials through domestic production. The Program envisages that by 2015 the capacity of cement factories will reach 4 million tons, and reinforcing steel production will reach 300,000 tons, which have met all domestic demand for these materials. However implementation of these strategies has fallen behind initial plans.

The Ministry of Mining has recognized the importance of the beneficiation and agglomeration of iron ore in order to achieve an extension of the iron and steel value chain. It is intended to expedite the implementation of major mining projects. Up to now, there has been little progress in executing these

projects. The domestic metal processing industry is poorly developed and fragmented. The quantity of long-run products cannot be covered by the only domestic producer Darkhan Metallurgical Plant (DMP) and the increased demand is embraced by imported steel products.

The Government's Action Plan and the "Construction Materials Production Support Program", approved by Cabinet Resolution No.171, aims to establish a metallurgical complex plant in the Darkhan/Selenge region. The declared objective is to increase domestic manufacturing capacities for supplying construction materials, such as reinforcing steel, and to build a DRI plant at the Darkhan Metallurgical Plant (DMP).

Ownership of state-owned "Darkhan Metallurgical Plant", which owns the Tumurtolgoi, Tu- murtei and Khust iron ore deposits, was privatized on February 28th 2014 and transferred to a private company QSC LLC, for a term of 30 years under a Concession Agreement in order to support the metals sector, and was approved by seven ministries.

Under the joint order of the Minister of Mining, Minister of Economic Development (MED) and Minister of Industry and Agriculture (MIA), a working group with the purpose of developing the "Mongol Steel" program was created. The group is assigned to cover the entire cycle from iron ore extraction to the production of final metal products. As a result, the Ministry of Economic Development (MED) prepared and submitted the list of major public investment projects for 2014-2018 to the Cabinet. One of the current priorities for MED is the development of the 330 soums (the "Soum Development Programme"), involving local small-scale service providers and manufacturers, such as meat processing plants. It has not been fully elaborated yet, whether the iron and steel industry can play a significant role in these plans.

6.2. PRIVATE SECTOR INITIATIVES

Looking at private sector initiatives, the most noteworthy is the **Mongolian Association of Iron Producers (MAIP)**. It includes almost all iron producers of Mongolia and operates as a non-government organization. The MAIP promotes common interests of its members, e.g. vis-a-vis the Government, and offers consulting services. The organization encompasses 24 private

companies, including 6 from China. The association's task forces work on iron ore processing, on value adding products and on the project "from pig iron to steel".

10 MAIP members also founded the **Mongolian Steel Consortium LLC (MSC)** which aims (in stage I/III) to produce wet iron concentrate that meets international standards and to supply major steel manufacturing plants in China. The objective is a "single window" service for traders in order to decrease obstacles for dealers and to increase exports. During this process, the establishment of 6 new flotation plants and the upgrade of 3 plants are planned. Thus, the export of 10 million t/p.a. iron concentrate would be possible by 2015. In stage I I/I 11, the establishment of 3 ore pelletizing plants with a capacity of 2 million t/p.a. each is planned. Stage III requires the creation of an ore smelting plant with capacity of 1 million t/p.a. and a 362 million USD investment for a period of 4 years. According to the Mongolian Steel Consortium, 7,000 permanent jobs directly attributed to this project are expected to be created. Should these numbers be confirmed, this would constitute a major contribution to employment in Mongolia's industrial processing industries.

6.3. OUTLOOK: POLICY ISSUES TO CONSIDER

The current iron and steel industry in Mongolia is marginal in comparison to other mineral resource industries. Even considering effects such as domestic employment, tax revenues and exports, the sector has almost no impact on the Mongolian economy. Therefore, this chapter tries to identify key challenges that need to be overcome in order to tap the sector's full future potential.

GIZ IMRI recommends comprehensive support by the Government in terms of a proper policy framework. A lack of bilateral trade agreements with major steel consumers in close vicinity, in particular China, impedes the exploitation of the full potential in international trade. Due to short-term contracts, and small-scale trade the average price generated for a ton of iron ore ranges between 50 and 60 USD in trade with China. IMRI argues that a price as high as 100 USD is achievable. Negotiating bilateral trade agreements, as it has

been concluded with Japan in February 2015, may have the potential to boost trade and improve the terms of trade. Long-term contracts may also have a positive effect on reducing vulnerability to volatile resource prices. Current negotiations with Japan may serve as guidance for further bilateral or even multilateral regional agreements.

In Mongolia steel production is limited due to a lack of infrastructure, weak macroeconomic conditions and an uncertain investment environment which diminishes long-term prospects for the mining sector. Therefore, the Mongolian steel industry is unlikely to be able to compete against its neighbors in the near future.

Therefore, the domestic production of finished steel products is not a realistic option for Mongolian steel plants. In terms of exports, the only realistic option would be steel pre-products for the steel industry in neighboring countries, particularly China. Such semi-processed products could be iron pellets or bricks of pig iron (MMJ 2014).

Regarding the domestic Mongolian market, there is demand for a range of steel products (see chapter 2.1) and it may **be advantageous to develop an iron and steel industry oriented at domestic supply and substituting imports at international standards**. The domestic production of steel pre-products could be the basis for an export-oriented production, but should be secured through long-term supply agreements with appropriate prices. According to GIZ IMRI analysis, the current production of steel products in Mongolia utilizes only about 50% of the available production capacities and the domestic production of steel products does not cover domestic demand.

Extensive capital expenditures will be necessary to develop the Mongolian iron and steel industry. According to ERI, iron ore producers need an additional 18.8 billion USD of capital investment in the next 15 years in order to develop and continue its operations (ERI 2014). Such investments need to be flanked by technology transfers, management knowledge and experience. Moreover, the return of investments will depend on the accessibility of markets for raw materials / steel-products, on the long-term prices negotiated, and on competitive technologies.

7. THE SAINSHAND STEEL PROJECT

A major change in the Mongolian iron and steel market could be induced by the Sainshand Industrial Complex, an industrial development project planned by the Ministry of Industry and Agriculture (MIA). The Sainshand steel and metallurgical plant in Dornogovi province is envisioned to be a metallurgical plant with two blast furnaces and an annual production capacity of 5 million t/p.a. It is planned to process iron ore and to produce pig iron in bricks of 50 kg. The iron ore which is necessary for the plant will be shipped by train from the state owned Turmurtei mine 800 km north. The coal necessary for a new coke oven plant will be transported from the Tavantolgoi coal mine southwest of Sainshand Industrial Complex by more than 400 km railroad, which has to be newly built.

The plant is expected to be 51% state-owned and 49% private. A significant share of the 2012 Chinggis Bond has been dedicated to finance the project. An investment deal with China is being considered, including the option of repayment by providing output. If such a deal for financing is agreed with China, the plant's equipment is likely to be imported from China. However, the Ministry is conducting further research on alternative equipment from Germany and Japan.

A feasibility study authored by the National Development and Innovation Committee in 2011 identified major challenges for the medium-term financial sustainability of the project due to necessary state subsidies and high production costs. So far, private investors have refrained from financial engagement and construction has not started.

The plant could generate an income for more than 2,300 people. The raw materials for this project are available. However, there are significant further investments necessary for machinery and infrastructure, adding to more than 3 billion USD. Technology-transfer and training is needed for the project planning phase (e.g. for commissioning), for its development (construction), and for commencing operations. Experience from other similar projects shows, that prior to starting operations of comparable plants a considerable built up of knowledge and additional investments of up to 1 billion USD are needed.

The lack of water in the region and transport volumes of twice the production must be considered as additional risks for this project. The existing railroad capacity is limited to roughly 22 million tons (Government of Mongolia - Ministry of Roads, Transportation 2012). Already, there are logistical bottlenecks for the transportation of freight via train.

As a building block of the project's financial sustainability, one of the most crucial challenges for the Sainshand steel plant will be to find a customer for 5 million t/p.a. of pig iron. The economic profitability of such a project requires a long-term sales agreement e.g. with China at predefined prices. German expertise is available for the selection of relevant equipment, the training of suitable staff and engineers, as well as for an economic cost-benefit analysis. The authors will be happy to provide contacts.

8. IRON AND STEEL INDUSTRY IN THE DARKHAN REGION

Currently there is no designated national development strategy for the steel sector. Despite various studies and resolutions conducted by the government within the last years, the development has been largely driven by private business interests.

The Darkhan-Selenge region has a fairly established infrastructure and is located in close proximity to several iron ore and coal mines. It has sufficient water resources available for industrial and household use. The Darkhan Power Plant has the capacity to provide the district with 48 MVA of electricity and steam. Recently, new circuits have been established and old ones have been refitted. There are plans to renovate the plant and no electrical shortage in the Darkhan-Selenge region is expected.

Darkhan is home to some of largest steel plants in Mongolia, the Darkhan Metallurgical Plant (DMP) and The Darkhan Steel Complex (DASCO). Further, more than 250 small and medium-sized industries are operating in the area. These include cement production, steel and brick manufacturing, food processing (flour, meat, sunflower oil) as well as leather fabrication.

The Government of Mongolia (GOM) undertakes various efforts in order to further develop the Darkhan region, including the establishment of the

Darkhan Steel Competence Center (DSCC) and the Darkhan Industrial and Technology Park (ITP).

8.1. DARKHAN METALLURGICAL PLANT (DMP)

Darkhan Metallurgical Plant (DMP) was, until recently, a 100% state-owned joint stock company and the largest steel plant in Mongolia. The plant was built in 1990 for a capacity of 100,000 t/p.a. of billet round bars, steel angles and deformed bars for reinforcement. In 20K, the decision was made to privatize the state-owned "Darkhan Metallurgical Plant", which owns the Tumurtolgoi, Tumortei, Khust iron ore deposits, under a Concession Agreement in order to support the metals sector, and was approved by seven ministries. A private enterprise, QSC LLC will now manage the plant operations for 30 years.

The production line uses Electric Arc Furnace (EAF) and continuous caster. The production is based on scrap iron. The plant was commissioned in 1993 by Mitsubishi Heavy Industries with expertise from Kobelco, Japan. High prices for scrap iron have limited the output until present day at approximately 55 t/p.a. Due to cost considerations one shift melts steel and casts billets at night. These are rolled in other shifts. According to DMP, no profit has been generated since the plant was built. Currently, DMP works only at 50-60% of its capacity, apparently due to its strategic orientation and a scarcity of scrap metal (Mongolian Views 20U).

DMP owns three iron ore deposits in close proximity to the plant. The three deposits Tumurtolgoi, Tumortei and Khust amount to at least 267 million tons of total iron ore reserves. The iron concentrate is sold mainly to China.

- The Tumurtolgoi Mine has a capacity of 1.3 million t/p.a. It started its operation in 2009. It's beneficiation of iron-ore by dry magnetic separation operating since June 2010. A new dry magnetic separation plant started operating in September 2013. About 270 people are employed at the mine, and 25 local students are currently being sponsored by QSC LLC to study at Darkhan Vocational Education Training Center (VETC), and following their training, will work in the

concentrator plant. The concentrator has the capacity to process three to four million tons of iron ore a year.\

- The Tumurtei is the largest deposit close to Darkhan and has about 230 million tons iron ore reserves and a capacity of 1 million t/p.a. In 2007, the deposit was classified as a mineral deposit of strategic importance and it is estimated that the deposit's reserve could reach 300 million tons. It started operating in October 2011 (Mongolian views 2014). In order to fully develop the project, an estimated amount of 700 million USD in investments is projected to be necessary. After a time span of almost four years, constructions on an iron ore concentrator with the capacity to process three to four million tons of iron ore a year was finalized in July 2014. Besides a concentrator based in Govi-Altai Aimag by Altain Khuder LLC, this is the only company with the capacity of processing such large amounts of iron ore in Mongolia (UB Post 2014).
- Khust iron ore deposit has about 4.4 million tons iron ore reserves (Luvsan- dorj/ Khashchuluun/ Batnasan 2012). It is expected that 50 million USD of total investment are needed in the future.

DMP has a distinct strategy (see figure below), which seems to be fully supported by the national and local authorities. In Phase 1 all three iron-ore deposits are to be developed. Subsequently, the mining output processing plants are set up. The iron ore beneficiation will be done via dry and wet magnetic separation. The relatively high sulfur content (up to 2.5% from Turmurtolgoi mine) will be removed. The construction of a wet magnetic separation plant with an annual ore processing capacity of 1 million t/p.a. (equal to 700,000 t/p.a. output iron ore concentrate) has been concluded. A plan using 300,000 t/p.a. of tailings will be used for the production of bricks.

A pelletizing and DRI plant are currently being developed as the start of Phase 2. The plant will increase DMP's production capacity to 340,000 t/p.a. The steelmaking capacity can be increased by additionally charging of DRI into the electric arc furnace. Thus, 180.000 t/p.a. of billets and 160,000 t/p.a.

of other products like wire, rods and sections can be produced. Furthermore, pellets and about 160.000 t/p.a. of DRI could be sold.

In addition, a coal-to-gas processing unit is being constructed as part of the DRI plant. Kobe Steel of Japan and Outotech of Finland are considered to provide the technology and expertise regarding the DRI plant. Samples of the iron-ore have been sent to both plants for laboratory purposes. DMP is in the process of identifying suitable DRI technology with a capacity of 300 to 350 kt/p.a. For Phase 2, a feasibility study is being conducted by the World Bank-financed Mining Infrastructure Investment Support (MINIS) Project.

A big challenge is the relatively high level of sulfur (up to 2.5 percent) in the iron ore. Samples of the iron ore have been sent to Shougang Center Laboratory near Beijing. Independent laboratory testing at the "Research Centre for Iron Ore Beneficiation and Metallurgical Testing of Burden Materials SGA" in Liebenburg/ Germany was not an option due to high cost.

A group of representatives from the previous Ministry of Industry and Agriculture, Ministry of Mining, and the metallurgical industry visited Kobe Steel's ITmk3 demonstration plant in Minnesota, USA. This plant processes waste and excess raw materials with low iron content to produce steel. The group also visited Kobe Steel plant in Kobe, Japan. So far the representatives are in favor of the "fast melt" technology of Kobe Steel.

It is estimated that investments of five to six million USD will be needed for the development of the DRI plant. This includes USD3.2 million to purchase the DRI equipment from China and 2 million USD for constructing the building. The DMP has 1,300 employees, including engineers, technicians and workers. In addition, the wet magnetic separation plant is expected to create 100 jobs plus about 250 jobs for the DRI plant.

The operation of the DMP's expansion will begin in 2016. It includes the expansion of the steelmaking and casting, the new building of a reheating furnace and the expansion of the coal gasification unit.

Overall, DMP's expansion strategy seems reasonable. It should be considered, however, that even with the increased capacity, which is likely to result in lower production costs per unit, DMP will still have difficulties to compete with international quality and price standards. Therefore, it will be crucial to focus on the specific needs of the steel processing companies in Mongolia and the Darkhan-Selenge region (e.g. production of rails). Moreover, the company should strive to fulfill international standards.

8.2. OTHER IRON AND STEEL OPERATIONS IN THE DARKHAN REGION

There are a several other private initiatives that have changed the iron and steel sector in the Darkhan region recently. The so-called Darkhan Steel Complex (DASCO) was built for the beneficiation of 1 million t/p.a. of iron ore. A small wet separation for 30.000 t/p.a. is already in operation. A pilot DRI unit and a rail link are under construction.

In addition, a dry magnetite beneficiation plant with the capacity of 1 million tons of ore became operational at the Tomortolgoi deposit with reserves up to 25 million tons. Another dry beneficiation plant with reserves up to 229 million tons and with a capacity of 3 million t/p.a. has opened in the end of 20U.

Currently, a feasibility study for an integrated steel plant, including wet beneficiation and direct reduction plants is being prepared under the World Bank-financed Mining Infrastructure Investment Support (MINIS) project. In 2012 an initial scoping study had been carried out and the terms of reference for preparation of the feasibility study had been prepared to express interest. The wet beneficiation plant has the capacity to process 1 million tons of iron ore. The machinery and equipment are procured from ZENIT factory of the People's Republic of China, and are currently being installed. The plant will produce 700,000 tons of concentrate with over 65% iron content. The direct reduction plant will have the capacity to smelting 150,000-300,000 tons of iron. The project is at the technology selection stage.

8.3. DARKHAN INDUSTRIAL AND TECHNOLOGY PARK (ITP)

The Governments of Darkhan Aimag and Darkhan Soum are planning to construct the "Darkhan Production and Technology Park" (the plan has been

known for some time already). They have defined three zoning categories: "Heavy Industry", "Old Darkhan Production" and "Training and Research". The Government is considering the construction of a new oil refinery (crude petroleum, 2 million tons) and a dry waste processing facility as well as the expansion and upgrade of the existing steel plant (Darkhan Metallurgical Plant, DMP) in the "Heavy Industry" zone.

According to the authorities, the establishment of the "Darkhan Production and Technology Park" is aimed at creating employment through export-oriented and import-substituting industries. The Governor's office of Darkhan-Uul Aimag coordinated an international seminar to discuss and identify a strategy to develop an "Industrial and Technology Park" (ITP). A feasibility study was carried out by external consultants. A budget of 450,000 USD was confirmed to be available in November 2013. The government prefers the development of light industries (e.g. leather and imported wood processing) within the framework of a four-year plan. A state-owned company which will be responsible for the establishment and initial operation of the ITP has been established. Once in operation, the Government expects ITP creates 5,000 - 7,000 jobs. Even if the main focus of ITP is on "light industries", it would be beneficial to locate steel processing industries near the steel plant to ensure the consideration of the quality, quantity and delivery time requirements of their products already in an early stage. The production of forged steel grinding balls from rod and other special steel products for the heavy and light industry could be examples of such synergies.

As of late 2014, the Darkhan Technology Park unit had officially registered as a legal entity with a scope of steel production and construction material, and research activity. This is currently in the development stage. Most recently, an enterprise known as Technometal LLC was created using funding from the first sale of Chinggis Bonds, focusing on steel and cast iron production.

8.4. DARKHAN STEEL COMPETENCE CENTER (DSCC)

The wider Darkhan area fulfills the best preconditions to become the center of iron and steel research and development in Mongolia. The iron and steel

laboratory "Darkhan Steel Competence Center (DSCC)" set up by DMP will support the development

of Darkhan's iron and steel industry in the future. The center consists of a wet-chemical, a non-destructive, and a destructive material testing department with respective equipment using state of the art technology.

The center shall provide education and training in the metallurgical process technology for e.g. material tester, skilled worker and engineers. In addition, there is potential to offer iron and steel research, production development and troubleshooting. Further, the center may play a major role as a coordinator between ITP, DMP, DASCO, as well as the private iron and steel companies like Beren Steel and Mongolian Steel Consortium (MSC).

In addition, the local universities are an essential building block for the development of Darkhan as a center for the Mongolian iron and steel industry. The Mongolian University of Technology and Science (MUST) branch in Darkhan teaches mining, energy and natural science with metallurgy, construction and machinery for two decades. The current number of students is expected to increase in the short term by 1,600 to 4,400 with new buildings and laboratories. This branch of the university specializes only in a few majors of metallurgical processing. Three associate professors are teaching these subjects. They run a small iron and steel test laboratory. The branch plans for a close connection to Darkhan Industrial and Technology Park (ITP).

The Polytechnic College of MUST on site and Darkhan-Uul Aimag's Vocational Education and Training Center also have excellent equipment, but they mainly train for the construction industry, and do not specialize in the metallurgy. All three institutions meet best practice standards.

9. EXPERIENCE AND TECHNICAL -TRANSFER BETWEEN GERMANY - MONGOLIA

In order to improve the quality and quantity of iron ore processing and to become competitive against neighboring countries such as China and Japan, the implementation of international technological standards are crucial for Mongolia. Advancing the development of the iron and steel value-chain, in

addition to the production of iron and steel pre-products, requires process and product knowledge implemented by a well-trained management and staff. It is the purpose of this chapter to have a closer look at the benefits of cooperation with German companies.

The exchange with German companies who are certified according to international norms helps to gain an insight into the knowledge of various stakeholders of a differently structured iron and steel industry. Mongolian state-owned and private companies are already interested towards participating in the experience of the German iron and steel industry for training their management, engineers, technicians and skilled workers. For example, the members of the Mongolian Association of Iron Producers (MAIP) want to import knowledge of international standards in iron ore processing and steelmaking. In order to exchange experiences of experts in designing a steel plant, to have discussions with professionals for pricing, transport and marketing and for setting up the federation organization, MAIP wants to have an exchange with German companies. The authors are happy to provide contacts.

Additionally, the Mongolian industry could benefit from a rise in investments and activities of German companies in the Mongolian market. For foreign companies, there are opportunities in the sales market. Mongolia offers considerable potential for foreign companies, particularly in mining supply products. Up until now, these potentials were barely exploited. However, the Mongolian business environment proves to be rather difficult for foreign business. Companies face a lack of transparency, a lack of access to market information and ongoing projects, and a relatively unstable environment for foreign investment as major challenges. For example, the 2012 Foreign Investment Law of Mongolia (FIL) limits foreign ownership of assets and access to use rights in various key sectors, among them natural resource extraction. In addition, there are only few institutions that provide information and consultation (the German-Mongolian Business Association, DMUV, is a noteworthy exception). Therefore, German and other international companies hesitate to invest in Mongolia. The sharp decline in foreign direct investments in Mongolia during 2013, to some extent reflects a declining confidence by investors in Mongolia's business climate. Irrespective of the iron and steel

sector's specific regulatory environment, Mongolia has been requested frequently by representatives of the international corporate sector to improve its institutional framework for conducting business over the past few years. Investors have recommended developing Mongolia's transport and energy infrastructure, improving the functioning of its market, to create transparent and high quality regulation for foreign investment, and to develop its financial sector (World Economic Forum 2013).

Regarding opportunities for cooperation between German and Mongolian companies in the iron and steel industry, the service providers DMUV and GIZ IMRI can facilitate the necessary match-making. Contacts to relevant German business associations (e.g. the German Steel Association or the World Steel Association) are available and an exchange will be gladly assisted.

10. CONCLUSION AND RECOMMENDATIONS

Mongolia's iron and steel sector is characterized by high costs, small volumes and low quality. This impedes the competitiveness of Mongolia's iron and steel sector and limits new investment. Opportunities to optimize production costs are currently limited due to infrastructure constraints, macroeconomic volatility and an inappropriate investment environment. Facing these circumstances, the iron and steel industry's existing potential has not been fully utilized, yet.

The iron and steel industry in Mongolia provides only a small portion to the domestic market. Only 13.7% of domestic demand is coming from domestic production. Steel plants operate with outdated technology at low volumes. Supposedly, since DMP was built, no profit has been generated. Currently, DMP works only at 50 - 60% of its capacity, and even with the increased capacity of DMP in the future it will still have difficulties to compete with international quality and price standards. However, there are supporting projects such as the Government's "Construction Materials Production Support Program" which intends to improve the capacity of reinforcing steel production that will reach 300,000 tons by 2015, which would meet all domestic demand for these materials.

Along with the little developed domestic market, the Mongolian export market is equally underdeveloped. However, Chinese companies demand a steady supply of large quantities of ore and this demand comes with low prices: Currently, Mongolian exporters of iron ore only make a profit of 5 USD per ton for raw iron ore, compared to the possible exporter's profit of processed iron pellets of more than 60 USD per ton. In order to extend the processing of iron ore, the report concludes that the production of steel finished products is not an appropriate option for Mongolia.

Based on GIZ IMRI's research and analysis it seems recommendable to concentrate on steel pre-products. Future projects like the Sainshand Industrial Park are only designed for the production of steel pre-products and no steel plant in Mongolia is yet producing steel finished products. Furthermore, the Mongolian iron and steel industry is unlikely to be able to compete against its neighbors in the near future. Steel plants in China produce at much lower costs per unit due to economies of scale. For example, China is able to produce the annual Mongolian steel production with one of its blast furnaces in less than five days.

Currently, steel pre-products are produced at a low level and Mongolia lacks processing industries that could multiply employment effects and profits. The current production of steel products in Mongolia utilizes only about 50% of the available production capacities and even if the commodities sector absorbs labor from other sectors by increasing labor demand and wage levels, the sector's employment factor is at least 1:5, comparing to Germany's ratio of 1:25.

Assessing the future prospects, it is indicated that the effect of iron ore for the wider economy will be marginal compared to other mineral resources mined in the country. Major current iron ore mining projects such as Eruu Gol are scheduled to stop operations after 2022, so that mining production will decline, if no new projects are developed. Also because of the expected decline of commodity prices in the midterm due to excess global supply and the diminishing demand of China's steel plants in 2025 due to political decisions, it is estimated that the iron and steel sector will become negligible by 2030.

The massive decline of Foreign Direct Investments (FDI) in recent years due to unfavorable framework conditions exacerbates the future support of operations of iron ore projects. Hence, in order to develop and continue the operations of existing iron ore projects considerable investment is needed: It is estimated that iron ore producers need additional 18.8 billion USD of capital investment until 2030.

In order to capitalize on the existing potential, it is crucial to reduce the share of unprocessed iron ore in exports, to increase the level of pre-products, as well as to increase the quality and price of export products. Appropriate policy conditions could trigger indirect effects in upstream (supplying) as well as downstream (processing) industries. Therefore, an integrated political concept that considers the Government and the private interests of a future iron and steel industry is recommended. Such a concept should scrutinize the costs and benefits of different projects, both from an overall economic perspective and in terms of a business case. A coherent policy framework could also help with the plausibility of individual projects currently discussed as strategically important.

Looking at experiences from other sectors (food industry, automotives, infrastructure development, etc.), the exchange with German companies could prove useful to improve the quality of iron ore processing in Mongolia, In particular, this could help to help Mongolian companies to adapt to international quality standards, Therefore, the Mongolian state-owned as well as private companies in the iron and steel industry are recommended to use German expertise more intensively, The authors will be happy to facilitate a match-making with business contacts,

SOURCES

Akers, Helen (2014): How do I compare Electric Arc Furnaces and Blast Furnaces?, http://www.ehow.com/how_8043445_do-arc-furnaces-blast-furnaces.html, 03.07.2014.

Economic Research Institute Mongolia (2014): An Economic Impact Assessment of the

Iron Ore Sector in Mongolia, in: Mining journal (2014): The reality of the Mongolian metal industry, No. 5 (67), 2014, Ulaanbaatar.

Government of Mongolia - Ministry of Roads, Transportation (2012): Railway Developments of Mongolia, 2012.

Infomongolia (2012): A Railroad Construction Along the South of Bogd Khan Mountain to

Start Soon, <http://www.infomongolia.com/ct/ci/5096>, 02.06.2014.

Luvsandorj, Puntsagdash / Khashchuluun, Chuluundorj / Batnasan, Namsrai (2012): Mongolia at the Market, LIT Verlag GmbH & co. KG, Wien.

M.A.D. (2013): The Mongolian Real Estate Market - Construction Sector, <http://mad-research.com/mongolian-real-estate-market> /construction-sector/, 15.06.2014.

Mining leaders (2014): <http://www.mining-leaders.com>, 10.06.2014.

Mongolian Mining Journal (2012): Metallurgy complex needed immediately,

<http://en.mongolianminingjournal.com/content/22784.shtml>, 02.06.2014.

Mongolian Mining journal (2014): The reality of the Mongolian metal industry. No. 5 (67),

Ulaanbaatar.

Mongolian Views (2014): Iron Ore Concentrator to be put into operation this year, <http://mongolianviews.blogspot.com/2014/02/iron-ore-concentrator-to-be-put-into.html>, 04.06.2014.

NSO (2015): Mongolian Statistical Information Service 2015, <http://www.1212.mn>, 01.04.2015.

IJB Post (2014): Tumortei iron ore concentrator launches,

<http://ubpost.mongolnews.mn/?p=10442>, 10.02.2014

World Steel Association (2010): Steel Statistical Yearbook 2010, World Steel Association, Brussels, 29-33.

World Steel Association (2014): World Steel in Figures 2014, World Steel Association, Brussel.

World Economic Forum (2013): Global Competitiveness Report 2013-2014

11. Full Data Edition, World Economic Forum, Geneva.