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Sustainable assessment of metal industries for policy advice

The case of the Philippines, Thailand, Indonesia and Viet Nam

INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT

Sustainable assessment of metal industries for policy advice

The case of the Philippines, Thailand, Indonesia and Viet Nam

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1. Overall introduction

Over the past decades, globalization and industrial development have facilitated high economic growth in several emerging countries in the ASEAN region. The region's GDP has grown more than 5 percent annually since 1990 - much faster than the world's average at around 3 percent. Unfortunately, this economic growth was coupled with a rapid rise in energy demand, high natural resource use, as well as a degradation of the environment.

To meet the energy and material demands for development and to ensure that pollutants and unsustainable resource consumption decrease in total terms, it is paramount to decouple economic growth from environmental impact. This can be achieved with an integrated framework for supporting the greening of industries, consisting of industry-led initiatives, the adoption of best practice technologies, market-based policy instruments and regulations, accompanied by political support and information flow. However, more often than not, the rule of the game is damage control in the pursuit of continued economic growth.

This report is the result of a new methodology that aims to provide a sustainable assessment of industries in an effort to provide an adequate analysis to inform policy making. It focuses on the metal industry in five ASEAN countries, namely Indonesia, Malaysia, the Philippines, Thailand and Viet Nam.

"Manufacturing" as the engine of growth is commonly heard as a slogan in favour of manufacturing. In his most recent book, the internationally acclaimed Cambridge economist, Ha-Joon Chang, devotes one full section to the importance of manufacturing for economic growth (Chang, 2007). Chang claims: *"History has repeatedly shown that the single most important thing that distinguishes rich countries from poor ones is basically their higher capabilities in manufacturing, where productivity is generally higher, and, most importantly, where productivity tends to (although does not always) grow faster than in agriculture and services"* (Chang, 2007:213). Hence, the case for industrial policy remains strong and has become stronger with technical change and globalization (Lall, 2003) in order to attain the full potential of manufacturing sector growth in any country.

Industrial development depends on the international context, which is changing rapidly, driven by globalization, liberalization and technological change. Specifically, it is characterized by tighter linkages within global value chains based on close coordination between national and international actors within integrated systems. The success of national industries thus increasingly depends on a country's ability to actively participate in industries that are dynamic, fast growing and with high returns. On the other hand, the national context also matters. On the

supply side, the fundamental changes that occur in any economy can, to a large degree, be associated with changes in a country's factor endowment which entail differences among countries in terms of labour and capital stock. At the static level, this notion proposes that any country must align its productive capacities and labour with its current endowment structure. At the dynamic level, it suggests that countries which excel in the production of goods and services that are in line with their endowment structure can accumulate capital and knowledge and thereby change and improve their endowment structure.

1.1   Prospective AEC formation and the industrial sector

Founded in 1967, the Association of Southeast Asian Nations (ASEAN) strives to promote economic and political cooperation between member states in East Asia, at the same time facilitating interaction between its members and the rest of the world. Following the Bali Concord II in 2003, the formation of an ASEAN Economic Community (AEC), has been recognized as the end-goal of regional economic integration. Transforming ASEAN into a single market and production base by 2015, while achieving the free movement of goods, services, investment, skilled labour and freer flow of capital within the region lies at the heart of this AEC concept.

The formation of AEC opens up a plethora of opportunities and challenges to industries. We list a few of them in this section.

The most obvious opportunity is the enhanced market, which comprises over 600 million people. Over the period 1998-2012, the ASEAN's average economic growth was 5.9 percent, exceeding most other regional blocks, signifying this market's expanding purchasing power.

Cheaper raw materials: Most industries can tap into the cheaper raw materials stock elsewhere in the AEC. ASEAN is rich in natural resources; it holds over 40 percent of the oil and gas resources of the Asia-Pacific. This, too, will enable industries to find a cheaper and reliable supply of resources.

Reduction in production costs: In addition to cheaper raw materials, industries can further reduce their costs through improved logistics, reduction in tariffs and other bureaucracy. A McKinsey Research Report[1] finds that firms in the electronic goods industry alone can cut up to 20 percent of their costs due to the formation of AEC. The report also finds scope for similar cost reductions in other industries as well.

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[1] McKinsey (2004).

Increased competition: With the formation of AEC, all industries must brace themselves for more competition. Firms not only have to compete with their counterparts in other ASEAN economies, but with foreign counterparts as well, as the formation of AEC will make the region a more lucrative market.

Increased flow of foreign investments: Charumanee (2012) predicts that the formation of AEC will result in increased flow of foreign investments to the region. This will definitely have an impact on the region's industrial landscape.

The former Secretary General of the ASEAN2 accurately identifies its three strengths: 'We (ASEAN) have abundant natural resources in our region. We have large supplies of professionals and talented people. And, we have the capability to adopt, adapt and advance technology.' Effective industrial policy must capitalize on these strengths and adapt to the opportunities and challenges posed by AEC. This includes, but is not limited to, improving hard and soft infrastructure to reduce logistic barriers, providing capacity building of domestic firms, channelling skills development to support industries and creating opportunities for those rendered unemployed due to increased competition. We provide certain guidelines on such policy measures in this report to foster the ASEAN industrialization strategy's sustainability.

1.2   Profile of the metal industry

The profile of the metal industry (defined under ISIC Rev 3.1) covers the following activities: the manufacturing and casting of non-ferrous metals, iron and steel as well as the manufacturing of basic precious metals. This division is based on the productive activities characterized by the processing of metal products from metal ore and / or scrap metal. Manufacturing activities vary from refining metals, casting molten metal into desired shapes or producing inputs for the refining or casting process. The metal industries utilize both ferrous and non-ferrous metals and produce pure metal products or alloys in the form of end products or stock and intermediates for use by other industries.

Steel producers use three types of processes for converting iron ore into steel: coke oven, electric arc furnace or the corex process. Two types of products are manufactured by the main producers - long products and flat products. Long products include bars, structural products, wire rods, angles and rounds. They are used in construction and heavy engineering. Flat products include hot rolled coils/sheets, cold rolled coils/ sheets and galvanized sheets.

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[2] Remarks by H.E. Ong Keng Yong, Secretary General of ASEAN, at the ASEAN Gala Dinner, London, 4 December 2006.

Table 1 Metal industry classification

ISIC Rev.3.1 code 27: Manufacture of basic metals

- 271 - Manufacture of basic iron and steel

    - 2710 - Manufacture of basic iron and steel

- 272 - Manufacture of basic precious and non-ferrous metals

    - 2720 - Manufacture of basic precious and non-ferrous metals

- 273 - Casting of metals

    - 2731 - Casting of iron and steel

    - 2732 - Casting of non-ferrous metals

1.3   Global overview of the metal industry

'The global metal industry experienced a robust growth during the last five years but is expected to slow down, and the industry revenue is forecast to reach an estimated $2,374 billion in 2017 with a CAGR of 5.5% over the next five years (2012-2017)'[3]. Looking at the metal industry's world export data, Germany, China and Japan top the list with 7.7 percent, 7.4 percent and 6.6 percent market share. The graph below presents the major exporters and their market share in world metal industry trade.

A survey conducted by the Economist Intelligence Unit in 2011 among the top execuitves of global metal manufacturing firms revealed price volatility of key inputs as the metal industry's most important challenge.   According to another market research document produced by a strategy consulting firm , the four main challenges attached to the metal industry currently are 1. Decline in demand for metals; 2. Decline of metal prices; 3. Exposure to high procurement costs; 4. Refinancing difficulties. Most of these challenges are in fact a direct consequence of the financial crisis and economic recession. Firms across the globe have used this period of slowed growth to restructure their businesses, make structural adjustments to their capacity and to achieve cost efficiency. This certainly enables firms to grab opportunities as soon as the world economy's growth momentum returns.

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[3] Lucintel, 'Global Metal Industry 2012-2017: Trend, Profit, and Forecast Analysis.' as reported in http://www.researchandmarkets.com

Figure 1   Global export market share

In the UNEP report entitled 'Priority products and materials: assessing the environmental impacts of consumption and production', which assesses and ranks different product categories based on their total environmental impact, the members of the metal industry (iron and steel products) belong to the high impact 1st priority group. This impies that the industry has a lot to offer in terms of reducing the environmetal impact of manufacturing growth in any economy. For instance, the recycling of metals is an efficient sustainability strategy but the 'recycled content' values across the globe remain low and, according to UNEP's 'Recycling Rates of Metals' report, are expected to remain low in the near future, states the UNEP. A PwC report warns that 'the risk of scarcity (of metals and minerals) is expected to rise significantly, leading to supply instability and potential disruptions in the next five years'[4]. Hence, it is imperative for national governments and private actors to further investigate the metal industry's sustainable devlopment, both to reduce the enviornmental impact and to meet the looming challenge of metal scarcity.

2   Economic analysis

2.1   Introduction/conceptual framework

To effectively design appropriate industrial policies, it is crucial for governments in developing countries to understand their competitive position in comparison to other countries and the rest of the world given the current domestic and global demand trends. It is equally important to

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[4] PWC, 'Minerals and Metals Scarcity in the Manufacturing: the ticking time bomb', December 2011.

understand the domestic factors and conditions that influence this competitive position. Such an analysis not only benefits governments, but also the private sector, as it provides the information on which strategic decisions can be based.

Global integration through international trade and flow of capital are the cornerstones of modern economics. If an economy is to become competitive and to develop, it will need to actively engage in trade with other economies – economies that can rely on catering to their domestic markets only are very few. This means that it is important for a country to identify products and sectors that are:

- in line with its current endowment structures.

- growing dynamically at the global level due to current and future consumption trends.

The former represents the supply side of our analysis, i.e. what the core competencies of the country are, and the latter signifies the demand side of our analysis, i.e. is there a growing market for the products of specific industries.

Understanding supply side constraints relates to understanding a country's comparative advantage which is defined by its endowment structures. According to the former chief economist of the World Bank, Justin Lin, a country's factor endowment entails differences among countries in terms of labour and capital endowments as well as with a country's ability to create the necessary capabilities given those endowments (Lin, 2011; 2012). These in turn determine what countries are capable of producing. Lin's theory builds on an integrated approach, which, on the one hand, emphasizes the role of markets for resource allocation and on the other, on the government's role in actively coordinating investments for industrial upgrading and diversification, and in compensating for externalities generated by first movers in the dynamic growth process.

One cannot look independently at the supply side of the coin and continue to produce goods that are declining in terms of demand. Demand is driven by international and domestic markets. Some industries, like food and beverages or construction materials, are inherently more geared towards demand on the domestic market, while others focus more on the international market. Products are increasingly becoming more complex and reliant on intermediate goods, which in turn depend on other intermediate goods. The result is that the production of final goods is becoming increasingly intrinsically linked with their degree of reliance on intermediate goods along the supply chain. Consumption patterns and, hence, demand, be it domestic or international, affect the growth of industries that produce final goods, as well as those that

produce intermediate goods. The entire value chain is consequently affected by consumption, and this makes it important for an economy to identify its growing industries in terms of international and domestic demand both for final goods as well as for intermediate ones.

Consolidating these two aspects to construct a rigorous approach for industry selection is not an easy undertaking, but can be paramount for a country to successfully undergo structural transformation from poorly performing industries to dynamic ones that generate high value added and provide sufficient employment opportunities without harming the environment.[5]

This opens up the following questions.

- **On the demand side:** Which are the dynamically growing industries at the global level? What weight does a country carry in globally growing industries and how has its position changed from a decade ago? Can such industries also cater to domestic demand?

- **On the supply side:** Are these industries in line with its comparative advantage and its endowment structure? Does the development of selected industries guarantee positive spillovers to other industries of an economy through the supply linkages?

These two aspects form the basis of the analysis framework presented in this report.

2.2   Methodological considerations

Some important methodological considerations need to be outlined:

- *Use of quantitative and transparent data.* This report does not rely on business perceptions to assess countries' industrial competitiveness. Notwithstanding their usefulness, perception-based surveys generate partial indicators for inter-country comparisons, as the views of individuals and companies are shaped not only by objective circumstances, but by subjective and context-sensitive factors as well. The United Nations Industrial Development Organization's (UNIDO) methodology relies on a number of carefully selected objective, outcome-based indicators published by international organizations. Although quantitative indicators will never be perfect proxies of what they intend to measure, they provide a solid foundation for inter-country analyses.

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[5] At UNIDO, this approach is called the "3 E's" - "economy, employment and environment".

- *Analysis of levels and trends.* The report assesses countries' industrial performance as well as the overall trends for a specific period. Such an analysis is particularly useful for countries experiencing high levels of growth and which have not yet achieved the rates of development typical of industrialized countries. The analysis covers the period 2000–2009 for all countries.

- *Macro- and sectoral analysis.* Macro-analysis provides a general overview of a country's industrial competitiveness vis-à-vis other countries. By using UNIDO's methodology, the report combines macro- with sectoral analysis, enabling policymakers to establish realistic and applied parameters. The depth of sectoral analysis depends on various factors, including data availability and the objective of the study. The report analyses sectoral performance at the 2-digit level in SITC revision 3 and ISIC revision 3.

- Data

  - *Value added data source.* Value added is defined as the return to factors of production. It is the difference between total output and total operating costs incurred in the production of goods where total operating costs refers to the sum of total materials and operating costs. This data can be derived from INDSTAT. The major limitations of INDSTAT are limited sector, country and year coverage. The case may be that there is a number of missing data for a given country for certain years in a selected industry. Another limitation of the INDSTAT data relates to the fact that some countries report data as a combination of two or more 2-digit ISIC categories – this requires us to aggregate the data, which can lead to the loss of relevant information, which we would otherwise attain at a more disaggregated level. Furthermore, for the 2-digit ISIC categories, the source of value added data is industrial surveys, which only include a representative subset of all the firms operating within that industry.

  - *Export data source.* Export data was obtained from UN Comtrade and covers extensive international trade data in terms of product, sector, country and time coverage. The data can therefore provide us with a detailed overview of trade patterns at the global and country level for a selected industry or product. UN Comtrade data have two major limitations. First, data are presented in nominal terms, meaning that they are not adjusted for inflation and might therefore show a distorted picture in terms of actual trade performance, which could either be under- or overestimated, depending on the country in question. The second limitation is that all trade data are output data, meaning that we cannot determine the true value addition of a country's trade performance, as we are also

accounting for intermediate input, which covers: (a) value of materials and supplies for production (including cost of all fuel and purchased electricity); and (b) cost of industrial services received (primarily payments for contract and commission work as well as repair and maintenance work).

– *Input-output tables*. Input-output tables capture the most important financial transaction between different industries and consumers within an economy. They provide an overview of the whole economy along the production and supply chain to intermediate and final use. Input-output tables can be obtained at the national and international level. In this paper, we use input-output tables at the international level. One of the major limitations of input-output tables is that they are disaggregated at the sectoral level and not at the product level, which can lead to omission of some of the most important interdependencies.

2.3   Economic assessment

2.3.1   *Analysis of exports*

A sector's competitiveness can be assessed by analysing its world export share, along with the product's international dynamism and demand for it (measured by the annual growth of the product in the world market). Our analysis covers a period of 11 years, from 2000 to 2011. To evaluate the dynamism of the industrial sector in the world market, the key question we aim to answer is how the industry is growing in relation to the manufacturing sector's average. We calculate the compound annual growth rates (CAGR) of the industry-specific exports and of the manufacturing sector's total exports. From this analysis, we can determine whether an industry's exports are growing faster or slower than the average manufacturing exports. Those industries that are growing faster than the average manufacturing exports are considered to be dynamic, while those industries that are growing slower than the average are considered to be static.

The share of the country's manufactured exports is then calculated for the period 2000 to 2011 to measure the country's impact on world demand for the products of that particular industry. The share of exports in the world exports of a particular industry reveals a country's competitive position relative to others in the international market. Gains in world market share reflect improved competitiveness, while losses denote a deterioration of the country's competitive position. Such an analysis provides us with a methodology to classify industries into four categories based on their export performance (described below).

Champions: a champion export is a highly dynamic product—growing above the average of world exports—with a gain in world market share. Successful exporters tend to have an important number of champion exports, reflecting the country's ability to gain world market share in the most dynamic and demanded products;

Underachievers: these exports are highly dynamic in world markets, but the country is losing world market share. Such exports are considered 'lost opportunities' as the country is failing to compete in fast growing products;

Champions in Adversity: overachiever exports are not very dynamic products—they grow below the average of world exports—and yet the country is gaining world market share. This tends to be a common feature of many resource-rich. developing countries as their major exports see sluggish growth in world demand;

Decline: products from this group are slow growing exports in world markets where the country is losing world market share. It must be noted that it is not necessarily a bad sign for the country to have declining exports if they are balanced out by champion exports. This is indeed a feature of many industrialized countries that lose competitive edge in slow growing, labour-intensive exports while strengthening the position of high value added and technology-intensive exports.

Figure 2 groups the five ASEAN economies' metal industries into the respective four categories based on their export performance.

Figure 2   **Analysis of exports**
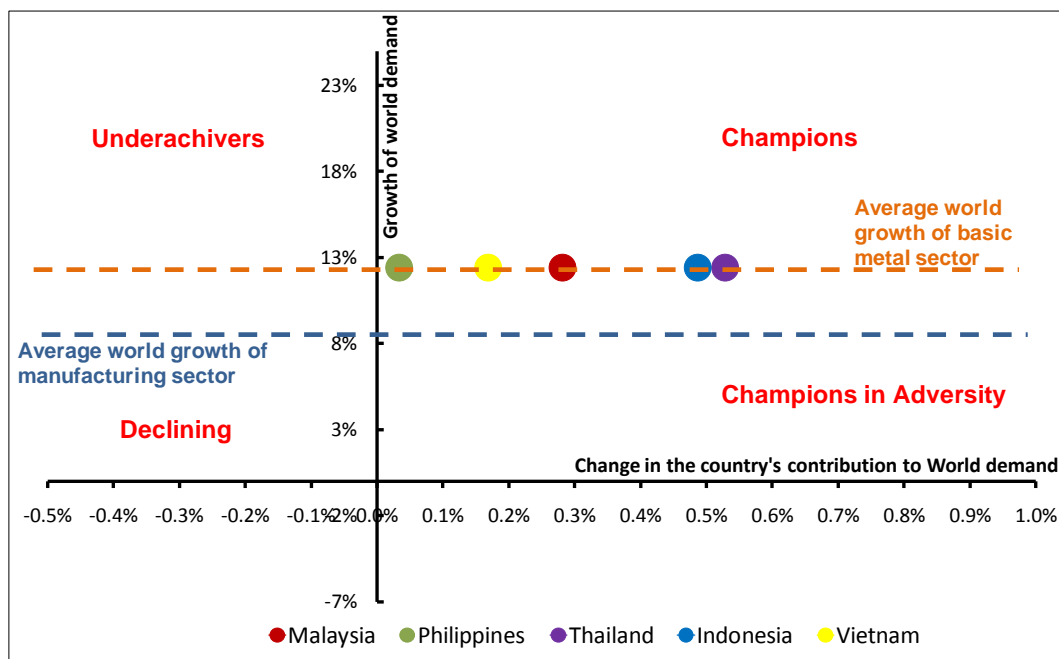
Manufacturing accounts for the bulk of world exports (78 percent in 2010), and is less exposed to external shocks, price fluctuations, climatic conditions and unfair competition policies. The price of manufactured goods tends to be more stable than that of commodities, as unfair competition policies have distorted prices around the world, limiting the potential for export growth of some commodities. Our figures show that this growth in manufacturing exports is a sustained one, with an average global growth of 10 percent between 2000 and 2011.

On a global scale, the metal industry's products have been faring even better than the average manufacturing exports, with an average global growth in demand of over 12 percent. This trend is set to continue with the industry's extensive links with other growing industries such as metallurgy and construction, which are both set to experience a tremendous boost in the region due to Asia's increased growth momentum.

Hence, it is important to examine the countries' responses to the increasing world demand for metal products. Between 2000 and 2011, out of the five countries investigated here, Thailand and Indonesia managed to take the biggest share of the world's growing market for metal products, with a growth of 0.66 percent in the world market. Malaysia and Indonesia follow with a growth of 0.36 percent and 0.16 percent, respectively. Viet Nam and the Philippines, however, lag behind with a minor increase of 0.08 percent and 0.06 percent, respectively.

The metal industry is a "Champion" industry in each of the countries studied here. In essence, demand for products ofr the metal industry has, on average, been growing at a higher rate than products of the manufacturing sector as a whole, and all five countries increased their share in world exports of metal products during this period.

2.3.2 Analysis of domestic demand

In the previous section, we analysed the metal industry's performance with regard to the export performance dimension. In this section, we apply a similar analysis, but at the domestic level.

We want to determine how local demand for products from the metal industry grows over time and how the metal industry performed in terms of adjusting its production capacity. Furthermore, we track the domestic demand for products of the metal industry (measured by the industry's annual growth in the domestic market) relative to domestic demand for manufactured goods on the whole.

For this analysis, we use input-output tables to calculate the growth rate of domestic demand as the sum of the industry's intermediate and final demand. Unfortunately, no input-output table was available for Viet Nam. Due to the reliance of this analysis on input-output tables, our analysis covers a period of 10 years, from 1990 to 2000. We rely on INDSTAT for data on sectoral value added.

To conduct the analyses, we employ a graph (Figure 3) with the following description. The y axis shows the changes in domestic demand for products of the metal industry and the x axis shows the changes in value added for the metal industry in the country's total manufacturing value added. The dotted line represents the average domestic growth of the demand for products of the manufacturing sector on the whole during the same time period.

Figure 3   Domestic demand analysis
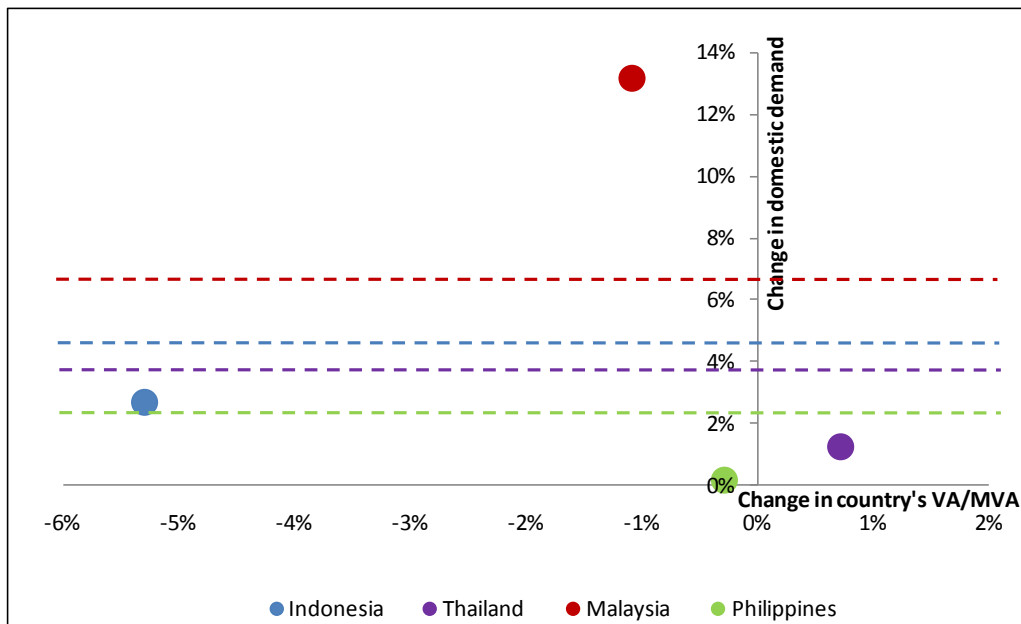
Those industries that registered a growth in demand that was higher than the manufacturing average (i.e. above the dotted line) while at the same time recording a positive change in the ratio of sectoral value added to total manufacturing value added, will be termed 'Local Champions'. Yet the above figure reveals that the metal industry did not emerge as a 'local champion' in any of the countries. Malaysia witnessed the biggest change (13 percent) in domestic demand for products of the metal industry, followed by a 3 percent and 1 percent rise in Indonesia and Thailand, respectively. Changes in demand for products of the metal industry in the Philippines remained negligible. The only country that increased its metal production share in total manufacturing over the ten-year period covered by this analysis is Thailand. Indonesia experienced the biggest movement away from the metal industry. Despite the high increase in domestic demand in Malaysia, the industry's structure was not able to meet that demand. Malaysia was also the only country where the metal industry was very dynamic, with domestic demand being higher than the average demand for manufactured goods.

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2.3.3 *Analysis of structural change*

It is important to compare the development and performance of different manufacturing industries with those of other countries that are in a similar stage of economic development or with countries that have successfully transformed themselves through manufacturing growth and are therefore considered a role model. The structural change analysis described in this section is a comparative analysis. It builds on a comparative advantage argument, assuming that income level is associated with a country's endowment structure, which entails differences between countries in terms of supply of labour and capital, as well as the necessary capabilities. These in turn determine what countries are able to produce and are related to structural change. This implies that if countries are able to perform well in industries which are aligned to their endowment structures, they can accumulate capital and their income per capita can grow. The implication is that the country's endowment structure also changes as it accumulates capital and the labour force acquires higher skills. As a country's endowment structure changes, it moves to more technologically sophisticated industries with higher capital intensity.

Figure 4   **The mechanics/mechanism of structural change**
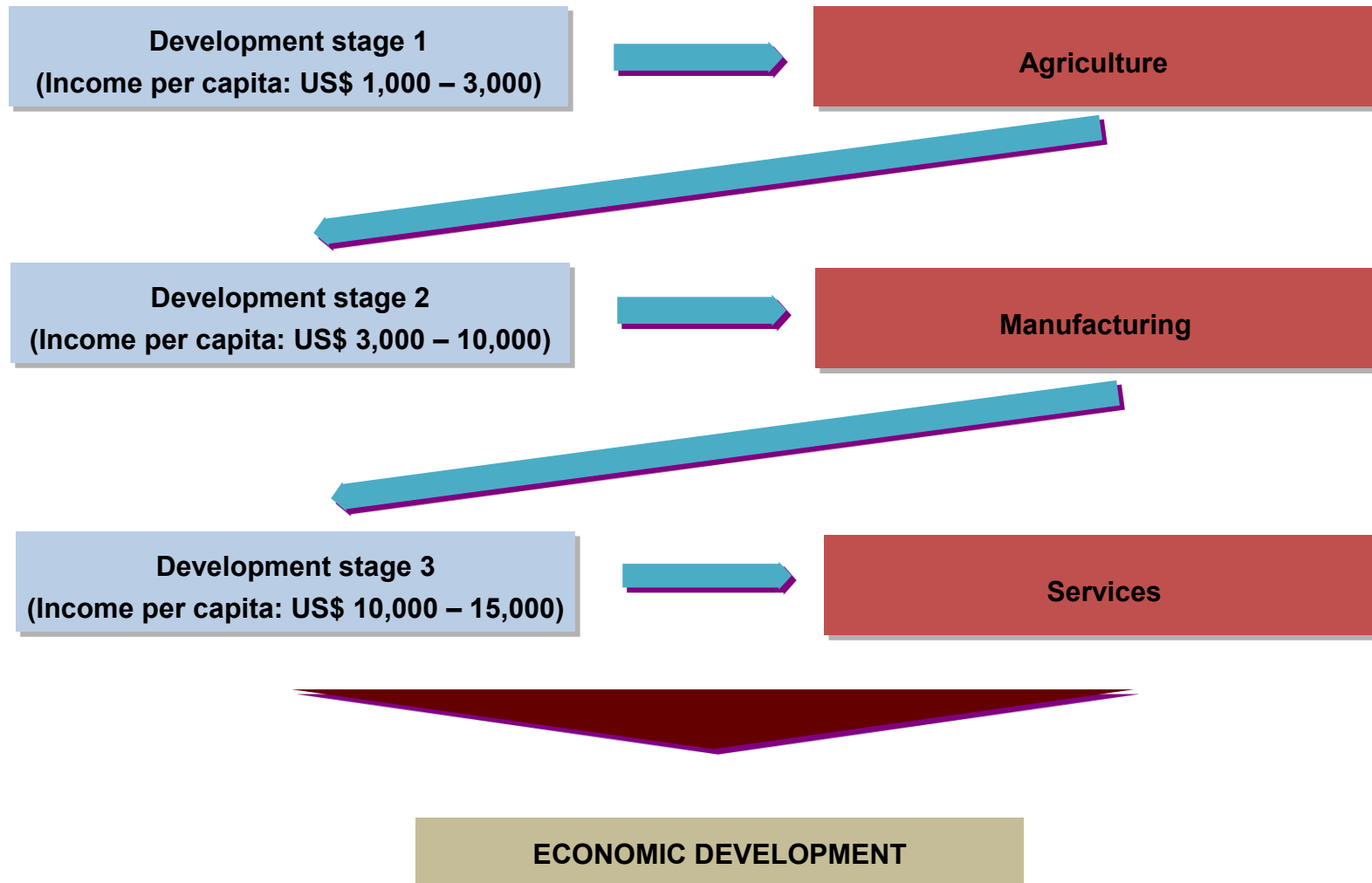
(GDP ranges are subject to change – this is just for illustrative purposes)

The chart above shows that countries in development stage 1 (which roughly corresponds to a GDP per capita that ranges between US$ 1,000 and 3,000) have endowments in terms of labour and capital which are more aligned towards agriculture. As countries' agriculture sector grows, they are able to move to the next development stage. The assumption is that during the growth of the agriculture sector, countries start investing in hard and soft infrastructure, which changes the country's endowment structure, aligning it more towards manufacturing and eventually towards services.

We apply this logic to the manufacturing sector and show how manufacturing industries go through pre-takeoff, growth and decline at different income levels. It is assumed that more labour-intensive industries have higher growth rates at lower income levels and start declining as income grows, while more capital-intensive industries can sustain high growth rates over a longer income range.

Given the selected ASEAN economies' development stage, we identify which industries are suitable given the countries' income level and analyse their deviation from the different industries' benchmark pattern identified above.

The structural change assessment methodology is based on the following steps:

1. <u>Identification of relevant country groups</u> with similar exogenous characteristics based on size, resource endowment and other relevant factors. Statistical testing indicates that three major groups share similar patterns of structural change:

   - Large countries: More than 12.5 million inhabitants

   - Medium countries: More than 3 million and less than 12.5 million inhabitants

   - Small countries: 3 million and less inhabitants.

   All countries selected for this study fall into the large countries category.

2. <u>Estimation of value added shares and growth patterns of manufacturing industries</u> at different income levels (development stages) for the identified country groups, using the following model:

$$\ln X_{ct}^{i} = \alpha_1 + \alpha_2 * \ln RGDP_{ct} + \alpha_3 * \ln RGDP_{ct}^2 + \alpha_4 * \ln RGDP_{ct}^3 + \alpha_c + e_{ct}^{i}$$

   - Where *X* stands for dependent variable: value added share in MVA and value added per capita.

- It is assumed that industries go through three development stages—pre-takeoff, growth and decline—following a pattern of a cubic function. Therefore, we apply a cubic functional form with real GDP per capita (PPP adjusted): *RGPD* as the independent variable.

- α represents any unobserved effects due to country-specific conditions.

- Both dependent and explanatory variables are expressed in logarithmic terms to measure the elasticity of each variable.

The resulting pattern is presented in the following figure.

Figure 5   Estimation of value added shares and growth patterns in the metal industry
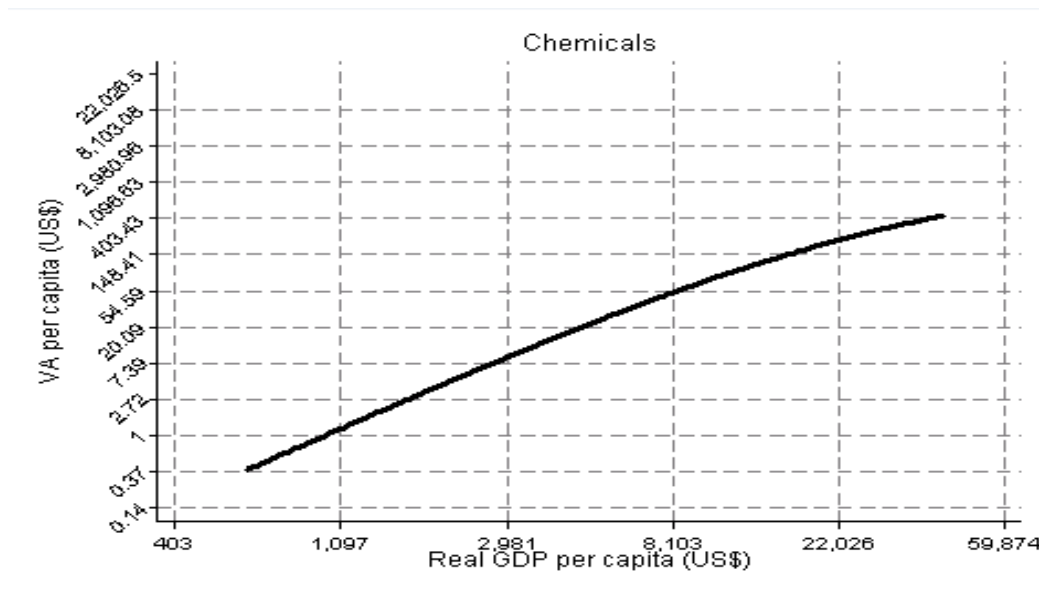
3. Step: Classify industries into early, middle and late industries. The 18 manufacturing industries examined in this report are classified into early, middle and late industries depending on whether the given industry has reached its highest share in total manufacturing value added before a GDP per capita of US$ 5,000, between US$ 5,000 and US$ 20,000 or more than US$ 20,000, respectively.

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Table 2 Sector classification

Real GDP per capita (PPP adjusted) range in US$	Industry
Early industries - real GDP per capita (PPP adjusted): US$ 0 - 5,000	Food and beverages Tobacco Textiles Wearing apparel Wood products Printing and publishing Coke and refined petroleum Non-metallic minerals Furniture, n.e.c.
Middle industries - real GDP per capita (PPP adjusted): US$ 5,000 - 20,000	Paper Basic metals Fabricated metals Precision instruments
Late industries - real GDP per capita (PPP adjusted): US$ 20,000 and higher	Metals Rubber and plastic Machinery and equipment Electrical machinery and apparatus Motor vehicles

Given the income levels of the five ASEAN economies studied here, we establish that the Philippines, with a real GDP per capita of US$ 4790.58, and Viet Nam, with a real GDP per capita of US$ 3742.71, have endowment structures which are more conducive for the development of early industries. The endowment structures of Indonesia (with a real GDP per capita of US$ 5185.75) and Thailand (with a real GDP per capita of US$ 5185.75) are more conducive for the development of middle industries, while Malaysia's, with a real GDP per capita of US$ 7892.7, it is the late industries.

This reinforces our results of the previous sections, whereby Malaysia's metal industry is more mature and more integrated vertically, while Thailand and Indonesia's metal industry is catching up, with growing production, domestic demand and exports. The metal industry has not yet achieved its full potential in the Philippines and Viet Nam.

By plotting the time series data of individual countries for GDP and value added per capita on the same graph as that of their country group, it is possible to compare the country's

performance relative to the average benchmark of its country group in terms of level and elasticity rate.

Figure 6   **GDP per capita**
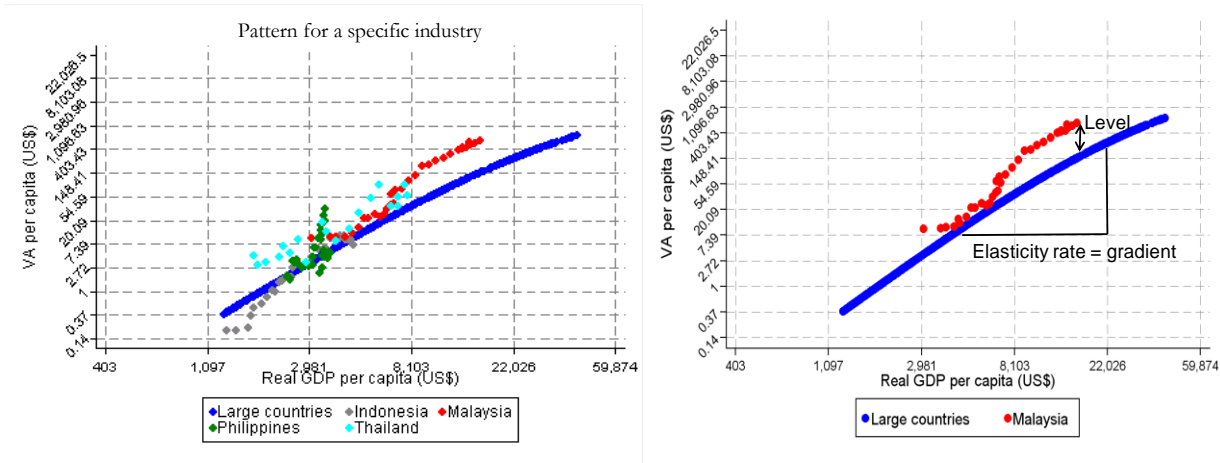
The difference in VA per capita is calculated as:

$$D = VApc_{country,latest} - VApc_{benchmark,latest}$$

The elasticity rate is calculated as:

$$E_i = \frac{\dfrac{VApc_{latest} - VApc_{initia}}{VApc_{initia}}}{\dfrac{GDPpc_{latest} - GDPpc_{initia}}{GDPpc_{initia}}}$$

Interpretation:

- If **E>1,** then the industry is growing faster than the economy

- If **1> E>0**, then the industry is growing, but slower than the economy

- If **E<0**, then the industry is declining.

We were only able to apply this methodology to the metal sector of three of the five countries selected for this study, as long time series data were not available for Viet Nam and Indonesia. On the other hand, the Republic of Korea was included in our analysis as a "role model" in the region against which to benchmark performance other than against the average of all "large countries". The analysis was also limited to the time period for which data were available. Table 3 compares the differences in VA per capita of each country and its respective country group.

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We find that the VA per capita of Malaysia and Thailand is negative, implying a lower capacity of the metal industry compared to the country group average. While the Philippines performed at par with its country group average, the Republic of Korea's performance significantly exceeded its country group average.

Table 3 Difference in VA per capita

Country	Last year of available data	For last year of available data (measurement point of level)			Difference (VApc in US$)
		GDP per capita (PPP adjusted) in US$	Country's VApc in US$	Country Group's VApc in US$	
Indonesia	NA	NA	NA	NA	NA
Viet Nam	NA	NA	NA	NA	NA
Malaysia	2004	15875	32	90	-58
Philippines	1996	3481	12	6	6
Thailand	2002	7528	21	28	-7
Republic of Korea	2004	21332	424	122	302

Figure 7   Average growth rates of the metal industry

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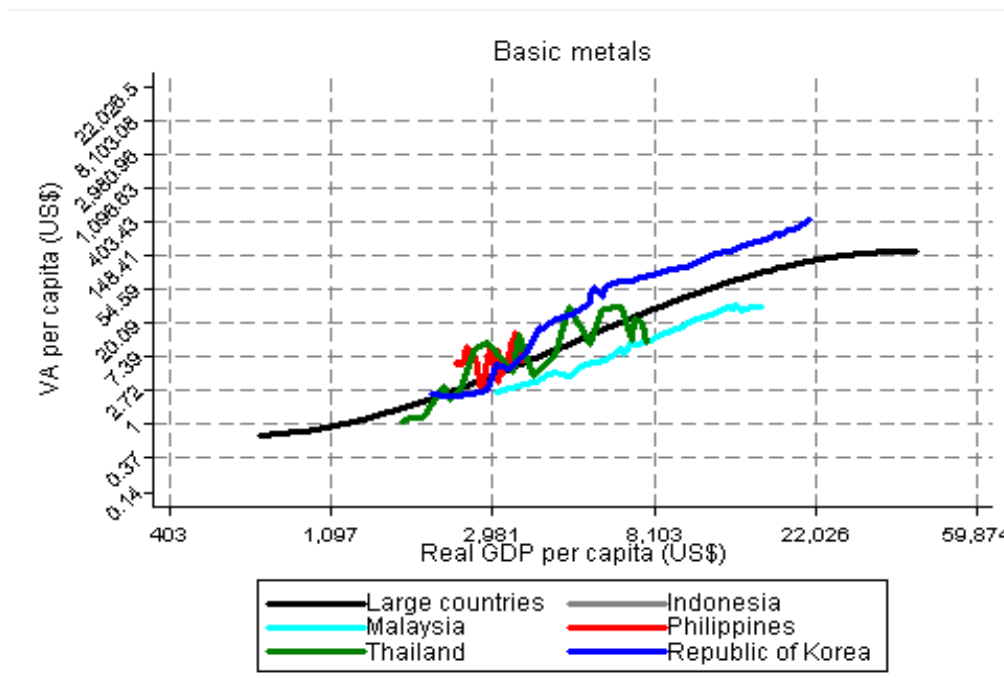
Table 4 presents the time period analysis of the elasticity rates depicted in Figure 7 above. The metal industry's average elasticity rates in Malaysia, the Philippines and Thailand closely followed the benchmark average of their respective country group. During this period, the Republic of Korea, the role model country, recorded a significantly higher elasticity rate than that of the benchmark country group, indicating a considerable expansion of the metal industry.

Table 4 Elasticity rates

		Time Period Analysis of Elasticity Rates		
Country	Time period analysed	GDP per capita (PPP adjusted) range in US$	Elasticity rates of industry in country	Elasticity rates of industry in country group
Indonesia	NA	NA	NA	NA
Viet Nam	NA	NA	NA	NA
Malaysia	1970 - 2004	3041 - 15875	3	4
Philippines	1963 - 1996	2396 - 3481	2	2
Thailand	1968 - 2002	1712 - 7528	5	5
Republic of Korea	1968 - 2004	2599 - 21332	24	5

2.3.4   Analysis of interdependence of industries

In addition to the above analysis, we examine the metal industry's impact on other manufacturing industries in the country. It is of crucial significance for policy purposes to establish the production linkages between manufacturing industries, or to determine whether any interdependencies exist at all among the manufacturing industries.

Defining these linkages and their changes over time is only possible with the use of input-output tables, which hold a detailed account of the country's economic structure in terms of demand and supply at the subsector level. Flows from one industry to another within the country can be examined as well as inter-industry flows between the country and another one.

Table 5 presents the manufacturing linkages in the different countries. The calculations are based on backward linkages. Backward linkages exist when the growth of a given industry leads to the growth of the industries that supply it. Hence, the values in Table 5 show how much a one dollar increase in the respective industries' output would affect demand for inputs from all other

manufacturing industries, including both direct and indirect effects. Direct effects are purchases of resources (inputs) by an industry from all other industries to produce one unit of output. Indirect effects are purchases of inputs by an industry that influence the growth of another industry, which in turn influences yet another industry. There can be multiple chains of indirect linkages.

As Table 5 reveals, all manufacturing industries are complementary and not a single industry has a negative effect on the manufacturing sector as a result of its own growth. However, what is visible is that some industries have a bigger impact on the growth of the manufacturing sector as a whole than others.

By contrasting the individual linkages with the average, it is possible to determine which industries have higher than average linkages with all other manufacturing industries and would thus generate higher than average spillovers to the rest of the economy. Industries with above average interlinkages are classified as 'high impact' industries. In Table 5, we highlight such 'high impact' industries for each country in yellow. We find that the metal industry emerges as a 'high impact' industry in Indonesia and the Philippines, whereby a unit increase in the metal industry would trigger a 0.15 and 0.11 increase, respectively, in the manufacturing sector as a whole.

2.3.5 *Macroeconomic linkages*

It is important to analyse each industry's macroeconomic position. We achieve this by looking at the sectoral contribution to exports, manufactured value added and employment. Table 6 provides the data required for such a macroeconomic linkage analysis of the metal industry in the five ASEAN countries.

Table 5 Interdependence analysis

	Indonesia	Malaysia	Philippines	Thailand
Food, beverages and tobacco	1.18	1.19	1.18	1.18
Textile, leather and textile and leather products	1.15	1.12	1.08	1.16
Lumber and wooden products	1.17	1.16	1.13	1.10
Pulp, paper and printing	1.12	1.12	1.09	1.10
Metal products	1.13	1.15	1.11	1.13
Petroleum and petroleum products	1.10	1.14	1.04	1.03
Rubber products	1.13	1.15	1.06	1.17
Non-metallic mineral products	1.15	1.14	1.16	1.14
Metal products	1.15	1.09	1.11	1.09
Machinery	1.12	1.06	1.04	1.07
Transport equipment	1.14	1.10	1.13	1.11
Other manufacturing products	1.13	1.10	1.06	1.12
Average	**1.14**	**1.13**	**1.10**	**1.12**

All highlighted industries are 'high impact' industries.

Table 6 Industry profile for 2011

	Country's metal industry exports (billion USD)	Metal industry's share in country's manuf. exports (%)	Country's VA from metal industry (billion USD)	Metal industry's share in country's manuf. value added (%)	Country's employment in metal industry (1000 of people)	Metal industry's share in country's manufacturing employment (%)
Indonesia	12.41	11	2.71	4	64	1
Thailand	9.80	5	1.41	3	71	2
Malaysia	8.33	4	1.93	5	55	3
Philippines	2.13	6	0.68	5	24	2
Viet Nam	1.85	3	0.09	2	29	2

In Indonesia, the metal industry accounted for 11 percent of the country's total manufacturing exports (US$ 12.41 billion), but only 4 percent of the country's value added share (US$ 2.71 billion). This implies that a significant share of the industry's production is geared towards the domestic market. It is also characteristic of an industry with resource-based manufacturing products that have a high inherited value content. Indonesia is well endowed with raw materials for the metal industry such as tin, nickel, bauxite, copper, gold and silver. The same is true for Thailand and Malaysia, which are rich in tin, tungsten, tantalum, lead and tin, copper, iron ore and bauxite. Thailand's total export value is US$ 9.8 billion, but the metal industry's manufacturing value added only accounts for US$ 1.41. The same is true for Viet Nam and the Philippines, but to a much lesser extent.

The metal industry accounts, on average, for 2 percent of total manufacturing employment in the countries included here. Thailand's metal industry employs the largest number of workers, but is nonetheless not the most labour-intensive, which is claimed by Viet Nam, with a low exports and value addition per employee. At the other end of the spectrum, Indonesia shows the best labour productivity both in terms of exports and value added. The high exports and value addition per employee in Indonesia is made possible by vertical integration of the industry within the country, whereby intermediate goods downstream in the value chain are sourced from within the country itself. In the metal industry, this is possible due to the existence and operation of foundry plants.

Figure 8   **Value added per employee in the metal industry**
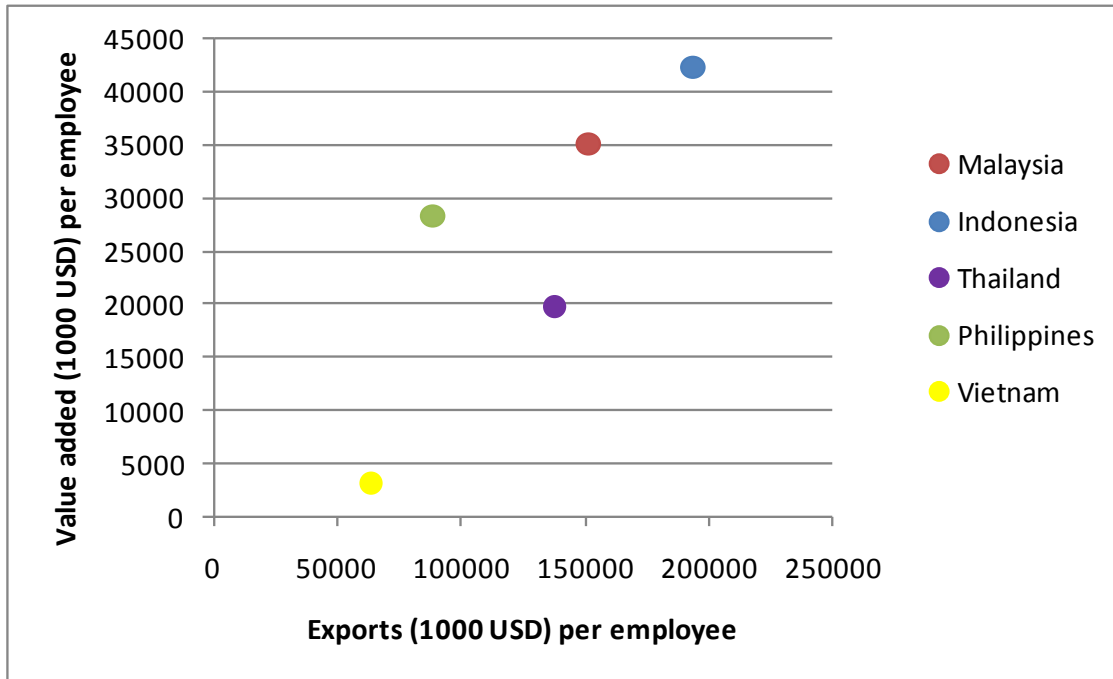
2.3.6   Country level summary of economic analyses of the metal industry

1. **Indonesia**

   • The metal industry has emerged as a champion industry in terms of export analysis. It is a dynamic industry in the world market and the country has been expanding its world market share.

   • The domestic demand analysis revealed that demand for products of the industry increased at a rate lower than that of the manufacturing average. Indonesia's metal industry decreased its capacity relative to the overall manufacturing capacity (measured by the industry's VA /total MVA).

   • Due to lack of data availability, we could not conduct a structural change analysis for Indonesia.

   • In the domestic demand analysis, the industry exhibited a linkage effect that is marginally higher than the manufacturing average's; hence, the industry emerged as a 'high impact' industry.

2. **Malaysia**

   • The metal industry emerged as a champion industry in the export analysis. It is a dynamic industry in the world market and the country has been expanding its world market share.

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- The domestic demand analysis revealed that even though demand for products of the metal industry increased at a rate proportional to that of the manufacturing average, it did not increase its capacity relative to the overall manufacturing capacity (measured by the industry's VA /total MVA). This could imply increased dependence on imports.

- Malaysia's value added per capita is lower than that of the country group average. The elasticity rate of the industry's value added per capita with respect to GDP growth per capita was lower than the country group average, which implies that the value added per capita will drop further than the country group average in future.

- In the domestic demand analysis, the industry's linkage effects were lower than those of the manufacturing sector's average.

3. The Philippines

- According to the export analysis, the metal industry emerged as a champion industry. The metal industry is a dynamic industry in the world market and the country has been expanding its world market share.

- The domestic demand analysis revealed that demand for products of the metal industry increased at a rate lower than that of the manufacturing sector's average. The domestic metal industry decreased its relative capacity relative to the manufacturing sector's overall manufacturing capacity (measured by industry VA /total MVA).

- The Philippines's value added per capita is higher than the country group's average, while the elasticity rate of the metal industry's value added per capita with respect to GDP growth per capita is similar to the country group's average.

- According to the domestic demand analysis, the industry exhibited linkage effects that were marginally higher than those of the manufacturing sector's average, hence, the industry emerged as a 'high impact' industry.

4. Thailand

- According to the export analysis, the metal industry emerged as a champion industry. The metal industry is a dynamic industry in the world market and the country has been expanding its world market share.

- The domestic demand analysis revealed that demand for products of the metal industry increased at a rate lower than that of the manufacturing sector's average, but the country's domestic industry increased its relative capacity relative to the manufacturing sector's overall capacity (measured by industry

VA /total MVA), which could imply increased export growth of the industry and domestic production driven mostly by global demand.

- Thailand's value added per capita is lower than the country group's average, while the elasticity rate of the metal industry's value added per capita with respect to GDP growth per capita is similar to that of the country group's average.

- The domestic demand analysis showed that the metal industry exhibited linkage effects that were marginally lower than those of the manufacturing sector's average.

5. **Viet Nam**

- The export analysis revealed that the metal industry emerged as a champion industry. The metal industry is a dynamic industry in the world market and the country has been expanding its world market share.

- Unfortunately, due to a lack of available data, we could not conduct any further economic analyses of the metal industry's performance in Viet Nam.

2.4   Limitation of methodologies

Analysis of exports

- The methodology is useful for assessing industries that are already exporting. It does not, however, take account of potential industries that may be producing goods but are not exporting these at the moment. This means that new or emerging industries are not included.

- The methodology also does not take account of the diversity of the industries. In cases in which the products of an industry are very diverse, variations in the performance of these products are expected relative to average world growth of the manufacturing sector.

Analysis of domestic demands:

- Since this analysis does not indicate the types of products for which there is growing domestic demand, we cannot ascertain whether the country is importing more raw materials or more finished goods.

- Nor is it possible to determine the share of manufacturing output by a specific industry, which ends up on the domestic market.

Analysis of structural change

- The analysis is based on benchmarking a country's performance to the average of countries with the same endowment structure. This methodology generates two criticisms: firstly, that endowment structures are determined solely on the basis of income per capita. Secondly, it implicitly sets the bar against which performance is assessed relative to the average achievements of the given country's peers rather than to a country that has excelled in the given industry. This also raises the question whether it is really not recommended for a specific industry to have a lower share and another to have a higher share than that of the country's peers' average. Hence, this analysis is only used as a reference tool, not as one from which any actions are recommended.

- In addition to factor endowments, historical and socio-political factors can also have an impact on a country's competitiveness, which are not accounted for in the methodology.

Analysis of interdependence of industries

In his early paper, Carl F. Christ (1955, p.140) made two major assumptions about input-output analysis. These assumptions still apply today.

- Constant returns to scale. This assumption is contested on the grounds that functions are more complex and cannot realistically describe production processes simply using shares.

- No substitution of the inputs in the production of any good or service is possible. According to C. F. Christ, "the second assumption is sufficient to exclude any optimizing from the supply side, because it excludes all choice about the proportions in which inputs are to be combined in the production of a given output. With such production function, all inputs are perfect complements" (1955: 140).

3. Environmental and social analysis

3.1 Introduction and conceptual framework

3.1.1 *The Five Enabling Abilities Framework for analysing manufacturing processes*

This analysis is structured in a way that goes beyond the typical simple measure of the scale of environmental or social issues. For each of the six dimensions of environmental and social performance – energy supply, water supply, emissions to air, emissions to water, solid waste and labour – we analyse data across all five enabling abilities (where data is available). The five enabling abilities are constraints, planning, operation, monitoring and education. These provide

a framework for identifying parts of performance that may strongly influence the future ability to manage the environmental/ social issue. For example, a nation may currently be far from its total capacity to deliver water, but a poor score in constraint, planning and education would help identify a future water issue for industry before it actually occurs. To understand environmental and social dimensions in detail, we must explore the following abilities individually, rather than characterize the entire industry using a single parameter.

Figure 9   Five Enabling Abilities Framework
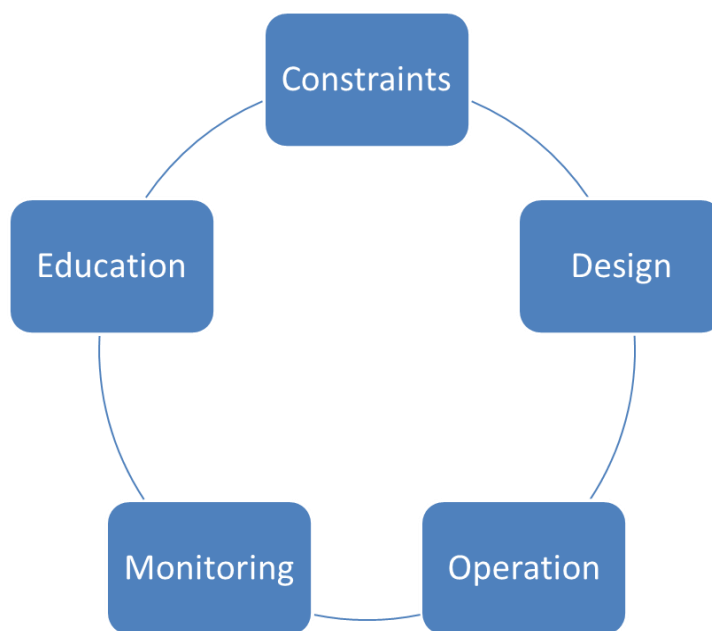
This more granular approach enables us to identify the likelihood of future problems, as well as the specific abilities that strongly influence the given industry. It should be noted that these abilities are interdependent. The definitions of the five abilities are as follows:

- **Constraint of systems**

    The ability of industry X to understand current and future constraints. This ability is concerned with knowledge. Competent industries will understand how close they currently operate to the limits of the natural system they are part of and be able to extend this knowledge into the future to determine how close they will be operating to the limits if a planned expansion or changes occur. This includes a need to understand a system's limits, which are often determined by governments, NGOs or trade bodies. Limits may be national or watershed, physical or legislative or mandated by customers; hence, limits are complex and awareness of these is a pre-requisite for analysis and planning.

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- **Planning of systems (Design of systems)**

The ability of industry X to develop a plan for a sustainable future. This ability is concerned with the effectiveness of those institutional mechanisms that bring together the many collaborators needed for effective action. Solutions are built and implemented by multiple actors – for example, the government introduces pollution regulations which are delivered to industry and monitored by NGOs or government bodies and felt by local citizens. Sensible and workable solutions must be designed. This enabling ability is crucial for complex interactive systems.

- **Operation of systems**

The ability of industry X to deliver current value within current national limits. This enabling ability is concerned with the current situation, and the industry's performance in terms of delivering an industrial system that can operate within current limits. It emphasizes how close the industry is operating to the actual limits. If the industry is currently working above its limits, then expansion is much more challenging. Equally, demonstrating competence at operating within the current limits is a good indicator of the industry's ability to continue operating within these limits in the future.

- **Monitoring of systems**

The ability of industry X to assess its own performance. This enabling ability is concerned with the institutional mechanisms that are in place to monitor, measure and enforce performance. This entails government competences in the enforcement of current legislation, scientific competence and capacity for full testing and monitoring, combined with industry competence to monitor developments at the plant level (to avoid failures). The ability to collect this data and use it to guide actions is also considered, as there is little value in accurate reports that go nowhere.

- **Education for systems**

The ability of industry X to organize and develop competence/knowledge. This enabling ability is concerned with the longer term ability to deliver the four abilities already discussed. Without competent people, the design, operation, monitoring and understanding of constraints will be severely limited. This ability analyses national institutions' ability to build educational programmes and to encourage enrolment. This may be professional accreditation or degree level, and may be delivered by academic institutions, trade associations or private companies.

Analysis

This study focuses on physical constraints that can prevent or enable an industry's future progress. 'Physical constraints' refer to those national resources that are critical for the specific industry to maintain current and future manufacturing activities. This includes labour performance as well as use of resources and creation of waste that needs to be managed.

In addition, we analyse the relationships between authorities, industry and society (including NGOs). A functioning system of checks and balances between industry, governments and citizens is useful to establish a robust licence to operate in the industry. In particular, the proper checks and balances should lead to better environmental and social performance, but also improved stewardship of national constraints.

Figure 10   A healthy industrial system
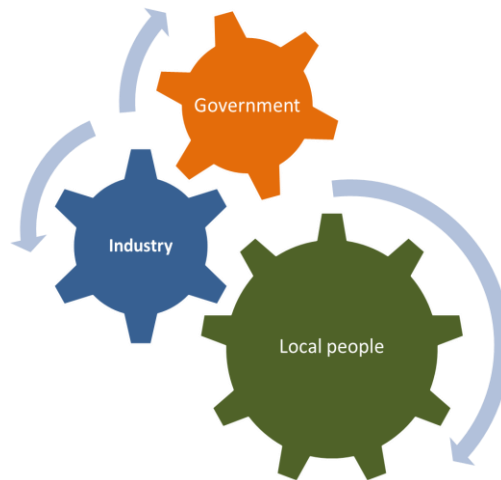
Analysis dimensions

To measure an industry's environmental impact, five dimensions are selected: energy used, air emissions, water used, solid waste and wastewater. For the social impact analysis, labour was selected. The analysis dimensions allow for varying situations across industries and nations. Scores are given using the five ranking index shown here (with the exception of cases in which no information is provided, which are termed 'blank spots' and have a zero score).

Table 7 Scoring for each dimension

Scoring	0	1	2	3	4	5
(meaning)	No data available	Not desirable	Less desirable	Acceptable	Very desirable	Most desirable
Constraint	Blank spots	Very close or over constraints	Close to constraints	Neither close nor far from constraints	Far from constraints	Very far from constraints
Planning	Blank spots	Not desirable	Less desirable	Acceptable	Very desirable	Most desirable
Operation	Blank spots	Not desirable	Less desirable	Acceptable	Very desirable	Most desirable
Monitoring	Blank spots	Not desirable	Less desirable	Acceptable	Very desirable	Most desirable
Education	Blank spots	Not desirable	Less desirable	Acceptable	Very desirable	Most desirable

3.2   Methodological considerations

Lack of data

There is no institutional or international agreement on data collection of environmental and social impacts, especially at the level of an industry (i.e. our analysis). Countries have no obligation to regularly report data to international entities such as the World Bank or ADB in forms that would facilitate a sectoral analysis (where reporting does exist, it is typically at national level). Voluntary efforts are also extremely limited, making it difficult to create a data set for industry level analysis of environmental and social aspects from published reports.

Environmental data is known to be notoriously scarce as it is not yet common practice to measure environmental variables, especially at different levels of aggregations. There have been some attempts at national level measurements and estimations for some of the environmental variables, but industry and sub-manufacturing industry level data with sufficient disaggregation and time series coverage is nearly impossible to come by, whether in international or national databases. Of the variables of interest for this study, energy was the only exception, with data at ISIC 2 digit level disaggregation being available in the IEA database.

This lack of data affects our ability to conduct a purely quantitative analysis of the environmental and social impacts as originally envisaged. Qualitative research methods were therefore developed where a lack of data occurred. In the long term, however, it would be

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desirable for each country to establish an own data collection system and a centralized national environmental database to facilitate an assessment of the main industries' environmental and social impacts.

Pre-fieldwork

- Various metal industry reports, national competitiveness reports and environmental or social reports for the case countries were obtained and studied;

- International databases were checked for data availability;

- The main concepts and analysis methodology were developed, including detailed interview questions for authorities, industry and NGOs.

Two-week fieldwork per country

- National consultants were hired to facilitate the fieldwork. Specifically, the national consultant helped secure interviews with the relevant parties and coordinated the visits.

- All researchers participated in the first fieldwork exercise to share common goals and develop and refine the approach to fieldwork.

- Several interviews were conducted with the relevant authorities, private sector, sectoral associations and NGOs.

- A small number of forums were organized to ensure that the views of firms across a wide range of firm sizes were obtained.

Post-fieldwork

- It was necessary to modify the research methodology to also include a qualitative analysis of the information gathered during the fieldwork due to the lack of quantitative data.

Information provided in this report was collected either from a desk study or during the two-week fieldwork in the country. It was generally assumed that ministry officials are in a better position to gather higher quality data on account of their networks and because they did not have a two-week time constraint.

A note on Malaysia's environmental and social data and analysis

After applying the above methodology in Malaysia, i.e., after two weeks of data collection in the country supported by local country experts, and covering around 60 interviews and meetings

with over 100 people and the compilation of Malaysian government and NGO reports, we failed to gather sufficient quantitative and/or qualitative data on the environmental performance of the metal industry to arrive at a robust analysis. Therefore, no environmental analysis for Malaysia's metal industry is presented here.

No comparison across countries

The objective of this study is to explore and understand the environmental and social implications of deepening activities of a specific manufacturing industry within a country to inform future industrial policies and strategies. The data and information collected were therefore very contextual to a specific industry in a specific country. As a result, the methodology does not allow for cross-national comparison and it would be ill-advised to engage in such an activity during the readership of this report.

Reading this report

The following sections follow a common format. Each of the four countries studied is presented in turn. The analysis of all six dimensions of environmental and social performance is presented for each country, namely energy used, water supplied, emissions to air, solid waste, emissions to water and labour. The report draws conclusions from the data for each dimension, starting with constraints on the system (energy system, water system, etc.), followed by planning, operation, monitoring and education abilities. Each of these is assigned a score from the above table and a diagram is used to present the scores (5 = best, 1 = worst, 0 = insufficient data).

The most important restrictions and enablers of industry growth in the given country are then summarized.

Next phase of methodology development

The methodology presented here discusses industry hotspots in terms of environmental and social aspects. Future developments could include the concept of industry coolspots. Coolspots represent opportunities for a positive environmental or social impact and relate to a particular industry. Secondly, the newly developed methodology is applicable not only to countries in the ASEAN region but also to countries in other regions, including developed countries. Finally, as this was the first attempt to collect data for this kind of methodology, it must be mentioned that the identification and collection of data was challenging.

3.3   Indonesia

Environmental assessment

3.3.1   *Energy*

Analysis of enabling abilities

Constraints

Blank spots: The desk study and fieldwork revealed that insufficient data is available on the exchange of information between local and national authorities and between industry and the local population about the capacity of the metal industry to understand current and future energy constraints. It is therefore not possible to make any conclusive statements on the energy constraints of Indonesia.

Planning

Considerable efforts have been made on the part of the authorities to establish a national energy plan, including subsidies, a pricing policy and the use of alternative energy sources. The Indonesian government notes that much of the country's clean coal is exported, whilst dirty coal is used for domestic energy production. The National Energy Council is in charge of the national energy policy, and deals with available energy types as well as their utilization. It is unclear, however, to what extent industry and the local population are engaged in addressing energy issues in the metal industry. In particular, beyond industrial committee meetings, it is not clear to what extent Indonesian authorities have effective communication channels with industry and the local population on energy demand, energy supply and energy saving within the metal industry. As such, it appears that the primary influence on the domestic metal industry is top-down policy formulated against the international community's standards.

Operations

The Indonesian authorities have introduced several policies in an attempt to encourage energy saving in industry. These efforts include the establishment of a 'green industry award', a 'new environmental law for both new and existing industries' and various activities carried out by the 'Centre for Green Industry and Environmental Affairs'. Whilst the aforementioned policies and initiatives appear to have an influence on large national and international companies, it is not clear to what extent energy saving efforts (e.g. installing new energy facilities or general best practice operations) are undertaken by SMEs in the metal industry.

Monitoring

Energy efficiency is currently being addressed by GIZ. Companies are audited to check whether they are complying with the regulations; compliant companies are rewarded with preferential credit terms from the Federal Bank. Furthermore, companies that collect energy efficiency and waste minimization data are accorded green status, whilst more advanced, high performing firms are awarded gold status.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on energy education in the metal industry is available. This was also confirmed by the authorities, industry and local population. It is therefore not possible to make any conclusive statements on the energy monitoring systems of Indonesia.

Summary

Figure 11   Energy analysis of Indonesia's metal industry
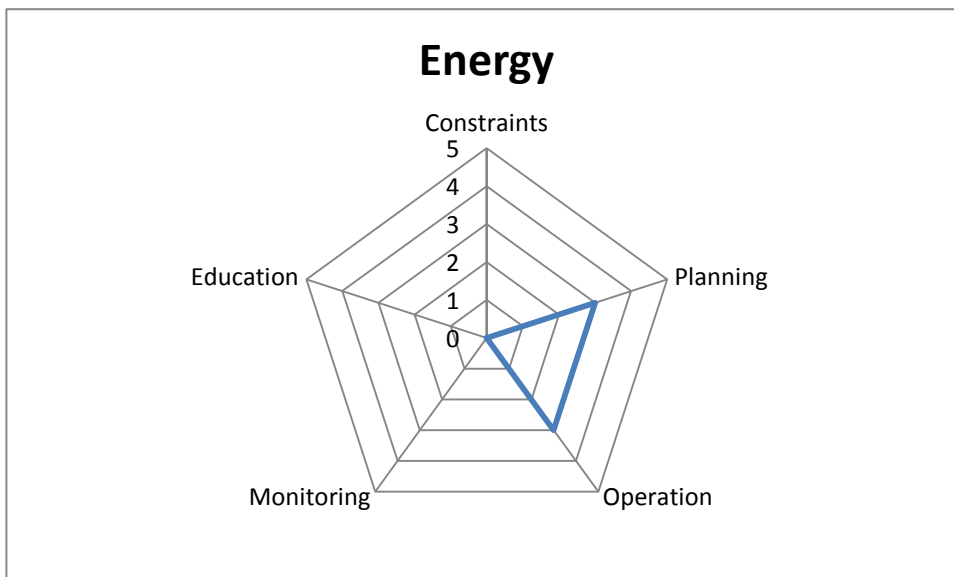
3.3.2   Water supply

Constraints

On the positive side, from the industry perspective, water supply is not problematic as there are a number of water treatment plants close to cities. The rate of water consumption per metric ton has also decreased. Some companies in the metal industry have a formal energy, water conservation and air pollution reduction policy endorsed by the top management. The main constraint is that the cost of energy, materials, water and waste management are considerable.

Planning

The Indonesian Ministry of Public Works deals with the regulation of water resources and with water-related issues for industry. The problem with water management in Indonesia is that it lacks centralized information management. To obtain detailed information, researchers need to acquire data from each individual water municipality office. Furthermore, information on collaborative work in water supply planning by the authorities, industry and local population could not be obtained.

Operations

Blank spots: The desk study and fieldwork revealed that insufficient data is available on efforts undertaken by industry, the authorities and the local population to better manage and reduce water consumption. It was therefore not possible to make any conclusive statements on Indonesia's water operation system.

Monitoring

In terms of general environment monitoring, the Centre for Green Industry and Environment Affairs of the Ministry of Industry is preparing a new environmental law for industry which will include the metal industry. Furthermore, the Ministry of Environment has introduced a 'Green Industry Award' scheme which reviews firms' environmental performance.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts undertaken by industry, the authorities and the local population to educate one another as regards industry water supply in the metal industry. It is therefore not possible to make any conclusive statements on the education system related to water in Indonesia.

Summary

Figure 12   Water supply analysis of the metal industry in Indonesia
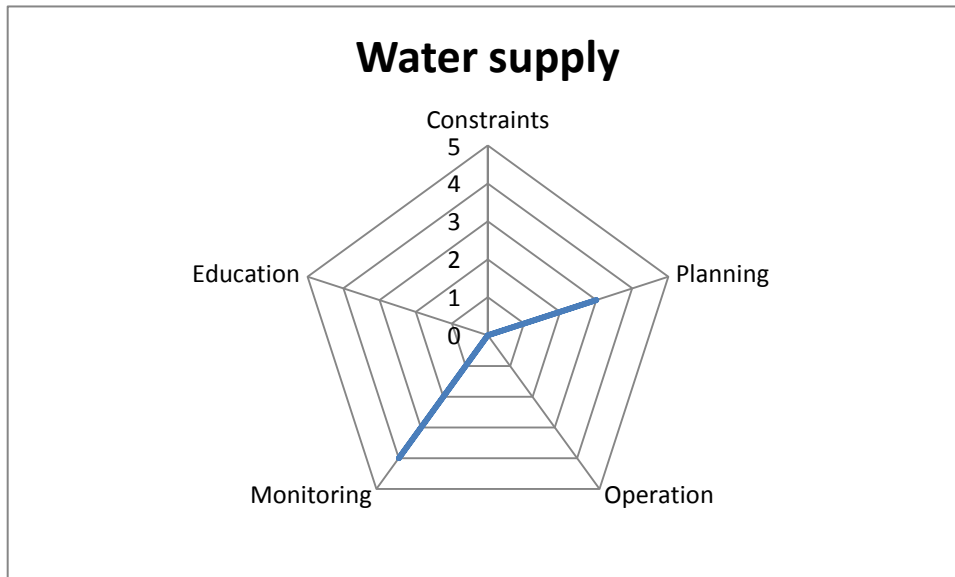
3.3.3   Air emissions

Constraints

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts undertaken by industry, the authorities and the local population to educate one another as regards water supply in the metal industry. It is therefore not possible to make a conclusive statement on constraints related to air emissions in Indonesia.

Planning

A National Action Plan to reduce emissions in Indonesia was established by Presidential Instruction No. 61/2011. Target industries of this regulation are basic metals, cement, pulp and paper, glass and ceramic, fertilizers, petrochemical, food and beverages and textile. The objective of the National Action Plan is the reduction of emissions in these industries which are especially problematic and energy intensive. The Ministry of Industry and the Ministry of Environment have carried out a number of studies and published evaluation reports.

Industry in Indonesia is in a stage of fast growth. The country's water capacity is expanding. The domestic market and domestic demand for metal products is increasing as metal products are being used as inputs to other industries. The metal industry is expected to grow over the next decade as there is still a large gap to fill in the growing domestic market. Air emissions are expected to increase as a result.

Operations

Air emissions are regulated by the government and inspections are conducted biannually. Indonesian firms are generally compliant, with occasional cases of firms exceeding the compliance guidelines. In cases where raw materials cannot be substituted, some firms plant trees around their facilities to absorb the CO_2 emissions produced by the factory. It is estimated that 1,195 trees are able to absorb around 29 tonnes of CO_2. In addition, by saving energy, firms are also able to reduce CO_2 emissions. For reheating furnaces, for example, firms use a regenerator with a ventilation system which is efficient since it reduces energy used by 35 percent and decreases CO_2 emissions into the air. This technology is being imported from Japan and the Indonesian government regularly sends experts to Japan for training in such new technologies.

Monitoring

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts undertaken by industry, the authorities and the local population to educate one another as regards industry water supply in the metal industry. It is therefore not possible to make a conclusive statement on monitoring of air emissions in Indonesia.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the tools, techniques, education programmes or best practices being shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on air emission-related education in Indonesia.

Summary

Figure 13   Air emissions analysis of the metal industry in Indonesia
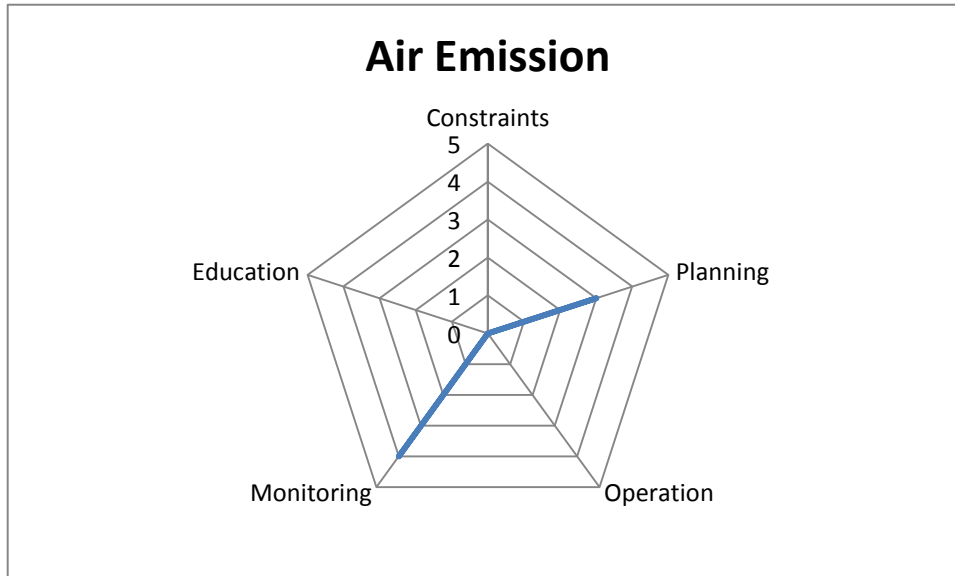
3.3.4   Solid waste

Constraints

Blank spots: The desk study revealed that insufficient information is available on solid waste management in the metal industry in Indonesia. It is therefore not possible to make any conclusive statements on the constraints Indonesia faces with regard to solid waste management.

Planning

Blank spots: The desk study and fieldwork revealed that insufficient information is available on solid waste management in the metal industry in Indonesia. It is therefore not possible to make any conclusive statements on the planning Indonesia needs to undertake in solid waste management.

Operations

According to the authorities, the Basel Convention Regional Centre for South-East Asia assists authorities in dealing with the hazardous component of waste from all industries and from other activities. In addition, according to the Ministry of Environment, the Centre is authorized to set standards on waste for each industry. It is not clear how often this actually takes place for the metal industry.

Monitoring

The Centre for Green Industry at the Ministry of Industry is in charge of enforcing waste management in the industrial sector. Monitoring is conducted in the following areas:

- Toxic free water campaign which focuses on the Citarum River (20 percent of industry is located in close proximity to the river). Around 70 percent of industry in this area is textiles. 80 percent of water is supplied to Jakarta.

- Climate and energy issues: the main focus in the energy discussion is on coal. The government considers coal a driver of economic development. Indonesia is the second largest coal exporter after Australia. Reserves are being depleted and now only lie at 0.4 percent.

- Coal usage in domestic industry is significant: allegedly, 33 percent of domestic industry uses coal;

- 85 percent of coal is exported; the rest is used domestically;

- Social impact of coal power plants:
  - Health: respiratory disease
  - Loss of livelihood
  - Environmental impact

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on solid waste management in the metal industry in Indonesia. It is therefore not possible to make any conclusive statements on education relating to solid waste management.

Summary

Figure 14   Solid waste analysis of the metal industry in Indonesia
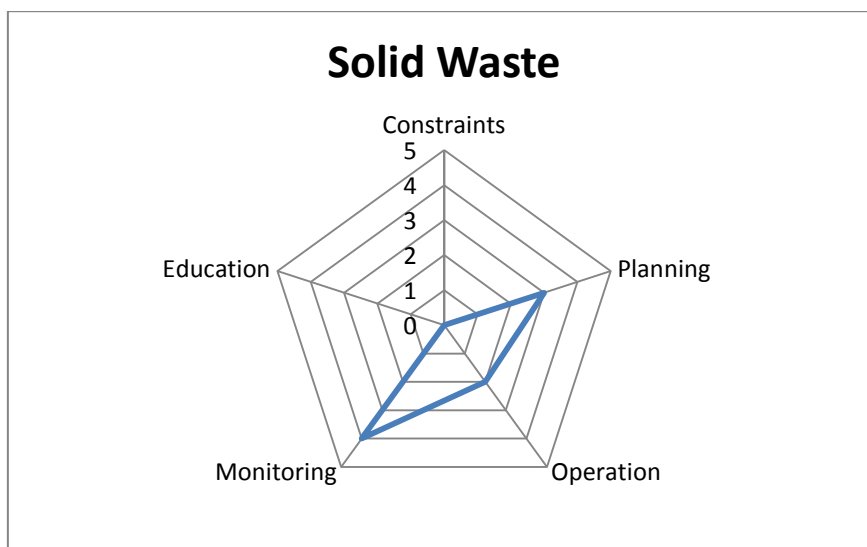
3.3.5　Wastewater

Constraints

Blank spots: The desk study and fieldwork revealed that insufficient information is available on wastewater management in Indonesia's metal industry. It is therefore not possible to make any conclusive statements on wastewater management constraints in Indonesia's metal industry.

Planning

Blank spots: The desk study and fieldwork revealed that insufficient information is available on wastewater management in the Indonesian metal industry. It is therefore not possible to make any conclusive statements on wastewater management planning in the metal industry.

Operations

Blank spots: The desk study and fieldwork revealed that insufficient information on the wastewater operations of Indonesia's metal industry. It is therefore not possible to make any conclusive statements on wastewater operations in the metal industry.

Monitoring

As regards water pollution and emissions, the department conducts inspections of firms to determine whether they comply with the regulations. Based on a set of criteria, they categorize firms and label them: black, red, blue, green and gold, with gold indicating that the respective firm is more advanced. The main purpose of the inspection, however, is to check firms' compliance status. The status of firms is also used by the Federal Bank to decide whether the industry will get investment credit through low interest rates, etc. For gold and green industries, data related to energy efficiency, waste minimization, CSR, etc. is available.

The Centre for Green Industry at the Ministry of Industry is responsible for enforcing waste management in the industrial sector. Monitoring is conducted in the following areas:

- Toxic-free water campaign which focuses on the Citarum River (20 percent of industry is located in close proximity to the river). Around 70 percent of industry in the area is textiles. 80 percent of water is supplied to Jakarta.
- Climate and energy issues: the main focus in the energy debate is on coal. The government considers coal a driver of economic development. Indonesia is the second largest coal exporter after Australia. Reserves are being depleted and only lie at 0.4 percent.
- Coal usage in domestic industry is significant: 33 percent use coal;
- 85 percent of coal is exported; the rest is used domestically;
- Social impact of coal power plants:

- Health: respiratory disease
- Loss of livelihood
- Environmental impact.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on educational programmes relating to wastewater management for the Indonesian metal industry. It is therefore not possible to make any conclusive statements on this issue.

Summary

Figure 15   Wastewater analysis of the metal industry in Indonesia
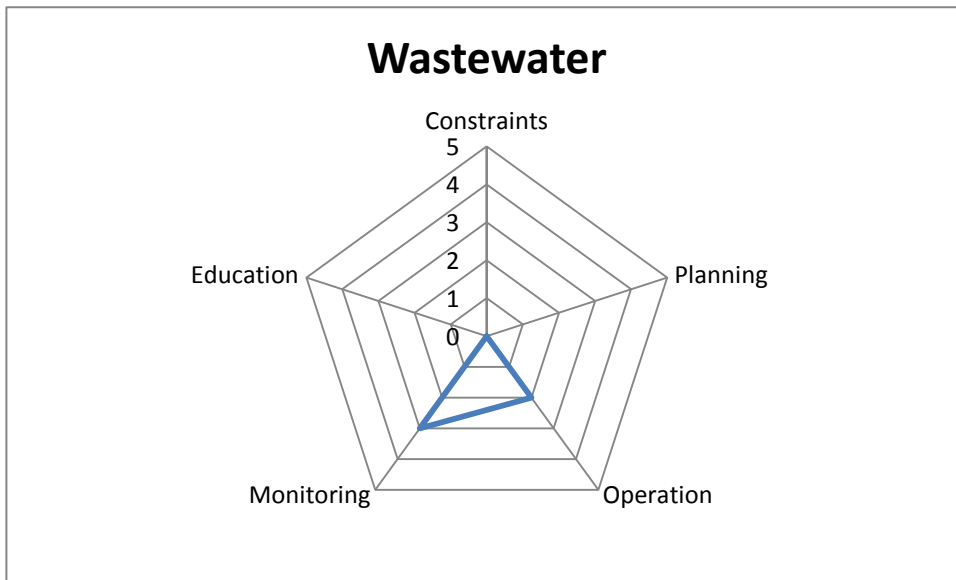
Social Assessment

3.3.6   Labour

Constraints

The education system in Indonesia is deemed adequate for the needs of the country. However, it was also reported that the country is facing a 'brain drain' problem, especially to the Middle East.

Planning

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the planning of labour needs for Indonesia's metal industry. It is therefore not possible to make any conclusive statements on this issue.

Operations

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the efforts undertaken by industry, the authorities and the local population to improve working conditions. It is therefore not possible to make any conclusive statements on Indonesia's labour management system.

Monitoring

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the planning of future labour management and future skill needs of Indonesia's metal industry. It is therefore not possible to make any conclusive statements on this issue.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the necessary level of education of the workforce in Indonesia's metal industry. It is therefore not possible to make any conclusive statements on this issue.

Summary

Figure 16   Labour analysis of the metal industry in Indonesia
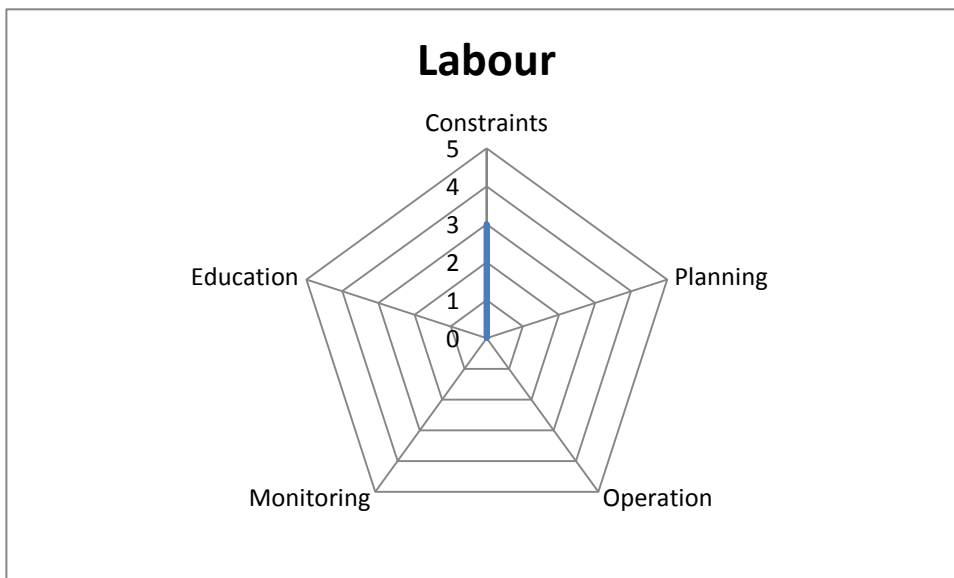
3.4   The Philippines

Environmental assessment

3.4.1   Energy

Constraints

'Reliability/availability of power' and 'energy costs' can represent constraints on national environmental and social aspects.

Planning

The Ministry of Energy is in charge of energy regulations and planning. The authorities have created industrial zones in which industries are concentrated, away from residential areas and with adequate facilities. The industry reported that various energy efficiency programmes have been introduced, such as 'Waste Plastic to Fuel', but little evidence was found of cooperation between the authorities, industry and the local population in the development of energy supply plans. Nor was any information available on the use of any form of sustainability indices to monitor environmental performance either nationally or internationally.

Like local NGOs, international organizations produce energy research reports on energy use patterns and energy efficiency at the country level, such as 'Resource Efficiency: Economic and Outlook for Asia-Pacific' (UNEP, 2012) or 'Shaping Policy Reform and Peer Review in Southeast Asia: Integrating Economies Amid Diversity' (OECD, 2008).

According to 'Resource Efficiency: Economic and Outlook for Asia-Pacific' (UNEP, 2012), the region should strengthen existing fiscal and financial instruments to incentivize renewable energy development in the Asia-Pacific region. Tax incentives, while not prominent in China, are widely used in India to attract investment. Renewable energy funds in various forms are used in economies such as China, India, Australia, New Zealand and the Philippines to support renewable energy development. Various forms of subsidies are also currently being implemented.

Further, according to 'Shaping Policy Reform and Peer Review in Southeast Asia: Integrating Economies Amid Diversity' (OECD, 2008), the energy development package will develop biofuels and renewables like wind, solar and geothermal energy. It will also promote oil and gas exploration, enhance energy conservation through the use of energy-efficient technologies and optimize privatization of the power industry. In 2006, Congress passed the Philippine Biofuels Act that provides fiscal incentives to companies producing and selling biofuel-blended petrol and diesel.

Operations

Industry believes that energy is not a hotspot as it accounts for only 4 percent of national demand. Some petro-metal producers have their own power plants to overcome periods of blackouts suffered by the national grid.

Monitoring

The electricity stock exchange has profound knowledge on demand and supply of energy.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the efforts undertaken by industry, the authorities and the local population to educate one another as regards energy issues in the metal industry. It is therefore not possible to make any conclusive statements on the education system related to energy in the Philippines.

Summary

Figure 17   Energy analysis of the metal industry in the Philippines
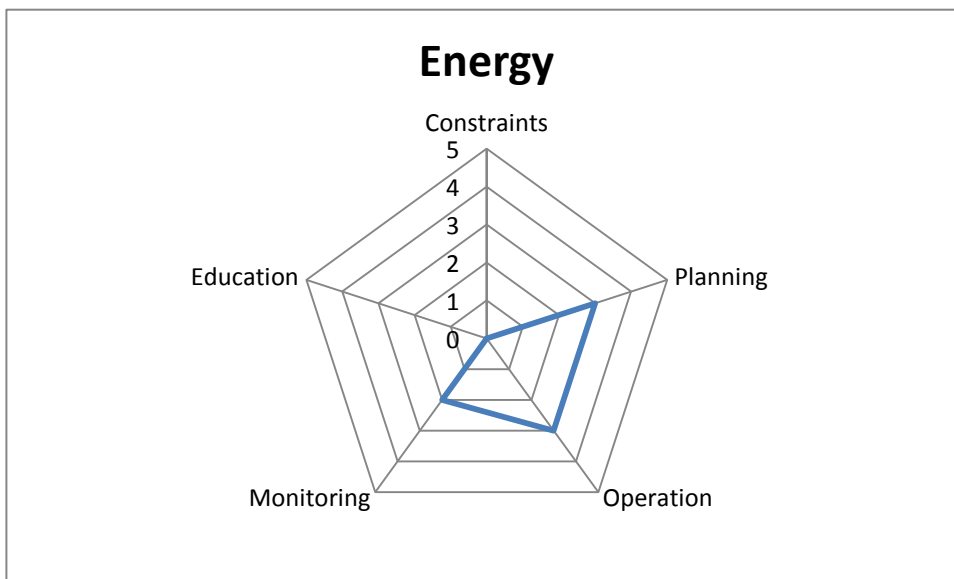
3.4.2   Water supply

Constraints

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the metal industry's water demand and how this information is shared among stakeholders. It is therefore not possible to make any conclusive statements on the education system related to water supply in the Philippines

Planning

The authorities interviewed claim that water supply for the mental industry is plentiful, with only a one-month drought in summer and occasional flooding. However, firms in the metal industry are still using old technology to capture water (silt dams). The metal industry has expressed concern about poor water capture and water management. Water tables are drying up due to over-exploitation and deforestation, and fresh water capture capacity is low.

According to the report 'Green Growth, Resources and Resilience' (ESCAP/ADB/UNEP, 2012), the Philippines is one of the countries with the most urgent sustainability challenges in relation to water. Specific problems afflicting the Philippines include 'increasing water scarcity', 'deteriorating water quality' and the fact that the country is 'flood-prone' and 'cyclone-prone'.

Operations

According to the metal industry, water supply costs in production are negligible.

Blank spots: It is unclear to what extent knowledge on operations in water supply planning in the metal industry is shared between the authorities, industry and the local population . More information is needed to understand how knowledge of operations is shared among stakeholders.

Monitoring

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts undertaken by industry, the authorities and the local population to educate one another on water-related issues in the metal industry. It is therefore not possible to make any conclusive statements on the water monitoring systems in the Philippines.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts undertaken by industry, the authorities and the local population to educate one another on water-related issues in the metal industry. It is therefore not possible to make any conclusive statements on the education system related to water in the Philippines.

Summary

Figure 18   Water supply analysis of the metal industry in the Philippines
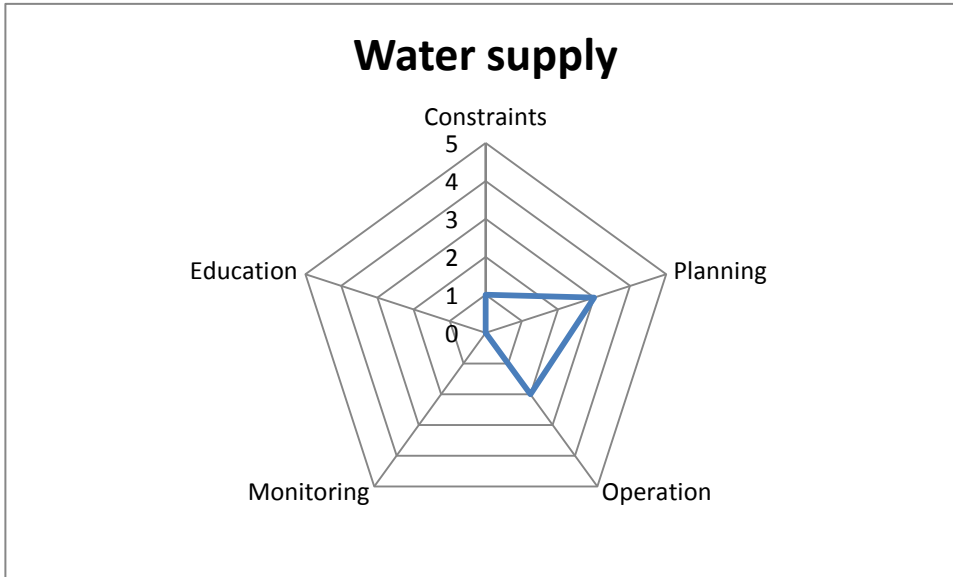
3.4.3   Air emissions

Constraints

According to the report 'Resource Efficiency: Economic and Outlook for Asia-Pacific' (UNEP, 2012), a high level of deposits of sulphur ions was detected at several sites in the Philippines. This is in part caused by the use of coal in metal plants, but these specific concentrations were mainly attributable to the large amounts of precipitation in those areas. This is likely to continue unless major changes are introduced and constitutes a limiting factor in the growth of the metal industry in the Philippines.

Planning

It is not clear how the Philippines' metal industry collaborates in the policy making process with the local population or NGOs. Despite the existence of international reports funded by UN agencies such as 'Resource Efficiency: Economic and Outlook for the Asia-Pacific' (UNEP, 2012) and 'Resource Efficiency: Economic and Outlook for the Asia-Pacific' (UNEP, 2012), it is unclear to what extent the local population and industry use the data from these international reports in the process of designing policies on air emissions.

Operation

Activities such as plating, galvanizing and painting are hotspots in terms of air emissions. According to the metal industry, more realistic environment regulations are necessary.

Monitoring

The metal industry has expressed concern that no strict and regular monitoring of air emissions has been carried out in the metal industry because only few government staff work in this area. Industry and the local population call for emissions monitoring to take place on a regular basis.

The authorities tend to believe that the threat of a law suit suffices to ensure that industry and individuals comply with the regulations. They also acknowledge, however, that harassment and petty corruption are common in the metal industry.

While a wide range of environmental regulations exist in the Philippines, the authorities are aware of the lack of manpower to adequately enforce them. The country therefore heavily relies on the role of CSOs to report environmental offences. In addition, the fear of being sued is widespread and functions as a deterrent to violating environmental regulations. There is a national monitoring programme for total suspended particulate (TSP); other initiatives include the *Air Quality Management Fund* and the *Metro Manila Air Quality Improvement Sector Development Program* (MMAQISDP).

National total suspended particulate (TSP) monitoring from 2003 to 2007 showed a 33% improvement over the four-year period, with concentrations decreasing from 144 to 97 micrograms per normal cubic metre (µg/Ncu.m.) Although the concentration of metals is decreasing, TSP geometric mean concentrations are still above the 90 µg/Ncu.m. annual mean TSP guideline value for one year averaged over time. Hence, more efforts are needed to comply with the guidelines by 2010, as set out in the General Plan of Action for Air Quality Management.

The Air Quality Management Fund (AQMF) was established as a special account in the National Treasury to be administered by the DENR to finance government containment, removal and clean-up operations in air pollution cases; to guarantee restoration of ecosystems and rehabilitate areas affected by the actions of CAA violators; and to support research, enforcement, monitoring activities and capabilities of the relevant agencies pursuant to Section 14 of the Philippine Clean Air Act of 1999. The AQMF is also used by the Airshed Governing Boards. The AQMF was assigned Fund Code 155 by the National Bureau of Treasury (BTr) in April 2004.

The Metro Manila Air Quality Improvement Sector Development Program (MMAQISDP) is an Asian Development Bank (ADB) loan-financed programme implemented by various national government agencies headed by the DENR. Its general objective is to promote policy reforms to improve air quality through the reduction and control of mobile and stationary sources of air pollution. It focuses on the Metro Manila air shed, the location of the main concentrations of air pollution, but policies developed have nationwide implications and/or may be replicated in other airsheds.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts being undertaken by industry, the authorities and the local population to educate one another on air emission issues in the metal industry. It is therefore not possible to make any conclusive statements on the education system related to air emissions in the Philippines.

Summary

Figure 19   Air emissions analysis of the metal industry in the Philippines
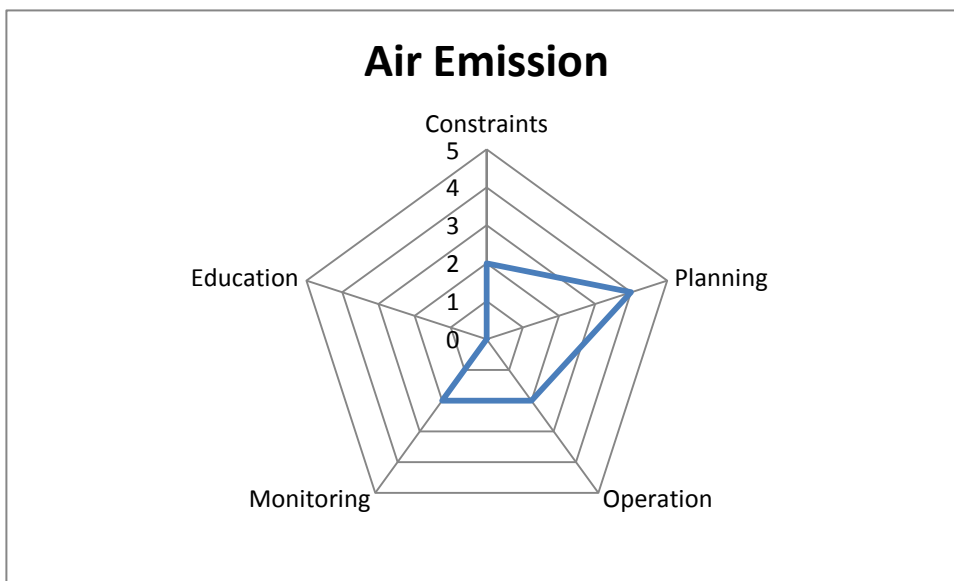
3.4.4   Solid waste

Constraints

Blank spots: The desk study and fieldwork revealed that insufficient information is available on education relating to water management in the metal industry. It is therefore not possible to make any conclusive statements on constraints to the solid waste management system in the Philippines.

Planning

Industry runs various efficiency programmes such as 'Waste Plastic to Fuel'. However, it reports that no guidance on waste minimization or management is offered to firms; nor does a sustainability index exist to allow for national and international comparison.

Industry claims that EAF dust and slag from factories is not properly processed due to geographical mismatches and the lack of a dedicated heavy industrial zone; there is no pooling of treatment facilities and foundry sand.

Although solid waste management is handled at the local government level, the Department of Natural Resources initiated the respective programme, requiring landfills to be established. However, many open dumps still exist because landfill sites fill up quickly. It was reported that the disposal of waste is not considered expensive and there is therefore little incentive, other than the intrinsic value, for waste valorization.

Nevertheless, some basic examples of waste valorization were noted, with schemes including the resale of waste generated during shutdowns, the use of unconverted monomers as power plant fuel and the conversion of gypsum to cement. The disposal of toxic waste, e.g. Silica chips, phosphoric acid and gypsum waste, is managed at individual plants with no pooling of resources. As of yet, there are no plans to pursue green chemistry. Socio-political problems surrounding the disposal of plastics were also noted.

Monitoring

A US-Philippines full-cost accounting guidebook for solid waste management was developed. Little to no evidence was found whether this guidebook has actually been implemented into practice for industry monitoring activities. The desk study and fieldwork revealed that insufficient information is available on monitoring activities of authorities in the metal industry.

Education

Insufficient information was available on education programmes developed by authorities on waste management in the metal industry. The manual 'Solid Waste Management Made Easy: A Field Book on Implementing a Community-Based Ecological Solid Waste Management Programme (UNDP/DENR/NSWMC, 2012)' has been published. There was no evidence, however, suggesting how solid waste management practices have been affected as a result.

Summary

Figure 20   Solid waste management in the metal industry in the Philippines

Solid Waste
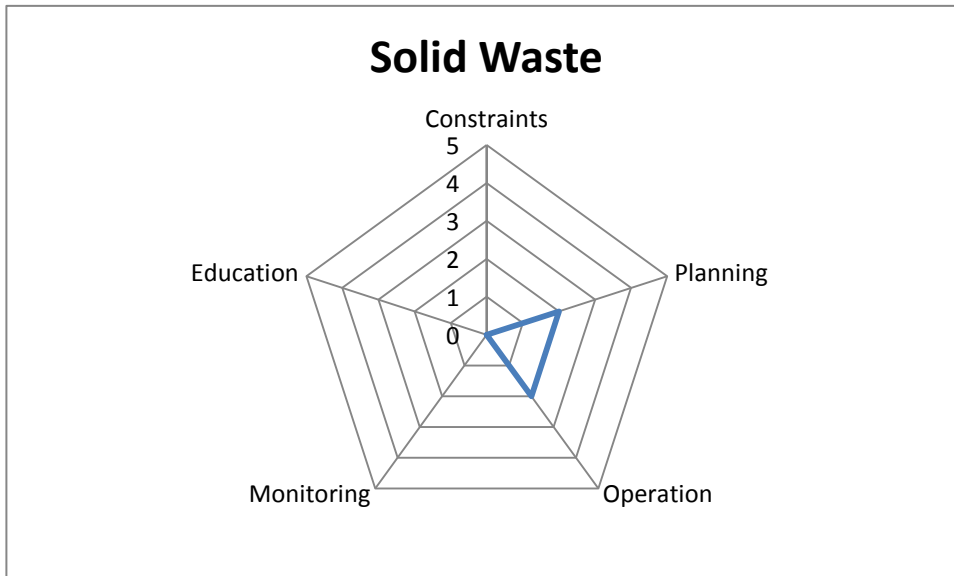
3.4.5   *Wastewater*

Constraints

Blank spots: The desk study and fieldwork revealed that insufficient information is available on education relating to water management in the metal industry. It is therefore not possible to make any conclusive statement on wastewater system constraints in the Philippines.

Planning

The Department of Natural Resources initiated the Responsible Care programme. Industrial zones in which to concentrate industries, located away from residential areas and with adequate utilities, were also created by the authorities. The desk study and fieldwork did not reveal any information on the use of any form of sustainability indices to monitor environmental performance, either nationally or internationally.

Operation

The government's requirements for the disposal of solvents and lubricants are not stringent.

- Plating, galvanizing and painting are hotspots in terms of wastewater
- Wastewater is treated before discharge in accordance with the environmental code (BOD, PH)
- Increasing costs of water treatment (sludge)

- No pooling of treatment facilities, due to geography and lack of a dedicated heavy industrial zone.

Monitoring

There is no monitoring of effluents due to a limited number of government staff and lack of advanced technological systems.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on education relating to water management in the metal industry. It is therefore not possible to make any conclusive statements on water management education programmes in the Philippines.

Summary

Figure 21   Wastewater analysis of the metal industry in the Philippines
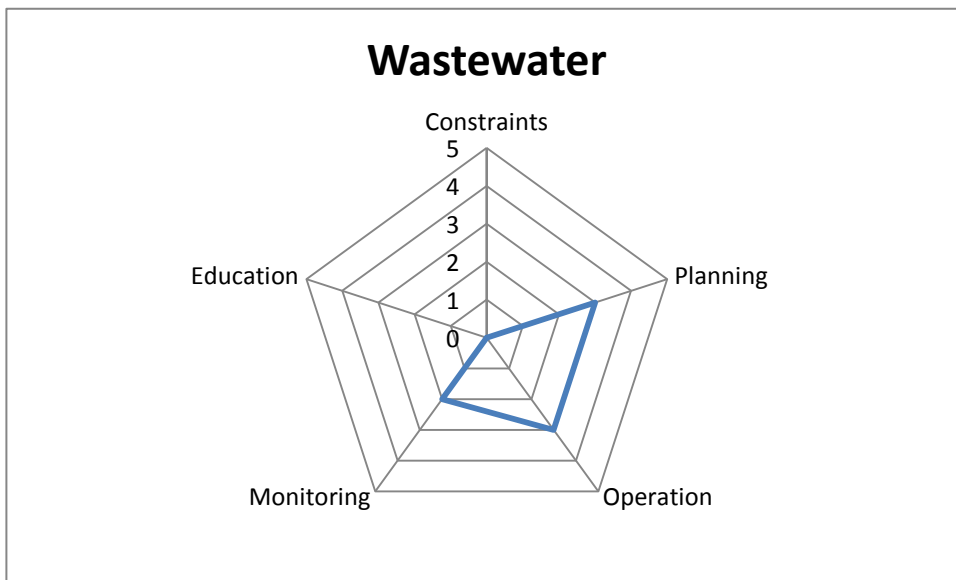
Social assessment

3.4.6   Labour

Constraints

Blank spots: The desk study and fieldwork revealed that insufficient information is available on education relating to water management in the metal industry. It is therefore not possible to make any conclusive statements on labour constraints in the Philippines.

Planning

Labour costs in production make up around 10 percent of the entire production costs. However, there is no well-established exchange between labour demand and labour supply in the metal industry for the purpose of labour planning. The authorities offer scholarships to universities in the Philippines to create the next generation of industry leaders. However, little information was found on how the authorities, industry and the local population collaborate to develop such programmes.

There are a number of international reports that are relevant to the Philippines' education system, such as 'Shaping Policy Reform and Peer Review in Southeast Asia: Integrating Economies amid Diversity' (OECD, 2008) and 'Skills Development Pathways in Asia: Employment and Skills Strategies in Southeast Asia' initiative (ESSSA) (OECD, 2012). The reports' key recommendation for labour is to upgrade under- and un-qualified instructors and outdated training systems in the Philippines.

Operation

The authorities have established the 'Metal Industry Research Development Centre (MIRDC)" which provides ISO9001 training. In addition, the government offers a three-year formal vocational training course and a three-month course on welding. Graduates of technical/vocational schools produce skilled workers, while universities or colleges create technicians for the metal industry.

It was noted that the quality of the labour force generated by technical and vocational schools for the metal industry is adequate. However, vocational training for metal casting is needed. There is a mismatch between what academia is producing (white collar employees) and the needs of industry (blue collar workers).

Monitoring

Severe 'brain drain' is being observed in the metal industry, with only low quality labour remaining in the country.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the methods of educating the metal industry's labour force. It is therefore not possible to make any conclusive statements on the needs of education of the labour force in the Philippines.

'Shaping Policy Reform and Peer Review in Southeast Asia: Integrating Economies amid Diversity' (OECD, 2008): the Philippines has long attempted to eradicate poverty in its poorest region of Mindanao. Inequality has been persistent in countries with the highest levels of poverty such as the Philippines.

'Skills Development Pathways in Asia: Employment and Skills Strategies in Southeast Asia' initiative (ESSSA) (OECD, 2012): reducing skills mismatches and increasing the links between training and industry needs. The Philippines seeks to strengthen industry education and training linkages with a focus on an enterprise-based training system.

The quality of skills training must be guaranteed and vocational pathways for high school leavers created. Despite the high unemployment rate among college graduates, vocational training paths are not chosen in the Philippines. High school graduates and their parents value academic studies more than vocational studies, aiming for white collar jobs that are not related to industry demands. There is also a high share of low-skilled workers in the Philippines, who are faced with demands to improve their skills.

There is a large share of micro, small and medium-sized enterprises (MSMEs) in the Philippines, accounting for 70 percent of total employment, 30 percent of total sales and value-added in manufacturing and 25 percent of total exports. Demand for training in the Philippines is two-fold: existing and potential entrepreneurs need to acquire business skills and knowledge—particularly in financing, marketing, technology and human resources development—to be competitive in the world market, and MSME workers need to be trained in the skills required in technology intensive industries and for improving productivity. The needs are even higher for smaller MSMEs. However, employer-provided training is very limited and the following constraints have been cited: insufficient access to finance, poor information on training needs, low perception of formal training and lack of training facilities. The government and education and training institutions, both public and private, are the major providers of the required skills training for the MSMEs, in which the Technical Education and Skills Development Authority (TESDA) is the lead government agency for managing TVET.

Summary

Figure 22   Labour analysis of the metal industry in the Philippines
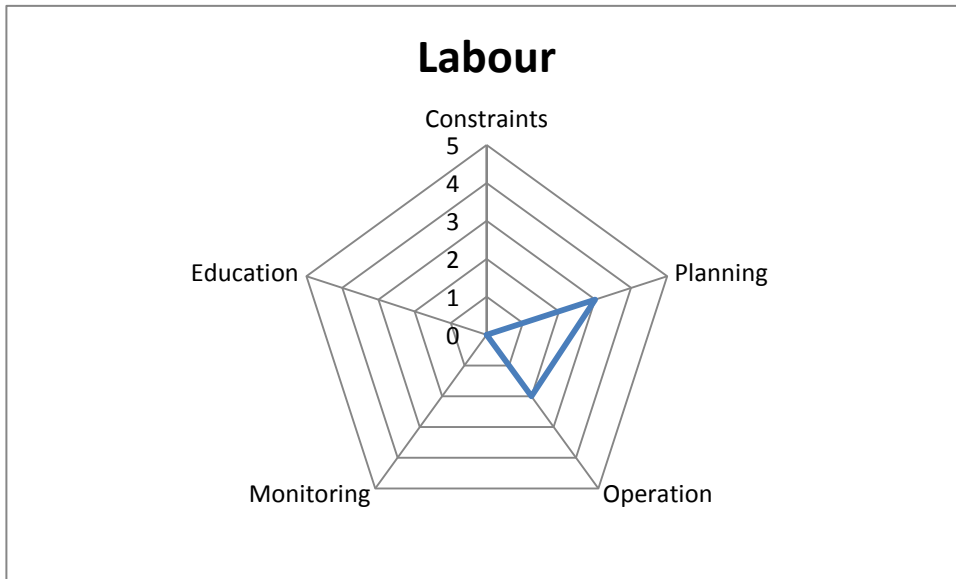
3.5   Thailand

Environmental Assessment

3.5.1   Energy

Constraints

Independent power plant production is a government policy designed to help cope with demand. The government encourages private sector investments in power plants. The complicated tariff structure is controlled by National Energy, with demand determining the prices.

Planning

Considerable efforts have been made on the part of the authorities to establish a national energy plan, including subsidies, a pricing policy and the use of alternative energy sources. The Metropolitan Electricity Authority (MEA) analyses load factors for customers and helps improve these to ensure that the load is acceptable. The 10 industries with poor energy efficiency were identified as department stores (retail), automotive tyre production, metal for construction, home appliance manufacture, paper, cardboard & packaging, wire, automotive assembly, plastics and textiles. Government energy efficiency targets are set by the industry in a 20-year plan (2010-2030), with the aim of reducing energy intensity by 25 percent over the period, although this has not yet been implemented.

In general, it is considered easy to operate, as energy capacity exceeds demand by more than 10 percent. The top energy consumers are commercial services, industry (which represents

approximately 30 percent of demand) and residential. Calls have been made to expand the grid to support commercial services, but there is a lack of funds for investment. In total, Thailand has 400,000 manufacturing units, with MEAs representing around 10,000 medium and large units each and 100,000 small units.

Department of Alternative Energy Development and Efficiency (DEDE)

The DEDE has set targets to reduce energy intensity by 25 percent over the 20-year period from 2010 to 2030. These targets vary across sectors, with the targets for industry and transport set fairly high (a reduction in energy intensity by 35 percent). Energy conservation based on ISO15001, is also being promoted, which targets the 3,500 factories drawing more than 1 MW. These factories are required to submit annual energy management reports, perform annual audits and assign someone who is responsible for energy (PRE). Factory breakdowns by industry are available and accredited consultants recommend energy saving measures although targets are not set. The PREs receive energy efficiency training by the Department, which including on benchmarks and good practice. In addition, the alternative energy development plan sets a target of achieving a 25 percent increase in alternative energy provision. Incentives are also in place for small and very small power producers. Overall, the aim is to reduce reliance on imported energy, although no specific target has been set for this objective.

Operation

The Electricity Generating Authority of Thailand (EGAT) is responsible for electricity generation in Thailand, although distribution is carried out regionally by the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA). Industry consumes 52 percent of total energy, and whilst GDP is growing at 2-3 percent per annum, electricity demand is growing by 5 percent each year. Demand side management aims to minimize energy consumption, and encourages energy efficient appliances in households. A time of use (TOU) tariff has also been employed with a 30 percent to 40 percent variation in price/usage. The reliability of current electricity supply is very high, and is even higher than that of the USA. The first 50 units of electricity are free, and prices range between BHT 3.28 for residential customers to BHT 3.502 for industrial consumers.

The limit for imported electricity lies at 15 percent, with current imports of electricity (drawn from the Lao People's Democratic Republic and Malaysia) at around 10per cent. Renewables (including small hydro, wind solar and biomass) account for 5 percent of Thailand's electricity supply, and hydro accounts for a further 10 percent. Local NGOs argue that renewables should be pursued; however, other sources suggest that growth opportunities in solar should be limited

as this could increase tariffs by 10 percent. Seventy percent of gas supply is purchased from Myanmar. Further, whilst the long-term plan was to move towards nuclear energy, it was postponed following the Fukushima crisis in Japan. The ASEAN master plan is ultimately to link the members' grids with each other.

Monitoring

Local NGOs point out the following problems:

a. Steel and petrometals, in particular, consume a lot of energy and cause environmental damage, leading to the destruction of local communities.
b. Thailand has scarce natural resources available for those industries.
c. Such industries tend to move towards coastal areas, which causes environmental damage to those areas (fisheries) and creates social tensions, i.e. immigration of workers from neighbouring countries, who work for wages lower than the minimum wage.

Local NGOs also argue that environmental standards in Thailand are very weak in comparison with other countries', and companies thus participate in 'legalized' pollution. Companies do not provide full public disclosure on how they comply with environmental standards. At the same time, the 'policing' of industries is very weak, with penalties only being imposed on a few industries. Local NGOs add that they support industrialization, but only where the local population benefits.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on energy education in the metal industry. It is therefore not possible to make any conclusive statements on energy management education programmes in Thailand.

Summary

Figure 23   Energy analysis of the metal industry in Thailand
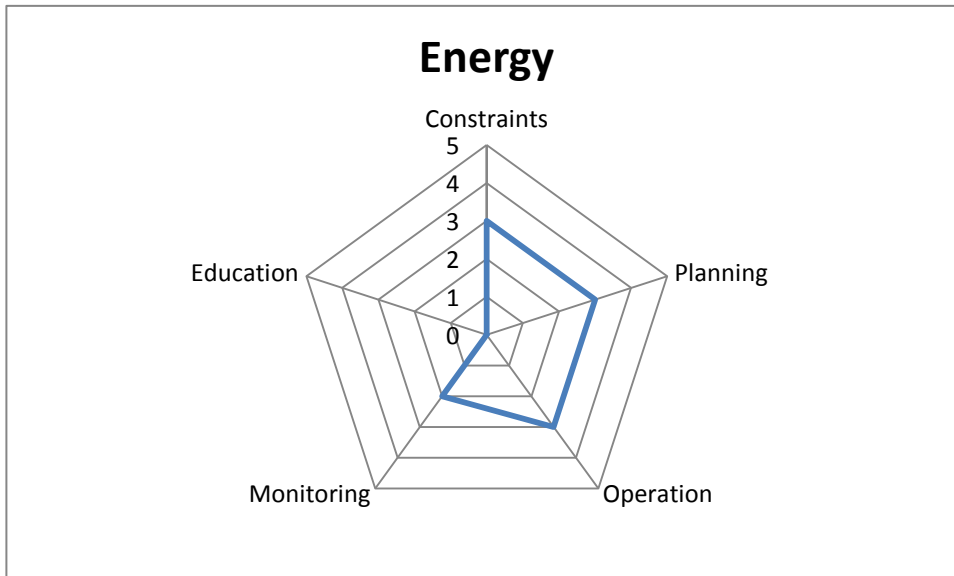
3.5.2   *Water supply*

Constraints

Government departments, such as the Pollution Control Department, are aware of the current water challenges: water extraction is close to carrying capacity in most areas, making water-intensive industries a key issue. Poor waste infrastructure for municipal waste means there are potential opportunities for new industries to grow in this area.

Water infrastructure is particularly problematic for small enterprises. However, authorities do not collect specific industry-level data on water demand or supply, though the water authorities have water data based mainly on geography rather than industry. Like in other countries, a firm that seeks to establish factories needs to submit a permit request to the Department of Groundwater Resources. In the permit document, the firm needs to state the amount of water consumption per day and identify the water resource (i.e. provide a water supply plan). However, these water consumption plans do not seem to be collected at the level of industry.

In Thailand, no central unit exists that supervises water, with responsibility for different areas divided across multiple organizations, including the Irrigation Department, East Water, River Basin Management and the Department of Industrial Works

Planning

According to the report 'Green Growth, Resources and Resilience' (ESCAP/ADB/UNEP, 2012), Thailand is one of the countries with an urgent sustainability challenge in relation to water.

The Department of Water Resources sets standards on effluent discharge and pollution control for each industry. It is also responsible for monitoring such activities in the country's major rivers. There are plans to increase water capacity by constructing more dams, although there are physical constraints to this activity. A further option to increase capacity is to transfer water from neighbouring countries, e.g. Myanmar and Cambodia. There is no fixed policy on water transfer, but has been practiced in the past. From 2000 to 2005, there were serious water shortages in the eastern area (River Basin Easter Coast). A project by East Water (a water management company) was implemented to transfer water from other regions to this area. This led to major protests. The transfer of water from the Mekong River Basin to Bangkok is being considered. Data for specific industries is not available, but some sources of data are available from the Institute for Sustainable Water at the Federation of Thai Industries. Some industries use groundwater supplies and, although there are plans to recharge suppliers, these have not yet been implemented.

Local NGOs point out the following problems:

a. Steel and petrometals, in particular, cause environmental damage, leading to the destruction of local communities.
b. Thailand has scarce natural resources available for these industries.
c. These industries tend to move towards coastal areas, which causes environmental damage in those areas (fisheries).

Local NGOs also argue that environmental standards in Thailand are very low in comparison to those of other countries, and that companies in Thailand participate in 'legalized' pollution. Local NGOs add that they support industrialization, but only when the local population benefits.

Operation

Blank spots: The desk study and fieldwork revealed that insufficient information is available on water supply operation activities in the metal industry. It is therefore not possible to make any conclusive statements on energy management education programmes in Thailand.

Monitoring

Data for specific industries is not available, but some data sources are available from the Institute for Sustainable Water at the FTI. Water use varies across the regions, and water is also transferred between regions (e.g. from Mekong to Bangkok). Some industries use groundwater and although there are plans to recharge supplies, these have not yet been implemented.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on water supply education in the metal industry. It is therefore not possible to make any conclusive statements on energy management education programmes in Thailand.

Summary

Figure 24   Water supply analysis of the metal industry in Thailand
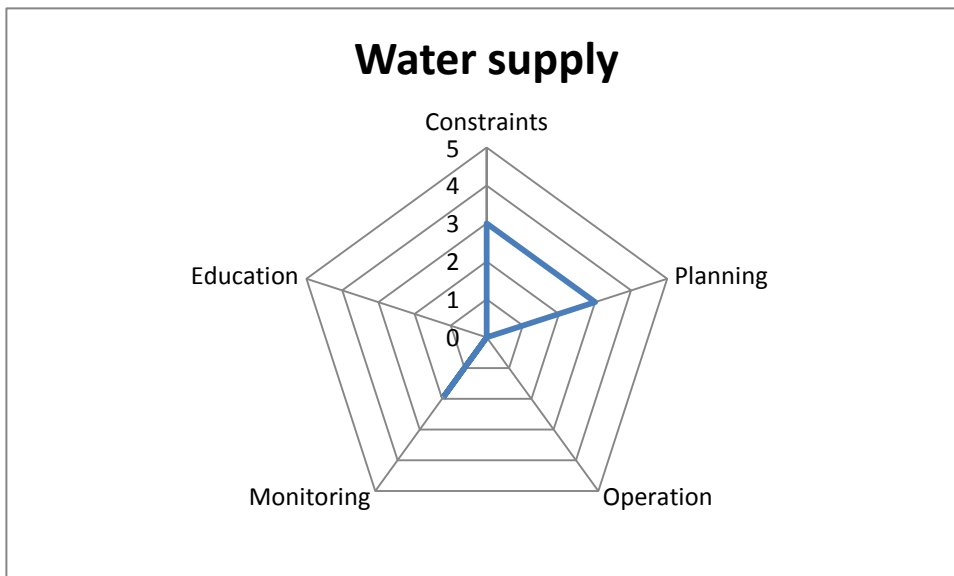
3.5.3   Air emissions

Constraints

The authorities point out that industries have been known to dump pollution. Thailand is reported to have tight environmental regulations covering a wide range of polluting activities. However, ensuring compliance is problematic due to under-staffing.

Planning

One of the main authorities responsible for air emissions planning in Thailand is the Office of Natural Resources & Environmental Policy and Planning (ONREP). There is scope for further integration between the ONREP plans and the national 20-year plan from the Ministry of

Industry (MOI). ONREP use both policy and regulations to achieve its mandate, with a clear priority sequence in area planning as follows: air pollution, water pollution, landfill and water extraction.

Operation

Blank spots: The desk study and fieldwork revealed insufficient information is available on efforts undertaken by industry, the authorities and local population to reduce air emissions. It is therefore not possible to make any conclusive statements on the water operation system in Thailand.

Monitoring

Various government departments, such as the Department of Industrial Works and the Pollution Control Department, engage in continuous emission monitoring. Authorities are nevertheless aware that industries have been known to dump pollution. Thailand is reported to have tight environmental regulations covering a wide range of polluting activities. However, ensuring compliance is problematic due to under-staffing.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on how air emission prevention tools, techniques, education programmes or best practices in the metal industry are shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on air emission education in Thailand.

Summary

Figure 25   Air emissions analysis of the metal industry in Thailand
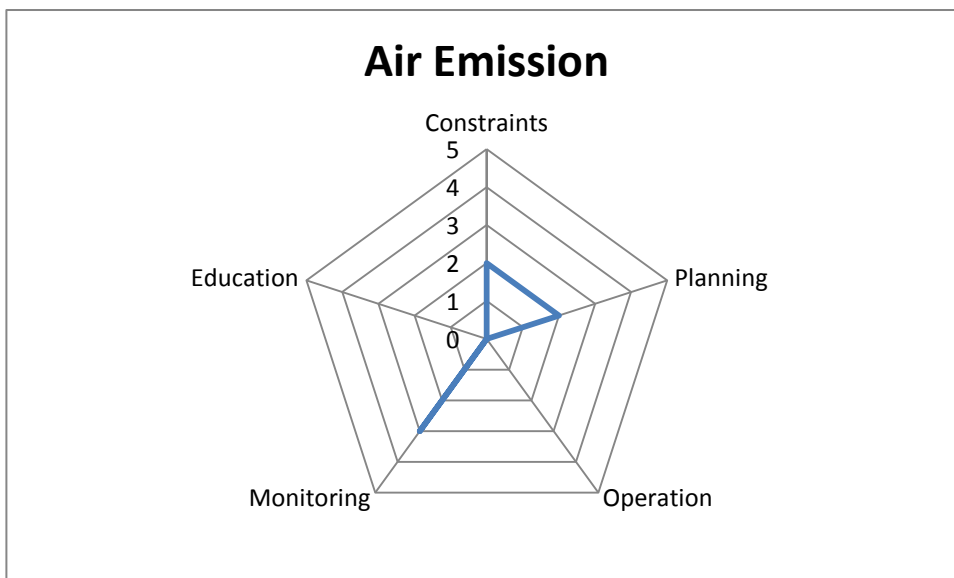
3.5.4   Solid waste

Constraints

The authorities are aware that industries have been known to dump pollution. Thailand is reported to have tight environmental regulations covering a wide range of polluting activities. However, ensuring compliance is problematic due to under-staffing.

Planning

A Strategic Impact Assessment for the Area has been issued to encourage the waste recycling industry to begin operations.

Operation

Large companies, such as PTT, undertake considerable efforts to reduce their solid waste: PTT has reduced its solid waste by approximately 60 percent; however, this requires close collaboration with every firm in the supply chain. The extent of efforts undertaken by local SMEs, in particular firms that do not supply large companies, to reduce solid waste to landfills is unclear.

Examples of waste treatment at industry level include:

- o   Central wastewater plant in each region
- o   Provision of incinerators for general waste
- o   For hazardous waste: Central Disposal Unit in some areas – IEA controlled transportation to the facility.

Monitoring

Authorities are aware that industries have been known to dump waste. Thailand is reported to have tight environmental regulations covering a wide range of polluting activities. However, ensuring compliance is problematic due to under-staffing.

The authorities claim that the amount of waste being collected and transported from facilities poses a problem. The collection system itself is also considered problematic. The authorities believe that improved systems for the collection of waste and increases in the capacity of waste treatment should be developed and implemented to improve solid waste management. The Department of Industrial Works collects data on the amount of waste factories generate. The Department also gathers data on waste that factories transport outside of their boundaries. The Department of Industrial Works needs to define industrial waste in a way that is consistent with industrial standards; currently, they are using a range of their own definitions.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on how solid waste management tools, techniques, education programmes or best practices in the metal industry are shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on energy related education in Thailand.

Summary

Figure 26   Solid waste analysis of the metal industry in Thailand
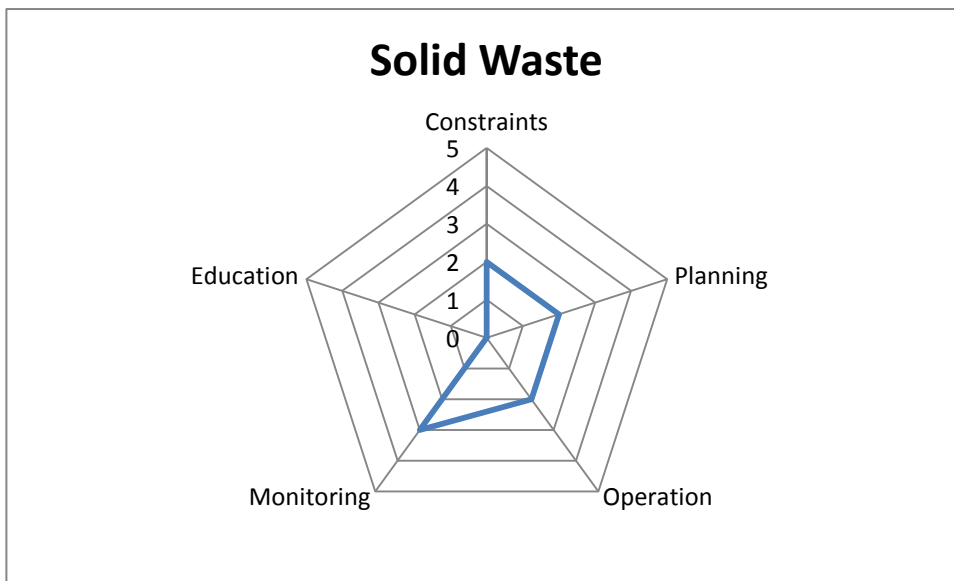
3.5.5   Wastewater

Constraints

The authorities are aware that industries have been known to dump pollution. Thailand is reported to have tight environmental regulations covering a wide range of polluting activities. However, ensuring compliance is problematic due to under-staffing.

Planning

Government departments, such as the Department of Water Resources, the Ministry of Natural Resources and the Royal Irrigation Department, collaborated to develop a water management plan. Components of the plan include the centralization of water regulations, the preservation of natural water resource areas, wet land preservation, general improvements and the building of small reservoirs in rural areas. However, it is unclear to what extent the metal industry and the local population, including NGOs, participate in the planning activities associated with wastewater management. Moreover, authorities do not have sufficient data to analyse specific

industries. Firms do not provide full public disclosure on how they comply with environmental standards. At the same time, the 'policing' of industries is very weak, demonstrated by the fact that only few penalties have been imposed on firms for pollution.

Operation

A wastewater collection system is in place: if a factory breaches the relevant regulations, the authorities can either fine the responsible firm or impose a number of other sanctions.

Monitoring

The authorities are aware that industries have been known to dump pollutants. Thailand is reported to have tight environmental regulations covering a wide range of polluting activities. However, ensuring compliance is problematic, mainly due to under-staffing, but also due to limitations in technical equipment and training.

Local NGOs also argue that environmental standards in Thailand are very weak in comparison with other countries, and allow firms to participate in 'legalized' pollution. Companies do not provide full public disclosure on how they comply with environmental standards. At the same time, the 'policing' of industry is very weak, and only few industries have been penalized. Local NGOs add that they support industrialization, but only where the local population benefits.

According to the Word Bank, the indicator for water pollution by the metal industry (in % of total BOD emission) in Thailand was 1.81 (January 1995), 1.59 (January 1998), 1.72 (January 2000), 1.68 (January 2002) and 1.89 (January 2006).

Water pollution of the chemical industry (% of total BOD emissions) in Thailand

12.16 (January 1996), 11.87 (January 1998), 12.29 (January 2000), 10.76(January 2002) and 12.41 (January 2006)

Source: World Bank database

Indonesia

Water pollution of the chemical industry (% of total BOD emissions) in Indonesia

12.915 (1998), 11.894 (1999), 12.044 (2000), 13.536 (2001), 13.156 (2002), 13.129 (2003), 12.618 (2004), 13.044 (2005) and 11.988 (2006)

Water pollution of the metal industry (% of total BOD emissions) in Indonesia

1.406 (1998), 1.400 (1999), 1.437 (2000), 1.660 (2001), 1.353 (2002), 1.319 (2003), 1.326 (2004), 1.338 (2005), 1.380 (2006)

Source: World Bank database

The Philippines

Water pollution of the chemical industry (% of total BOD emissions) in the Philippines

9.791 (1996), 9.777 (1997), 9.051 (1998), 8.629 (1999), 9.287 (2001), 9.928 (2003), 9.536 (2005)

Water pollution of the metal industry (% of total BOD emissions) in the Philippines

3.647 (1996), 3.580 (1997), 3.613 (1998), 3.450 (1999), 3.084 (2001), 3.107 (2003), 2.632 (2005)

Source: World Bank database

Viet Nam

Water pollution of the chemical industry (% of total BOD emissions) in Viet Nam

7.512 (1998), 7.069 (2000), 7.103 (2001), 7.004 (2002), 6.690 (2003), 6.783 (2004), 6.607 (2005), 6.775 (2006), 6.752 (2007)

Water pollution of the metal industry (% of total BOD emissions) in Viet Nam

2.888 (1998), 1.859 (2000), 1.695 (2001), 1.526 (2002), 1.480 (2003), 1.406 (2004), 1.429 (2005), 1.395 (2006), 1.448 (2007)

Source: World Bank database

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available in how wastewater management tools, techniques, education programmes or best practices in the metal industry are shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on energy-related education in Thailand.

Summary

Figure 27   Wastewater analysis of the metal industry in Thailand
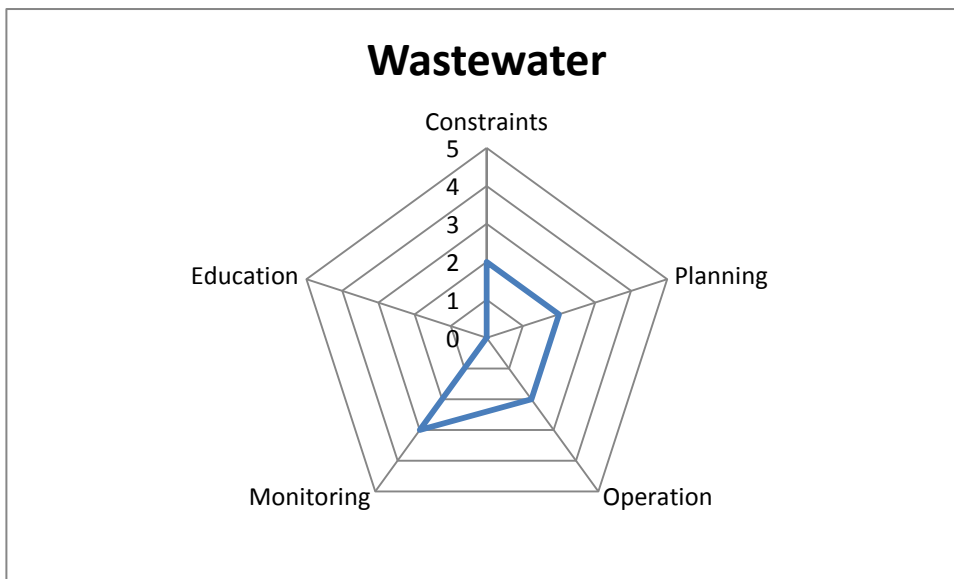
Social assessment

3.5.6   Labour

Constraints

University graduates have to settle for jobs which they are over-qualified for. Others refuse to compromise and instead remain unemployed or migrate. Therefore, low-skilled jobs are increasingly taken by migrant workers, a situation which has the potential to cause social problems in the future.

Planning

The Department of Skills Development (DSD) provides pre-employment training to primary school drop-outs. This programme is an alternative to secondary education and has a weak status in terms of recognition. The DSD also provides the opportunity for those already employed to upgrade their skills, e.g. entrepreneurship training for domestic staff. The authorities do not keep track of the educational profiles of employees in manufacturing or

industry, but do keep track of how many people employed in different industries have graduated from their skills training programmes. Local NGOs add that they support industrialization, but only when the local population benefits.

Operation

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts undertaken by industry, the authorities and the local population to reduce deaths and accidents among labourers as well as child labour and to provide generic training. It is therefore not possible to make any conclusive statements on labour operation systems in Thailand.

Monitoring

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts undertaken by industry, the authorities and local population to monitor labour conditions and activities. It is therefore not possible to make any conclusive statements on the labour monitoring systems in Thailand.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on efforts undertaken by industry, the authorities and local population to observe labour conditions and activities. It is therefore not possible to make any conclusive statements on the labour education system in Thailand.

Summary

Figure 28   **Labour analysis of the metal industry in Thailand**
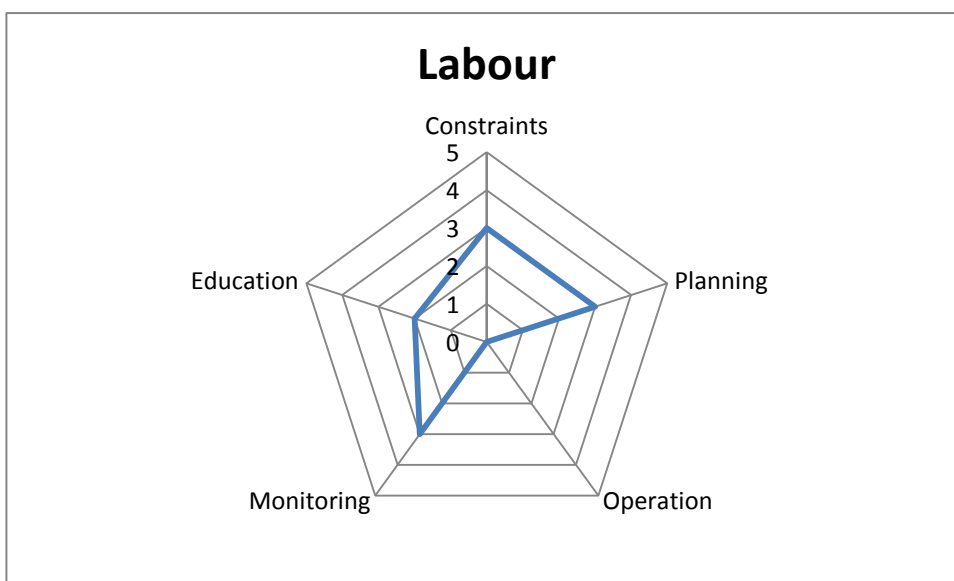
3.6   Viet Nam

Environmental assessment

3.6.1   Energy

Constraints

The economy has an overall growth rate of 6 percent to 10 percent annually, to which the metal industry is a major contributor. The government, industry and local population are highly aware that the metal industry's energy demands are increasing.

Planning

The government's efforts focus on the development of energy plans across a range of issues; however, there is little evidence of the authorities communicating with the metal industry and local population—including NGOs representing the local population—on the issue of energy supply to the metal industry. The industrial sector is aware that the metal industry is able to produce a wide range of metals, such as fertilizers and nitrogenous fertilizers, which can replace imports.

Operation

Metal firms routinely try to improve their energy supply and energy efficiency. Financial investments are often required to save energy or improve energy supply. However, most SMEs do not have sufficient access to capital to install new energy saving technologies.

UNIDO has implemented an energy productivity programme in various Vietnamese industries, including rubber and pulp: the project, which includes an investment of US$ 62 million, is funded by the Global Environmental Fund and was initiated in May 2011.

Monitoring

There are no financial incentives for firms to comply with the regulations set by authorities and there is little government monitoring of energy supply and efficiency. There is also little evidence on the involvement of the local population or NGOs in the monitoring of the metal industry's energy saving activities, although international entities do play a significant role in monitoring.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on how energy supply, energy efficiency tools, techniques, education programmes or best practices in the metal industry are shared between authorities, industry and the local population. It is

therefore not possible to make any conclusive statements on energy-related education in Viet Nam.

Summary

Figure 29   Energy analysis of the metal industry in Viet Nam
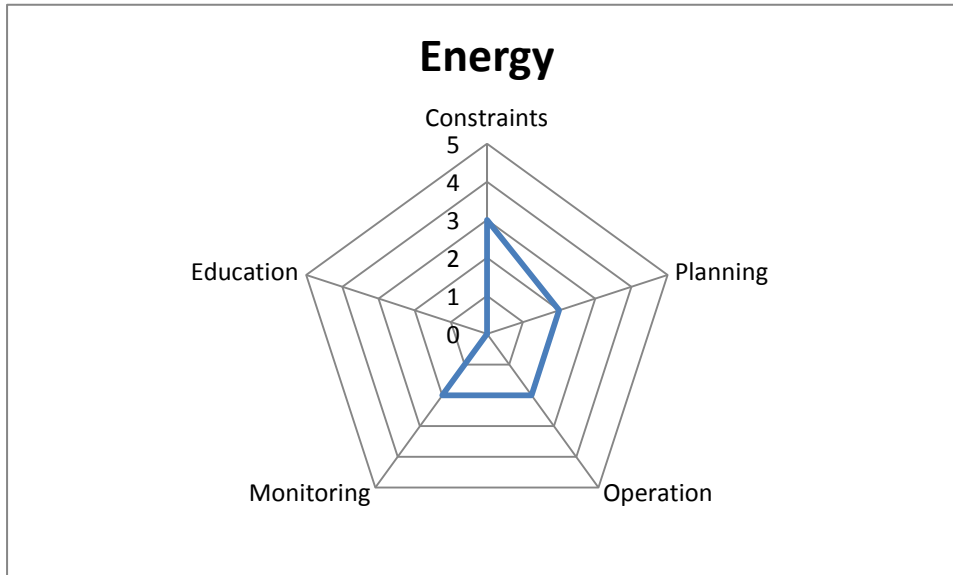
3.6.2 *Water supply*

Constraints

The metal industry considers some of the government's environmental policies and regulations to be onerous; since they are largely regarded as "formalities", they do not have a substantial practical impact. The industry points out that an effective policy could be helpful for enterprises, but that firms sometimes face financial burdens and tax problems related to environmental regulations.

Planning

Although it seems that considerable efforts have been undertaken by the authorities to formulate water supply plans, little evidence was found as to how the metal industry and the local population (including NGOs) are involved in the development of such plans. Furthermore, water supply data is only available at regional level, not at industry level. Accordingly, this lack of information on water demand in the metal industry poses obstacles to water supply planning in the metal industry.

Operation

Those interviewed in the metal industry stated that there is a gap between the authorities' policies and industrial reality, citing the fact that environmental policies are seldom consistently applied and do not have clear direction. It was also noted that people working in the metal industry believe that some environmental regulations are too rigid, particularly for the majority of SMEs. Also, it is unclear what efforts the metal industry—in particular SMEs—is undertaking to reduce water use in their operations. To improve their operations in terms of water supply, firms need to reduce water usage.

Monitoring

Those interviewed in the metal industry stated that financial incentives for enterprises to comply with water regulations are limited. Government monitoring of water supply is scarce. There is also little evidence on the involvement of the local population or NGOs in the monitoring of water supply to or water use in the metal industry, although international bodies play a significant role in water supply research in general. The authorities and the Vietnam Metal Industry Federation could monitor or collect information on the annual amount of water supply or water use of large firms and SMEs in the metal industry, but it seems that there is virtually no such monitoring activity.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on how water management tools, techniques, education programmes or best practices in the metal industry are shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on energy-related education in Viet Nam.

Summary

Figure 30   Water supply analysis of the metal industry in Viet Nam
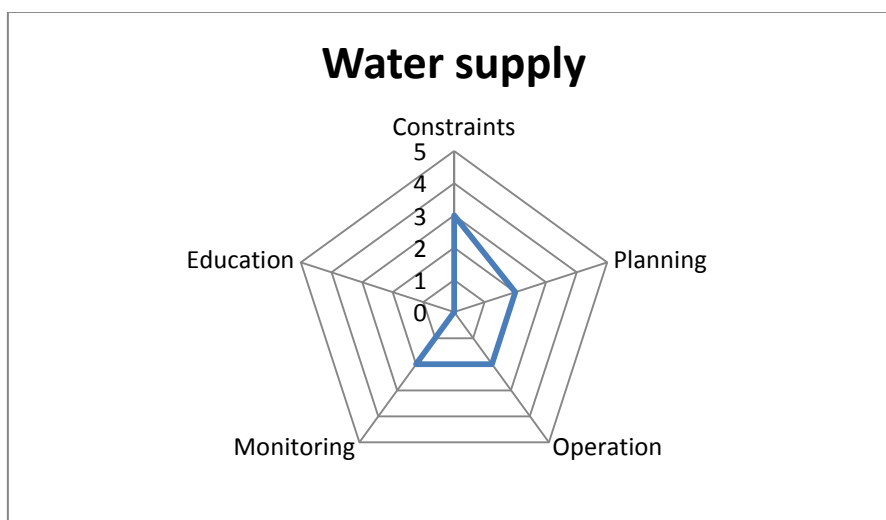
3.6.3   Air emissions

Constraints

According to the metal industry, some of the government's environmental policies and regulations on air emissions are onerous; since they are largely regarded as "formalities", they do not have substantial practical impact. Those interviewed in the metal industry highlighted the fact that effective policies could be useful for the metal industry, but that environmental taxes can be a financial burden on businesses.

Planning

Blank spots: The desk study and fieldwork revealed that insufficient information is available on the prevention of air emissions by Viet Nam's metal industry. It is therefore not possible to make any conclusive statements on the issue.

Operation

Those interviewed in the metal industry contend that there is a gap between the authorities' policies and industrial reality, citing environmental policies that are seldom consistently applied and which do not have clear direction. It was also noted that people working in the metal industry believe that some environmental regulations are too rigid, particularly for the majority of SMEs.

Monitoring

Those interviewed in the metal industry stated that financial incentives for companies to comply with regulations are limited. Government monitoring of air emissions is rare. There is also little evidence on the involvement of the local population or NGOs in the monitoring of the metal industry's environmental activities, although international bodies play a significant role.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on how tools for controlling air emissions, techniques, education programmes or best practices in the metal industry are shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on energy-related education in Viet Nam.

Summary

Figure 31   Air emissions analysis of the metal industry in Viet Nam
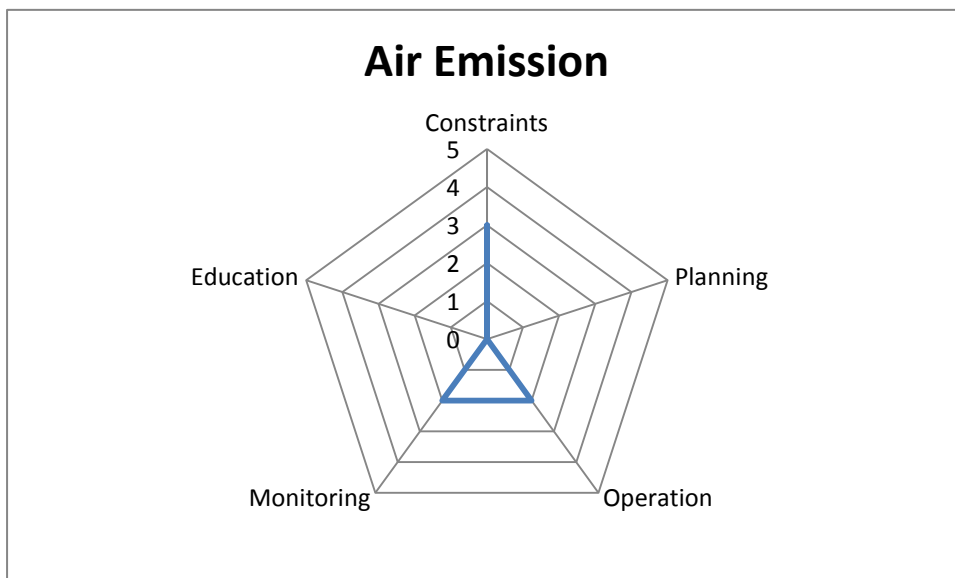
3.6.4   Solid waste

Constraints

The metal industry claims that some of the government's environmental policies and air emissions regulations are onerous; since they are largely regarded as "formalities", they do not have substantial practical impact. Those interviewed in the metal industry highlighted the fact that effective policies could be useful for the metal industry, but that environmental taxes can be a financial burden on businesses.

Planning

It is reported that the authorities have undertaken considerable efforts to develop plans, strategies and regulations on how to deal with solid waste, such as the "Policy on solid waste management in urban and industrial areas of Vietnam" issued on 10/07/1999 in Decision 152/1999/QD-TTG of the Prime Minister and "The National Environmental Action Plan 2001 - 2005 (NEAP)" which focuses on five programmes, among them Programme 2 which aims to improve solid waste management capacity, especially hazardous waste management in densely populated urban areas and industrial zones (The Asia-Link Progamme, 2008).

No information was available on how the authorities communicate with the metal industry and local population, including NGOs, to formulate a solid waste plan for the metal industry. The Vietnam Institute of Industrial Chemistry is responsible for drawing up a list of metals the

manufacturing and industrial sectors are allowed to use, as well as those which can be used for food processing and agricultural production.

Operation

Many of those interviewed in the metal industry state that a gap exists between the authorities' policies and the needs of industry. For example, some environmental policies of the Ministry of Natural Resources and Environment (MoNRE) and other ministries are inconsistent and do not set out a clear strategy concerning solid waste. Also, the metal industry is concerned that certain environmental parameters are too rigid for businesses to follow, and most SMEs struggle to comply with the regulations.

Monitoring

The government monitors the metal industry's hazardous waste in Viet Nam's largest cities: 2,242 tonne/year (Ha Noi), 3,300 tonne/year (Hai Phong), 73 tonne/year (Da Nang), 5,571 tonne/year (Ho Chi Minh City), 1,029 tonne (Dong Nai) and 879 tonne/year (Ba Ria-Vung Tau) (Centre for Research Investment Consult for Rural Development, 1999).

There are no financial incentives for firms to comply with the regulations set by authorities. Furthermore, there is limited government monitoring of solid waste. Little evidence is available on the monitoring of local solid waste by the local population or NGOs; international bodies are involved in monitoring the metal industry's environmental activities.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on how solid waste management tools, techniques, education programmes or best practices in the metal industry are shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on energy-related education in Viet Nam.

Summary

Figure 32   Solid waste analysis of the metal industry in Viet Nam
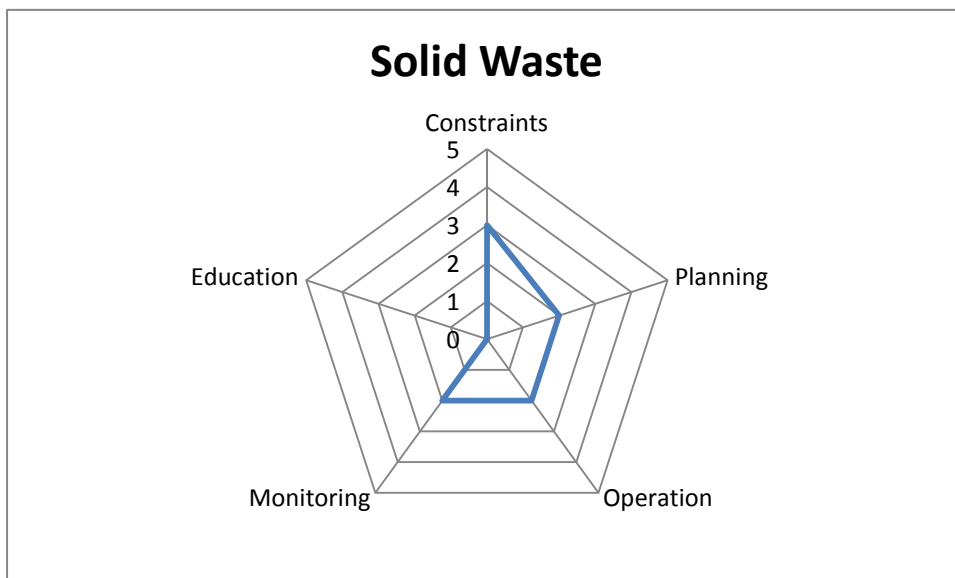
3.6.5 *Wastewater*

Constraints

According to the metal industry, some of the government's environmental policies and air emissions regulations are onerous; since they are largely regarded as "formalities", they do not have substantial practical impact. Those interviewed in the metal industry highlighted the fact that effective policies could be useful for the industry, but that environmental taxes can be a financial burden on businesses.

Planning

Various government bodies, such as the Ministry of Industry and Trade (MOIT), the Ministry of Agriculture and Rural Development (MARD), the Ministry of Health (MOH), the Ministry of Science and Technology (MOST), the Ministry of Natural Resources and Environment (MONRE), the Ministry of Defence (MOD) and the People Committee have participated in metal management policy in Viet Nam.

MONRE is primarily in charge of wastewater treatment plans. It is reported that the authorities undertake considerable efforts to develop wastewater plans. However, no information was available on how the authorities communicate with the metal industry and local population, including NGOs, on wastewater plans for the metal industry.

Operation

According to the metal industry, there is a gap between the authorities' policies and the actual situation in industry: some environmental policies are inconsistent across MOIT, MARD, MOH, MOST, MONRE and MOD and do not provide a clear strategy on the environment. Also, the metal industry considers some environmental regulations to be too restrictive on enterprises, and the majority of SMEs struggle to comply with the authorities' rules.

Monitoring

According to the metal industry, wastewater from its industry can often be dealt with more effectively by the industry itself. Also, individuals who work in the private sector state that authorities rarely monitor wastewater in the metal industry.

Moreover, there are no financial incentives for firms to comply with the regulations set by authorities. Finally, little evidence was obtained on how the local population or NGOs are involved in the monitoring of the metal industry's environmental activities.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on how wastewater management education programmes or best practices in the metal industry are shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on energy-related education in Viet Nam.

Summary

Figure 33   Wastewater analysis of the metal industry in Viet Nam
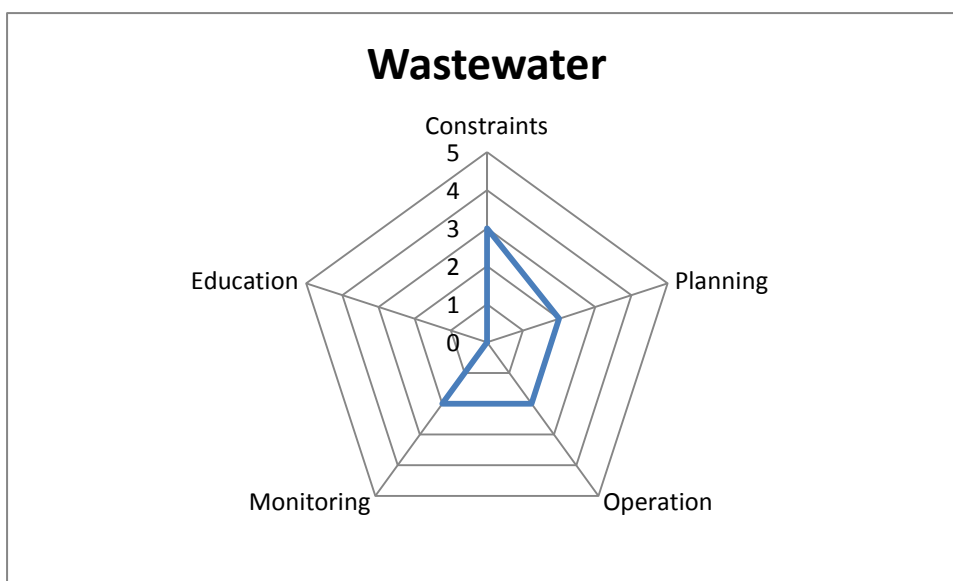
Social assessment

3.6.6 Labour

Constraints

Two issues have been raised by the metal industry: firstly, that the human resources available do not meet the requirements of enterprises; and secondly, that the metal industry considers some of the government's environmental policies and labour regulations to be onerous; since they are largely regarded as "formalities", they do not have considerable practical impact. Those interviewed in the metal industry highlighted the fact that effective policies could be useful for the industry, but that environmental taxes can be a financial burden on businesses.

Planning

Well-established communication channels between the government, industry and the local population exist in the development of labour plans.

Operation

Health and safety in operations have been improved, mainly due to recent efforts undertaken in these areas. Viet Nam's metal industry has collaborated with international bodies, including APEC, AMEICC, UNIDO, KEMI (Sweden), METI (Japan) and KOICA (Republic of Korea).

Monitoring

Some national regulations have been issued on metal safety and the laws regulating the use of metals:

- Environmental Protection Law
- Health Care Law
- Safety Code for production, use, storage and transportation of dangerous metals
- Narcotics Prevention Law
- Radiation Safety Law
- Ordinance on Plant Protection
- Prime Minister's Decision on Controlling Petrol, Oil and LPG.

However, no specific evidence was obtained on how the local population or NGOs are involved in the monitoring of labour issues in the metal industry.

Education

Blank spots: The desk study and fieldwork revealed that insufficient information is available on how the improvement of working conditions, labour programmes or best practices in the metal industry are shared between the authorities, industry and the local population. It is therefore not possible to make any conclusive statements on education concerning labour in Viet Nam.

Summary

Figure 34   Labour analysis of the metal industry in Viet Nam
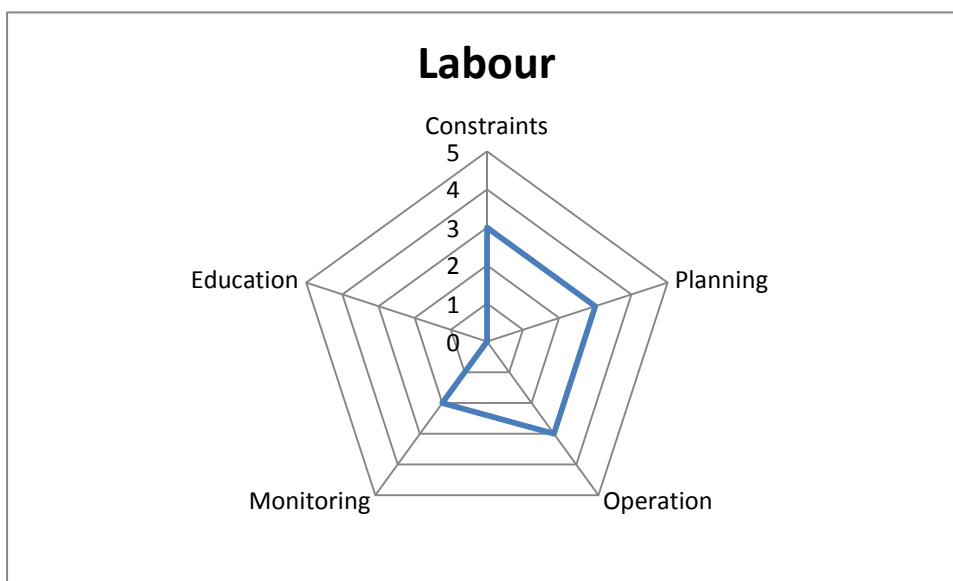
3.7   Evolution of the methodologies

To foster a rich discussion on environmental and social constraints and enablers, quantitative data for the energy, water supply, solid waste and wastewater systems is required in order to supplement the qualitative data already collected. Data availability and quality are always the key challenge of environmental analysis and the methodology has deliberately been designed to use both quantitative and qualitative data to paint the richest picture possible. Where quantitative data is missing—which is the case far too often—the methodology attempts to use only qualitative data to assess the situation. Often, this is possible, but is insufficiently robust to allow for a conclusive statement to be made. In these cases, the methodology relies on the researcher's ability to remain as subjective as possible during the course of the interviews and forums.

Data gaps, referred to as 'Blank Spots', are highlighted where they exist in order to draw clear attention to this problem and encourage local improvement in data collection. Over time, the methodology is designed to encourage more data availability and a shift to quantitative data

where appropriate. Over time, it will be possible to use the assessments to demonstrate a development path for the given nation and industry. Due to the different levels and the diverse nature of data across countries and industries, cross-nation or cross-industry comparisons are not appropriate.

4.   Synthesis of economic, environment and social analysis

In the previous sections, methodologies were developed to independently conduct an 'analysis of the economic component' and an 'environmental and social analysis' of an industrial subsector. In this section, a methodology to combine the earlier analyses is provided to derive policy recommendations that define potential pathways to green growth. Before doing so, however, it must be understood that bringing together these diverse aspects into one framework is challenging and that there are multiple ways of carrying out this task. Questions naturally arise regarding which aspects should be prioritized, and whether these priorities need to be homogenous across countries.

Hence, in formulating this synthesis methodology, we rely on the principle that any industrial sector with a promising potential in terms of any of the economic dimensions (namely export performance, local demand and domestic multiplier impact) deserves further policy attention. We then screen these industries through an environment and social lens in search of those industries with the highest positive impact. It should be noted that we never recommend an industry's closure or withdrawal if it has a highly positive economic or social impact, unless there is the possibility of an extremely adverse negative environmental impact that cannot be mitigated. In addition, even those industries which do not emerge as clear winners in terms of economic and social dimensions are tested to determine whether they have some potential environmental benefits that could distinguish them as a worthy investment. The methodology has been designed in such a way that none of our policy recommendations will result in any significant trade-off in the industrial sector's growth as a whole. Finally, by no means are we suggesting a 'one-size-fits-all' policy tool; on the contrary, we have developed a synthesis framework which incorporates country-specific contexts and local realities. The major advantage of this framework is the fact that we are able to incorporate the economic, environmental and social dimensions into one, a practice that is far from the norm in the current policy approaches. Such integration is indispensable in the quest to realize green growth, and we expect significant further developments of this and similar methodologies as we learn more about the practicalities of such integration. The overall structure of our synthesis framework is depicted in the following flow chart.

Figure 35   Step-by-step analysis from economic aspects to environmental-social aspects
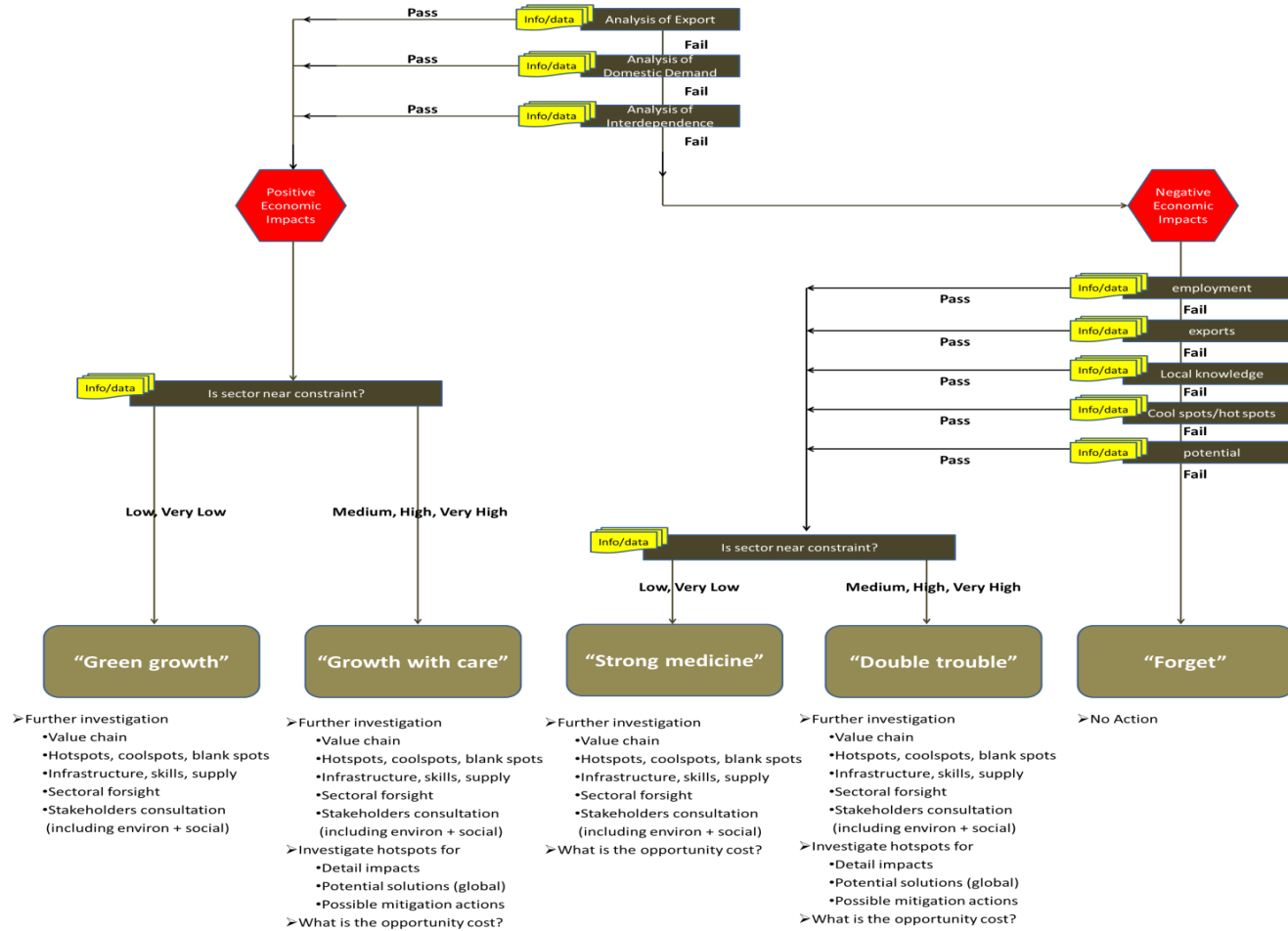
Step 1: The first step in the synthesis exercise is to conduct an economic analysis to test the economic potential of the industry. An industry is termed an 'economic winner' ('*Positive Economic Impacts*' in the figure) if it meets any one of the following criteria:

- The industry is classified as a 'champion' or 'under-achiever' in the export analysis conducted in section 2.3.1.

- The industry has been classified as a 'local champion' based on the domestic demand and production analysis conducted in section 2.3.2.

- The industry is classified as a 'high impact' industry based on the domestic interdependence analysis conducted in section 2.3.4.

For all case countries, the metal industry is a 'champion' according to the export analysis (conducted in section 2.3.1), hence we can classify this industry as an 'economic winner' ('*Positive Economic Impacts*' in the figure) based on the synthesis framework described above. It should be noted that the metal industry is also a 'local champion' in Thailand and Indonesia based on the domestic demand analysis, whilst it is a 'high impact' industry in Malaysia, the Philippines and Thailand according to the domestic interdependence analysis. The metal industry thus qualifies as an 'economic winner' ('*Positive Economic Impacts*' in the figure) based on multiple dimensions. Next, we move to the environmental and social analyses.

Step 2: The second step in the synthesis exercise is to conduct an environmental and social analysis to determine the industry's environmental and social potential. The environmental and social analysis examines the physical constraints that can obstruct or enable an industry's future progress and covers energy, material and water inputs, as well as air, waste and water emissions and labour. Classifying an industry as medium, high or very high indicates that it is operating at near or over the national constraint limits, and that there is a current or imminent issue that may cause a growth plan to be delayed or halted.

If the industry is classified as very low or low in the environmental and social analysis, the industry's growth will not be constrained by national capacity.

It should be noted that the analysis does not calculate future industry growth targets as the data is not yet of sufficient quality in the majority of countries, and that the actual environmental and social impacts occur as part of a larger system in which multiple industries influence national capacity.
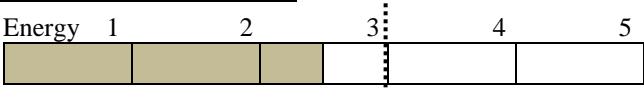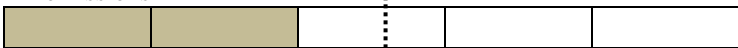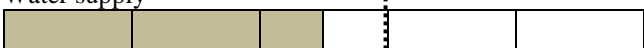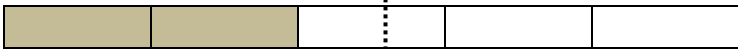
Step 3: The third step in the synthesis exercise is to establish a recommendation category for the industry (in this case, the metal industry) in each case country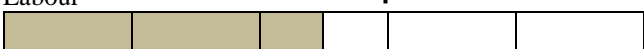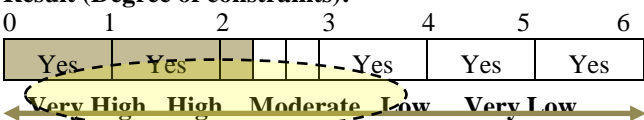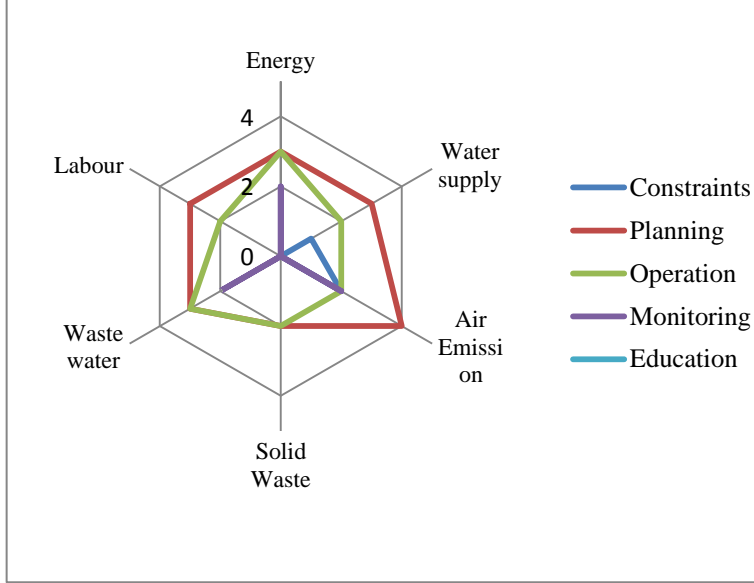. This categorization is based on the results of Step 1 and Step 2 and is also described in the figure. Further analysis is then recommended to identify the opportunities for improving value creation in the given country and industry, considering economic, environmental and social aspects.

- The policy recommendations are classified into five growth categories: 'Green growth', 'Growth with care', 'Strong medicine', 'Double trouble' and 'Forget.'

- Positive economic impacts lead to one of two categories 'Green growth' and 'Growth with care', depending on the environmental and social impact analysis.

- Negative economic impacts lead to one of three categories 'Strong medicine' 'Double trouble' and 'Forget', depending on the environmental and social impact analysis.
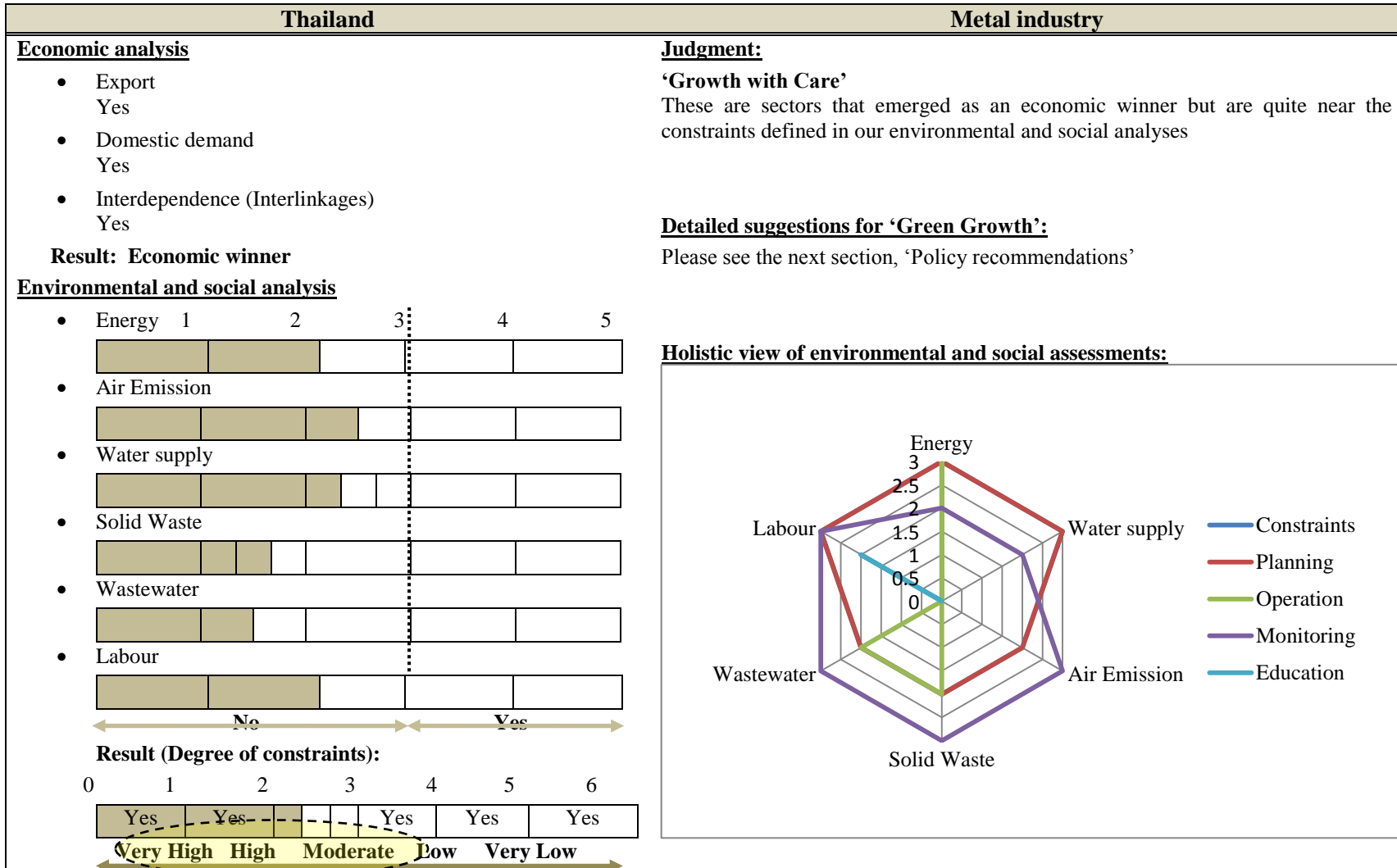
Indonesia

Indonesia	Metal industry
Economic analysis	**Judgment:**

Economic analysis

- Export
  Yes

- Domestic demand
  Yes

- Interdependence (Interlinkages)
  No

Result: Economic winner

Environmental and social analysis

- Energy

1	2	3	4	5

- Air emissions

- Water supply

- Solid waste

- Wastewater

- Labour

No ←——————→ Yes

Result (Degree of constraints):

0	1	2	3	4	5	6
Yes	Yes			Yes	Yes	Yes

Very High High Moderate Low Very Low

Judgment:

'Growth with Care'

These are industries that emerged as economic winners but are quite close to the constraints defined in our environmental and social analyses

Detailed suggestions for 'Green growth':

Please see next section, 'Policy recommendations'

Holistic view of environmental and social assessments

Legend:
— Constraints
— Planning
— Operation
— Monitoring
— Education

The Philippines

Philippines	Metal industry

Economic analysis

- Export
  Yes
- Domestic demand
  No
- Interdependence (Interlinkages)
  Yes

   Result: Economic winner

Environmental and social analysis

- Energy   1   2   3   4   5

- Air emissions

- Water supply

- Solid waste

- Wastewater

- Labour

        No   Yes

Result (Degree of constraints):

0	1	2	3	4	5	6
Yes	Yes		Yes	Yes	Yes	

Very High   High   Moderate   Low   Very Low

Judgment:

'Growth with Care'

These are industries that emerged as economic winners but are quite close to the constraints defined in our environmental and social analyses

Detailed suggestions for 'Green Growth':

Please see next section, 'Policy recommendations'

Holistic view of environmental and social assessments:

Legend: Constraints, Planning, Operation, Monitoring, Education

Thailand

Thailand	Metal industry

Economic analysis

- Export
  Yes

- Domestic demand
  Yes

- Interdependence (Interlinkages)
  Yes

Result: Economic winner

Environmental and social analysis

- Energy

- Air Emission

- Water supply

- Solid Waste

- Wastewater

- Labour

No ← → Yes

Result (Degree of constraints):

Very High   High   Moderate   Low   Very Low

Judgment:

'Growth with Care'

These are sectors that emerged as an economic winner but are quite near the constraints defined in our environmental and social analyses

Detailed suggestions for 'Green Growth':

Please see the next section, 'Policy recommendations'

Holistic view of environmental and social assessments:

Legend:
— Constraints
— Planning
— Operation
— Monitoring
— Education

Viet Nam

Viet Nam	Metal industry
Economic analysis:	**Judgment:**

Economic analysis:

- Export
  Yes

- Domestic demand
  No data

- Interdependence (Interlinkages)
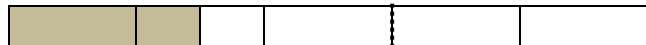 No data

  Result: Economic winner

Environmental and social analysis:

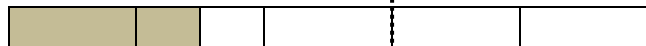- Energy   1   2   3   4   5
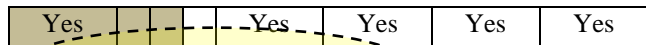
- Air Emission

- Water supply

- Solid Waste

- Wastewater

- Labour

  No   Yes

Result (Degree of constraints):

0   1   2   3   4   5   6

Yes   Yes   Yes   Yes   Yes

Very High   High   Moderate   Low   Very Low

Judgment:

'Growth with Care'

These are industries that emerged as economic winners but are quite close to the constraints defined in our environmental and social analyses

Detailed suggestions for 'Green Growth':

Please see next section, 'Policy recommendations'

Holistic view of environmental and social assessments:

Radar chart axes: Energy, Water supply, Air Emission, Solid Waste, Wastewater, Labour (scale 0–5). Legend: Constraints, Planning, Operation, Monitoring, Education

5.   Policy recommendations

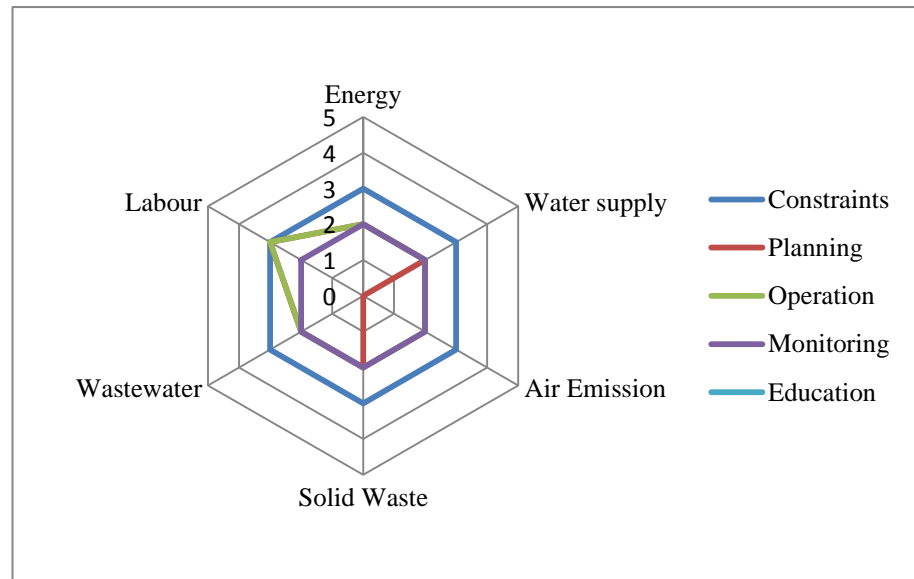➢ **The metal industry has been identified as a 'Growth with Care' industry:** these are industries that emerged as economic winners but are quite close to the constraints defined in our environmental and social analyses. **Policymakers should consider the following actions:**

- Take measures to further improve the competitive positions of these industries by taking strategic policy actions.

- Conduct an 'AEC scenario' analysis of the industries to forecast how the domestic market will respond to the AEC formation in 2015. Take steps to prepare the industries for possible increased competition.

- If the industry is an 'under-achiever' according to the export analysis, the country should try to improve the industry's export performance through proactive policy interventions to capture the increased world demand in this dynamic industry.

- It is important to evaluate the sustainability of future demand growth for these dynamic industries. If demand growth is found to be short-lived, then the country should not invest too many resources into these industries.

- The skills requirements in these industries need to be determined and the national education institutions encouraged to cater to these requirements.

- An in-depth industry-specific constraint analysis must be conducted and policy measures adopted to mitigate these constraints in order to foster faster industrial growth. This is crucial for ensuring that any growth policy is not hampered by an external constraint.

- An industry-level value chain analysis must be carried out to explore options for producing more value added goods within the industry.

- Organize stakeholder consultations to explore options to minimize the hotspot impact.

- The use of global best practices should be encouraged. Leading companies use less water and energy and generate less waste per unit of added value. The government should ensure a programme of learning for any growth industry, identify the best global standards and support programmes to upskill local staff to deliver such practices.

- National governments should consider using local government procurement to support high levels of performance by setting clear environmental and social

standards for supply, where such delivery performance is feasible. Government should work with local trade associations to develop these standards.

- Trade associations and leading companies in the industry should be encouraged to develop a roadmap for taking the industry to global levels of environmental and social performance. Such roadmaps should be endorsed by government and made public.

- Many firms in the metal industry suffer from poor infrastructure (national and internal). Trade associations and governments should seek ways to share infrastructure resources (such as two plants building one wastewater treatment facility), which may then become economically sensible due to increased volume.

- The metal industry is widely failing to maximize the value generated per weight of product. This is often attributable to poor quality raw materials and to limited technical competence. Poor quality processing also means that products may need re-processing, which significantly increases costs, environmental impacts and adds no value. Technical competence in process quality is a minimum competence and again there is considerable opportunity to improve skills and, hence, competitiveness.

- Finally, the metal industry has limited capacity to coordinate between firms in terms of by-product use (where one plant's waste is used as input material in another). We have seen some excellent examples, but they are still too rare. Other nations' experiences clearly show that government and trade associations play a key role in brokering such industrial symbiosis, which must be supported.

Local best practice

We have noted that in most of the countries studied, there is at least one particular firm that understands what global best practice means and implements an active programme to deliver such performance. Such firms are often part of global initiatives, such as the World Business Council for Sustainable Development. Governments would benefit from identifying these initiatives and encouraging participation in road-mapping at the national level.

The development of measurement and monitoring competence is generally needed, both within industry and government, while research and development competence in the emerging area of green chemistry should also be supported.

Data collection improvement for better industry policy

To support better policy design for industry, each country needs to further develop its national data collection system for environmental and social information. For example, if authorities want to determine the water demand of a certain industry, authorities can construct total water demand from one of two information sources: factories' annual water demand report (to local authorities) or factories' annual water consumption (which can also be collected by local water authorities).

Not all of the data required can, however, be collected in this way; here, we explore an alternative approach for the collection of data. Measuring the amount of solid waste in a certain industry is not a simple task. Across many countries, local authorities and central government collect solid waste data according to region. Accordingly, the collection of waste data at the level of industry, e.g. the metal industry, is not only difficult, but not necessarily important for local authorities. However, an indirect approach can provide important evidence as to the amount of solid waste and wastewater at the level of industry.

During the process of establishing a new factory, the firm is required to report the expected solid waste and wastewater production to the local authorities before a license to operate can be issued. Every year, the company needs to update this report to maintain its certification. Data that can support analysis therefore exists within a given country, but this data is in many cases not gathered nationally or processed at industry level.

If the government collects the data from waste plans held by the local authorities, a better picture of regional and industry-based waste production can be established. The plan calculations are unlikely to match the actual waste production in a region or industry, but can at least allow for an assessment to be made.

There are three important implications: first, local authorities should monitor the waste produced by local factories; second, they need to monitor the firms' plan for annual waste production. Third, firms shall be given a chance to review the amount of their waste production.

Figure 36   Reporting flows of solid waste and toxic waste
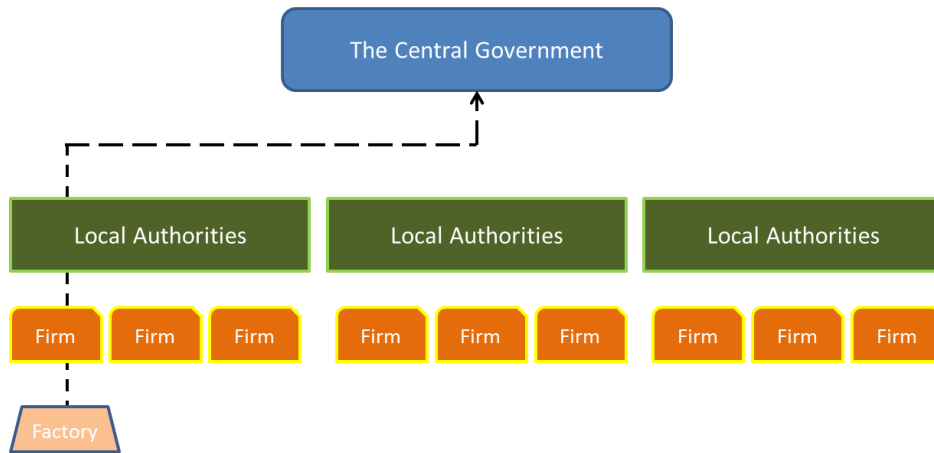
Communication among authorities, industry and the local population

This industry report found that opportunities exist to share information that can be used to set environmental and social targets. We strongly recommend for the three participants (authorities, industry and the local population) should improve their formal communication across all manufacturing processes from constraints, planning and operation, to monitoring and education. All three parties need to be aware that the five manufacturing processes are interlinked and interdependent in terms of delivering environmental and social improvement. In addition, the authorities should take note of the fact that social awareness of the environmental and social factors can help exert a positive influence on the metal industry in the long term.

6.   Conclusions

The metal industry is a large part of the ASEAN countries' industrial economy and will be expected to form a key part of any green growth future. All five countries studied have constraints that limit the ability of their own metal industry to expand; this is in some cases a water and/or wastewater issue or an air emissions, etc., with the specific constraint changing from country to country. As such, the metal industry has been identified as a 'Growth with care' industry in each case country, hence, industry expansion must be based on an in-depth environmental and social analysis of detailed plans. We have identified actions that emphasize skills and coordination, as these offer long-term strategic advantages at low cost. However, they are not without challenge and should not be rushed.

There is robust evidence that outstanding global companies exist in many locations. First, these outstanding companies are testimony that local conditions are not a limiting factor for achieving excellent environmental or social performance (though they often struggle with local infrastructure and the technical competence of the workforce, in particular). Secondly, they

offer proof that higher value creation is correlated with higher environmental performance (based on our interviews with industry representatives, we would argue that this is explained by the more successful companies' ability to demonstrate better process control). This implies that there is no structural reason for the ASEAN metal industry to push toward lower costs, lower quality and lower environmental and social standards, though this is a frequently used strategy that seems to offer an obvious logic – 'if our costs are lower than those of our competitors, then our market share will increase'. This is a 'race to the bottom' that is unnecessary and does not offer a means to increase added value, quality jobs and exports while improving local conditions. Thirdly, and finally, these outstanding companies offer local access to knowledge, which can be sought out, supported and used by the government to support progressive policies and develop practice-sharing education programmes that can help increase other companies' performance.

We have gathered some evidence that government and industry—whether through individual companies and/or trade associations—are failing to produce future roadmaps. Roadmaps help industry and government better understand each other's objectives and available instruments, and encourage efficient allocation of resources. Roadmapping can identify critical constraints and challenges (for example, skills) and offer a shared solution. Roadmaps can be negatively affected by strong lobbying from industry or strong short-termism from politicians, and must be conducted with care, especially where there is little history of co-operative problem solving.

Many of the metal companies in the region struggle with process quality control, which then creates more scrap, more re-work and thus uses more energy and water and generates more waste. This is both a company competitive and a national competitive issue, as the lack of capacity in the energy, water or waste system means that sector growth relies on infrastructure growth. The cost of such infrastructure growth is typically much higher than the cost of efficiency programmes that can deliver the same capacity. We strongly recommend the development of process quality control skills and national provisions of the more sophisticated process quality equipment. Such education and equipment availability will also enable the long-term development of better research competence in this crucial area. These actions have the additional benefit of helping to accelerate the shift of the industry towards higher value adding outputs.

The metal industry faces various local environmental challenges, in some cases competing with citizens for key resources such as water and in many cases polluting local air, rivers and soil. The government's competence to fully monitor performance is in many cases low, which discourages industry from carrying out its own monitoring. Monitoring competence is being

increased in each country with the provision of more education and more equipment and state laboratories, but this development must be increased rapidly as part of an agreed government-industry plan. Monitoring competence simultaneously increases the problem-solving competence of staff, which is key to decreasing any costs that may typically be associated with improving environmental performance.

It is important to note that there is a strong economic logic for supporting the ASEAN metal industry. None of the case countries exhibit critical environmental or social conditions that would immediately limit the growth of the metal industry. But each country's metal industry is operating near its capacity for one or more resources, and any growth plan must be accompanied with an equally powerful plan to increase the constraining capacity.

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