

Material use – a key indicator of sustainable industrialization

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Rationale of indicator

Efficient use of resources is one of the most important aspects of sustainable development. The material and supplies account for 60-80 percent of total input of industrial production. As the production rises the consumption of materials grows thereby increases the burden on natural resources. On the other hand material consumption has close positive correlation with carbon emission. Efficient use of materials reduces the effect of industrial production on environment. Therefore, from the perspectives of preserving natural resources as well as reducing pollution a measure of material use per unit of industrial output is considered as one of the key indicators of sustainable industrialization.

Statistical approach

In a traditional economic accounting framework, the industrial production flow captures the purchase of materials for processing, transformation into a new product and its sale to the market. However, this framework needs to be expanded in the context of SEEA. Materials for processing comprise natural as well as produced inputs. The accounting framework allows producing the related statistics on demand of resources from industrial production. On other side, industrial production results not only at products that are sold to market but also at the variety of residuals comprising waste water, emission to air and solid waste. A complete measure of their effect on environment is represented by GHG emission. In case of industrial production, CO₂ emission accounts for around 3/4th of GHG emission and estimation of CO₂ is possible from the data on energy use by resources.

For both ends – input and residuals from production – implementation of SEEA in industrial statistics provides necessary measures of sustainable industrialization.

Indicators of material use

Three types of indicators are considered for material intensity in industrial production.

- Average quantity of materials used

Material intensity = Quantity of materials used/ manufacturing value added (at constant prices, international dollars)

This indicator is identical to the material intensity for overall economy which is measured as *Total Domestic Material Consumption/GDP*

However, there are two major limitations of compiling this indicator at the economy level – first, not many countries maintain the complete material balance. Secondly, there is significant variation of material consumption by sectors. For example, construction has very high material consumption, especially compared to service sectors.

- Value based indicators

$$\text{Material intensity} = \text{cost of material input}/\text{VA}$$

As any value indicator, its limitation is related to the price differences over the years and across the countries. But at the same time, the ratio indicates cost effectiveness of products by sector and countries. For example, material cost is four times of value added in basic metal industry compared to two times in wearing apparel.

- Ratio at product level

Product level ratio indicates more precise level of material intensity in terms of requirement of material to produce individual products. For example:

- Quantity of water used per unit of a beverage
- Amount of coal used to generate 1 kwh electricity
- Metal used per unit of a passenger car

Due to the large number of products country could select only few materials and products for monitoring.

For the purpose of international monitoring the first indicator - *Quantity of material use per unit of MVA* is considered as the most appropriate. Material intensity in manufacturing can be reduced by improving production technology. It is also important to note that many products of manufacturing require further use of energy resources for operation. Production technology can pre-determine the efficiency of resource use at the production stage. By monitoring material intensity we would be also monitoring the technological innovation in manufacturing.

Data sources and monitoring mechanism

The main data source of material input in industry is the result of industrial survey. As per the international recommendations for industrial statistics, data on consumption of materials in quantity are collected from industrial survey. In European practice structural business statistics survey or material input survey covers the material input to industrial production.

International Recommendations for Industrial Statistics 2008

Some changes may be required in classification of products. Similarly, the difference may arise in measurement units, but a set of Raw Materials Equivalent (RME) conversion factor is being used by Eurostat.

Currently UNIDO collects industrial statistics data (B,C,D and E of ISIC rev 4) using its General Industrial Statistics Questionnaire in cooperation with OECD. The questionnaire includes value added (together with other variables) but does not include input item.

(b) Data items on quantity

Item number	Data item
Q4.1	Quantity of individually important materials and supplies
Q4.2	Quantity of individual fuels and gas purchased
Q4.2.1	Quantity of electricity purchased
Q4.2.2	Quantity of electricity generated
Q4.2.3	Quantity of electricity sold
Q4.2.4	Total energy consumed (terajoules)
Q4.3.1	Quantity of water purchased
Q4.3.1.1	Quantity of water abstracted for own use
Q4.3.1.2	Quantity of water sold
Q4.3.1.3	Total water used (cubic metres)
Q4.3.2	Quantity of wastewater treated on site prior to discharge
Q4.3.3	Quantity of wastewater discharged without treatment

Recently UNIDO started collecting value data on materials, energy and services. These data have helped to compile some value based resource efficiency variables for initial analysis. By adding input item(s) to the same questionnaire data could be obtained internationally through existing mechanism. For developing countries, UNIDO will enhance its existing technical assistance programme taking the new data demands into account.

Data maintained by UNIDO are internationally available for users.