

The Growth of Industry

Outlining an Analysis Based on UNIDO's System of Industrial Development Indicators (SIDI)

The question of 'industrial development', when considered in a global setting, has two major aspects: that of the changing location or the spread of industry across countries and that of the growth of industry within countries. The former aspect has been discussed in some breadth and depth at the 'Forum on Sustainable Industrial Development' held in Vienna on 29 November to 1 December 1999 in conjunction with the eighth session of the General Conference of UNIDO. The latter aspect informs empirical research on industrial development which is being carried out by the UNIDO Secretariat. And it is under this aspect that most of the issues presented in this short paper are approached.

*Undoubtedly, the one issue central to the development debate is the issue of **poverty reduction**, which is seen as the single overarching goal of international development. When poverty reduction is viewed from the angle of **sustainability** – a shorthand expression for a set of conditions for continuous progress towards this goal – there emerge some broad economic features which can be outlined as follows: While recent research has revealed poverty as being more complex than it may have been perceived previously, there is still widespread agreement that it is an economic issue at core. Hence, achievement of some of the more conventional goals of economic development is of the essence to 'sustainable poverty reduction', with economic growth being a pivot. Even though, in general, it appears to take more than the growth of per capita income to reduce poverty, recent analyses suggest that a balanced argument in favour of growth is unassailable, nevertheless. In consequence, sustained growth of developing economies must still be considered as essential to progress, also towards newly formulated goals.*

*Elsewhere (UNIDO, 'Industry for Growth into the New Millennium', Vienna, 2000) it has been argued at some length that **manufacturing industry is pivotal for economic growth**, in particular, in an era of increasing international integration, in short 'globalization'. At the same time it has been shown that in a globalizing world industry also has the tendency to agglomerate in space and thereby maintain or even reinforce great unevenness of the distribution of productive capacity around the globe. Hence, there is the danger for parts of the world to become marginalized with respect to the economic prosperity usually conveyed by industrial development. Thus, one of the difficult tasks of international development is to promote growth through industry, while at the same time helping to avoid marginalization becoming part of the process.*

I. Measuring Growth: UNIDO's System of Industrial Development Indicators

UNIDO's 'System of Industrial Development Indicators (SIDI)' is a systematic attempt at measuring the growth of industry. When the discussion is about growth – in particular, that of industry – three major aspects have to be taken into account:

- (i) the nature of growth,
- (ii) the sources of growth, and
- (iii) the constraints to growth.

These aspects also inform the design and development of the SIDI (as described in UNIDO, 'Measure by Measure', Vienna, 2000) and provide the system with a structure that facilitates the use of indicators for descriptive as well as for analytic purposes.

The nature of industrial growth One of the features the SIDI tries to capture is the variation in growth experience among industries pertaining to the manufacturing sector. This variation is typically assessed at country level leaving open possibilities for more aggregate views of growth performance at regional or even global levels. And although interest centres around comparison between 28 industry branches within manufacturing, some evidence is also given on the performance of the manufacturing sector within the whole of an economy as well as on that of broadly defined industry groups of which the sector is composed. Naturally, rates of the growth of output are central to this comparative assessment. However, there is complementary information provided on changes in output structure – as a consequence of growth differentials – and on performance in international trade in manufactured products. The latter, in particular, yields important information on industrial growth performance in an increasingly and rapidly integrating world economy.

The three sources An increase in overall industrial output stems from at least one of three different kinds of improvement: that of the allocation of resources among competing production activities, that arising from an enhanced volume or quality of resources or improvement of the methods of producing output from given resource inputs. Accordingly, the sources of the growth of industry are of three broad types each one of which is reflected in part(s) of the SIDI:

- (i) efficient (re-)allocation of resources in line with international specialization,
- (ii) growth of resource inputs to production,
- (iii) progress through technological change and related factors.

In the framework of the SIDI measurement of sources-of-growth phenomena is carried out in two different ways, namely, through a variable that directly quantifies one such source or through assessing the relationship between several variables that represents the (partial) causation of the growth of industry.

The re-allocation impact of the *international economy* on growth performance of the various manufacturing industries can in part be appraised through trade-based indicators contained in the SIDI. Foremost among these are measures of the growth of exports of manufactured goods and a detailed assessment of comparative advantages in the various product groups. While the former allows to draw some conclusions on the role of export orientation for growth, the latter can serve as an indication of the broad lines of international specialization along which a given country's productive

resources would be allocated most efficiently in order to render their optimum contribution to output expansion.

Input growth as a source of the growth of industrial production is measurable in a direct fashion. This is the case, in particular, for the three main kinds of factor inputs, namely, labour, physical capital and human capital. By comparing across industries the rates of growth of at least these three factor inputs, a first impression can be gained of the role which the expansion of factor supply plays for output growth in different types of industrial activity. More directly, changes of single factor-productivity – expressed as the difference between the growth rates of output on the one hand and of a given type of input on the other – can be assessed in a comparative fashion, highlighting variation both among countries and across industries.

Finally, increases in single factor-productivity – with labour productivity providing the most popular example and also the one included in the SIDI – give a first hint to the contribution of *technological change* to output growth. More importantly, however, attempts can be made to single out the technology portion of growth enhancement by determining so-called total factor-productivity (TFP) growth. The method of growth accounting normally used for this purpose relates output growth to the growth of major factor inputs simultaneously in order to filter out the contribution made by technological change and related developments. Thus TFP calculations and the resulting assessment of technology's role in growth are based on a clearly specified relationship between indicators already present in the SIDI.

Some constraints The most widely discussed external constraints facing the process of (industrial) growth today are to do with the natural environment. A whole portion of the design structure of the SIDI is devoted to this subject, and the indicators to be developed under the 'environmental heading' are expected to shed quantitative light on the delicate balance between the need for growth through industry on the one hand and the requirements stemming from environmental concerns on the other.

In summary, the SIDI provides both basic and sufficiently detailed quantitative information on the growth of industry, covering the nature, the major sources and some constraints of such growth. This information comes in the form of indicators and in some cases of analytic relationships among such indicators. Going beyond the immediate requirements of standard growth analysis, SIDI indicators can motivate empirical research into a greater number of analytic relationships. These relationships would in many cases invoke comparison across a large number of countries as, for example, in the following three examples:

- (i) The much debated question of whether countries do converge on a single growth path can be explored for the special case of industrial growth and the concomitant hypothesis of 'industrial convergence'.
- (ii) Patterns of international comparative advantage and the specialization emerging from it can be explored with a view to their underlying factor supply differences among countries. This can be done both for patterns of trade and for patterns of industrial production.
- (iii) A supposedly systematic relationship between the level of (industrial) development and compliance with environmental demands can be investigated in considerable detail using hypothesized relationships between appropriately selected members of the SIDI.

II. Analyzing Growth: The Diversity of Industry Performance

Over the recent past economists have shown increasing interest in the diversity of growth performance among countries. Both theoretical and empirical studies have dealt with this subject under headings like ‘Growth and inequality’, ‘The widening income gap’, ‘Convergence or divergence of growth?’ and others. Somewhat less attention has been paid to the other dimension of diverse growth performance, namely, that of growth rate differences among the various units constituting the supply side of an economy. For the policy maker, in particular, reliable information on the latter dimension is of equal if not of even greater interest compared to the former. Accordingly, the present discussion takes up questions surrounding differing growth performance among sectors, industries and even firms.

Yeast versus mushrooms The first question to ask in this connection is about whether there are significant differences at all regarding the nature, sources and constraints among sectors, industries or firms. Or – as one economist has put it metaphorically – whether the growth of an economy is best described as a ‘yeast’ or a ‘*mushrooms process*’. The analogy is based on the well-known fact that yeast causes expansion (of bread) to take place very evenly and uniformly in all directions, while mushrooms have the habit of popping up only in some places and not in others. The common impression of patterns of economic growth as well as most of the systematically collected empirical evidence on the subject are in support of the ‘mushrooms view’. More precisely, growth seems to ‘pop up’ in certain parts of an economy and these parts change over time in a fashion which is not easy to predict.

The sector level The point of departure for investigating the hypothesized ‘mushrooms pattern’ of growth is the relationship between economy-wide growth and growth at the sectoral level where manufacturing industry is expected to provide a case of particular interest to the analyst. Comparison of the respective growth rates or equivalently tracing of the share of manufacturing in total output shows how industry at large contributes to overall economic growth. Here broad expectations are for three successive phases of industrial development: industrial growth exceeding overall growth in the earlier stages, about equal growth rates of the part and the whole at a medium stage of development, and a less vigorous expansion of industry in comparison with overall growth at the late stage of incipient ‘de-industrialization’.

The industry level The main focus of the present exposition of how to analyze growth differentials are patterns at the level of 28 industries (or branches) of the manufacturing sector. In order to keep things manageable in the way of presentation and interpretation of a vast amount of figures, appropriate means of summarizing and displaying statistical evidence have to be used. In this connection, graphical methods are normally used to exhibit the distribution (or rather concentration) of growth among industries and thereby identify several broad types of industrial growth performance.

First of all the *growth of output* of the various industries can be pictured allowing for distinction between different growth patterns. There are a number of characteristic features of such patterns which should lead to a deeper understanding of how the various industries contribute to overall manufacturing growth. First, industries are divided simply by the signs of their growth rates according to whether they add to or subtract from manufacturing growth. Second, if there are examples for

both signs of industry growth rates, it can be shown which portion of production already accounts for the full increase of manufacturing output as well as which set of industries would have produced an even higher aggregate expansion than that of all manufacturing. Third, an indication of the concentration of growth in certain industrial branches can be provided, both regarding the overall degree of such concentration and the identity and specific contributions of the industries involved.

By way of analogy the empirical analysis of the ‘mushrooms phenomenon’ can be carried to the sources-of-growth level with essentially the same technical tools that are applicable to the output level. The immediate extension is to patterns of the *growth of resource inputs* where labour, human capital and physical capital are prime examples. In a next step, increases in productivity can be tackled in much the same fashion with *growth in labour productivity* providing a first approximation to analyzing technical-change sources of industrial growth. In this connection patterns of productivity increase within manufacturing can be analyzed along the lines drawn above for the case of output growth.

In the domain of sources of growth the most interesting, but at the same time the most difficult subject is that of differential *increases in total factor productivity (TFP)*, which is alternatively associated with differential rates of technical change or the variation across industries in relative amounts of ‘real cost reduction’ (RCR). The last one of these three labels proves particularly useful for examining a ‘mushrooms pattern’ of the sources of growth, since it yields convenient conditions for adding up the contributions of the various industries on the one hand and points out the fact that in addition to a most important technological factor a host of other things are likely to be involved in increases of total factor productivity. Or – as Arnold C. Harberger once stated – TFP must be expected to capture ‘at least 1001 ways to reduce real costs’ among which no doubt knowledge and the technical change it produces play a prominent role.

On the basis of industry-specific exercises of growth accounting the pattern within the manufacturing sector of technical-change sources of growth can be assessed. And by use of familiar graphical techniques the concentration among industries of TFP growth can be depicted and evaluated.

The firm level If the objective was a complete account of the ‘mushrooms process’ of industrial growth, the methods outlined above for an analysis in the 28-industry breakdown could be extended to investigations involving firm level information. In analogy to comparison among industries, for firms within a given industrial branch the growth of output, inputs and productivity can be measured and cross-firm variation assessed, summarized and interpreted accordingly. Clearly, the limitations for this final step, involving maximum detail, arise from the availability of data.

With the exception of the last step of firm-level analysis, information contained in the SIDI renders possible a detailed account of the variation across industries of contributions to manufacturing growth as well as the varying significance of the sources of the growth of industry. The completeness of such an account varies from country to country depending on the availability of the required data. Yet, for almost each one of the 138 countries presently covered by the statistics underlying the indicators system some features relating to the ‘mushrooms view’ of industrial growth can be identified, depicted and discussed.

III. Promoting Growth: The Contribution of UNIDO Activities

The majority of UNIDO's activities, one way or another, are about the sources of or constraints to the growth of industry in developing countries. Given the comprehensiveness of the growth account outlined previously, each one of these activities can be assigned a specific place in the framework underlying the aforementioned growth analysis. The location of these places varies from activity to activity. For example, environmentally motivated programmes fall squarely in the area of external 'sustainability' constraints for growth, while growth-enhancing activities may have to do with expanding the input base (e.g., through investment promotion), promoting technical change (e.g., through technology promotion or knowledge diffusion) or bringing about real cost reduction by working on an important one of its 1001 sources (e.g., through quality management or various business support services).

From the above it emerges that - with a view to UNIDO's role and activities - growth analysis of the kind outlined here and the indicators on which it is based serve at least three purposes:

1. For the Organization's functioning as the 'Global Forum' for discussions on the role of 'industry in development' it appears indispensable to portray recurrently the growth of world industry by means of empirical methods. Such portrait has to display sufficient industry detail on the one hand and approach as closely as possible global country coverage on the other – both being objectives of the underlying SIDI.
2. The country-specific assessment of patterns of industrial growth and its sources appears as the analytic prerequisite for identifying areas for potential assistance of the type UNIDO is prepared to offer. In particular, the assignment of weights to different elements in assistance programmes should be informed by – among other considerations - the results of growth analysis.
3. Invoking comparison among countries, the relative significance and special role of major sources of industrial growth need to be re-assessed in a general empirical fashion periodically. Such assessments provide important inputs to programmatic discussions and the resultant adjustments of programmes and activities to changes in the conditions under which industrial development takes place.