

Technical annex

UNIDO Scoreboard database

Exports

Data source: UN Commodity Trade Statistics (Comtrade) database. The technological classification of exports is based on the Standard International Trade Classification (SITC) revision 2 (table A.1).

Data adjustments: Export data refer to 1985 and 1998 except for Panama and South Africa (1986 rather than 1985) and Ethiopia, Malawi, Senegal, Yemen and Zambia (1997 rather than 1998).

- Export data for Singapore for 1998 were scaled down by 40 percent to reflect re-exports.
- Data were adjusted to account for re-exports for Bolivia (high-tech products in 1998), the Central African Republic (medium-tech process engineering products in 1998), El

Salvador (high-tech electronics in 1985), Guatemala (high-tech products in 1985), Jordan (medium- and high-tech products in 1985) and Mozambique, Nigeria and Uganda (all three for medium-tech products in 1985).

- Data for 1985 were unavailable for Albania, the Czech Republic, Romania, the Russian Federation, Slovenia and Yemen.

Manufacturing value added

TOTAL MANUFACTURING VALUE ADDED

Data source: UNIDO National Accounts database.

Data adjustments: Data for total manufacturing value added (MVA) refer to 1985 and 1998 and are based on national accounts statistics from the United Nations Statistics Division, supplemented by national statistics. Missing values were "now cast" using the best econometric model.

SECTORAL MANUFACTURING VALUE ADDED

Data source: UNIDO Industrial Statistics database.

Data adjustments: Because only some of the sample economies report industrial statistics according to the International Standard Industrial Classification of All Economic Activities, Third Revision (ISIC revision 3), data reported according to ISIC revision 3 were converted to ISIC revision 2. To fill in missing values, the ISIC revision 2 series was supplemented with the ISIC revision 3 series. The data were "now cast" to 1998 using the best econometric model. The data were then aggregated using the technological classification of ISIC revision 2 (table A.2).

Because reporting of data at the group (four-digit) level of ISIC is inadequate to allow separation of medium- and high-tech products, the category "high-tech manufacturing" was not

Table A.1 Technological classification of exports according to SITC revision 2

Type of exports	SITC sections, divisions or groups
Resource based	01 (excl. 011), 023, 024, 035, 037, 046, 047, 048, 056, 058, 06, 073, 098, 1 (excl.121), 233, 247, 248, 25, 264, 265, 269, 323, 334, 335, 4, 51, 512 (excl. 512 and 513), 52 (excl. 524), 53 (excl. 533), 551, 592, 62, 63, 641, 66 (excl. 665 and 666), 68
Low tech	61, 642, 65 (excl. 653), 665, 666, 67 (excl. 671, 672 and 678), 69, 82, 83, 84, 85, 89 (excl. 892 and 896)
Medium tech	266, 267, 512, 513, 533, 55 (excl. 551), 56, 57, 58, 59 (excl. 592), 653, 671, 672, 678, 711, 713, 714, 72, 73, 74, 762, 763, 772, 773, 775, 78, 79 (excl. 792), 81, 872, 873, 88 (excl. 881), 95
High tech	524, 54, 712, 716, 718, 75, 761, 764, 77 (excl. 772, 773 and 775), 792, 871, 874, 881

Table A.2 Technological classification of manufacturing value added according to ISIC revision 2

Type of manufacturing	ISIC divisions, major groups or groups
Resource based	31, 331, 341, 353, 354, 355, 362, 369
Low tech	32, 332, 361, 381, 390
Medium and high tech	342, 351, 352, 356, 37, 38 (excl. 381)
High tech	3522, 3852, 3832, 3845, 3849, 385

used; instead, medium- and high-tech products were combined in one category. The sectoral shares of value added were then calculated in relation to the total for all manufacturing sectors.

- Data on MVA by technological classification refer to 1985 and 1998 except for the Central African Republic (data for resource-based MVA refer to 1993 rather than 1998), the Czech Republic and Nigeria (data for low-tech MVA refer to 1995 rather than 1998), Jamaica (data for resource-based MVA refer to 1996 rather than 1998), Jordan (data for resource-based MVA refer to 1997 rather than 1998), Madagascar (data for medium- and high-tech and low-tech MVA refer to 1993 rather than 1998), Mauritius (data for medium- and high-tech and resource-based MVA refer to 1997 rather than 1998), Mexico (data for medium- and high-tech MVA refer to 1994 rather than 1998), Pakistan (data for low-tech MVA refer to 1996 rather than 1998), Saudi Arabia (data refer to 1989 and 1997) and Zimbabwe (data for medium- and high-tech MVA refer to 1995 rather than 1998).
- Data for 1985 were unavailable for Albania, the Czech Republic, Ethiopia, Mozambique, Romania, the Russian Federation, Slovenia and Yemen.

Note: Because of differences in compilation methods and statistical definitions, the figures for sectoral value added from the Industrial Statistics database do not sum to the manufacturing value added reported in the national accounts data.

Research and development financed by productive enterprises

Data sources: Calculated on the basis of data from UNESCO, *Statistical Yearbook 1994* and *Statistical Yearbook 1998*; OECD, *Science, Technology and Industry Scoreboard 1999*; Iberoamerican Network of Science and Technology Indicators

(<http://www.ricyt.edu.ar>); and central banks and other national statistical sources.

Data adjustments: Data refer to 1985 and 1997–1998. Where data were unavailable for those years, values for the closest year available were used.

- Values for OECD countries for 1997–1998 were calculated based on data from OECD, *Science, Technology and Industry Scoreboard 1999*.
- Values for Latin American countries were calculated based on data from the Iberoamerican Network of Science and Technology.
- Data for 1985 were unavailable for Albania, Bahrain, the Czech Republic, the Russian Federation and Slovenia.
- Many countries, particularly in Sub-Saharan Africa, do not report data on R&D financed by productive enterprises. Because of the weak industrial structures of these countries, R&D per capita was assumed to be negligible.

Foreign direct investment inflows

Data sources: World Bank, *World Development Indicators 2000*; UNCTAD, *World Investment Report 1995* and *World Investment Report 1999*; and national statistical sources.

Data adjustments: Data refer to average annual inflows of foreign direct investment during 1981–1985 and 1993–1997.

- Data for 1998 for Bahrain, Belgium, Saudi Arabia and South Africa are from UNCTAD, *World Investment Report 1999*. Data from that source may refer to periods that do not correspond exactly with 1981–1985 and 1993–1997.
- Data for Taiwan Province of China are from Taiwan Province of China, Council for Economic Planning and Development, *Taiwan Statistical Data Book 1998*.
- Data for 1985 were unavailable for Albania, Bahrain, the Czech Republic, Hungary, Nicaragua, Romania, the Russian Federation and Slovenia.

Technology licensing payments

Data sources: World Bank, *World Development Indicators 2000*; central banks; and International Monetary Fund, *Balance of Payments Statistics Yearbook 1999*.

Data adjustments: Data refer to 1985 and 1998. Where data were unavailable for those years, values for the closest year available were used.

- Data for 1985 were unavailable for Japan; data for the closest year available (1984) were used instead.
- Countries for which data for 1998 were unavailable and data for the closest year available were used instead are Albania (1994), Algeria (1991), Bahrain (1995), Cameroon (1995), the Central African Republic (1992), Greece (1997), Guatemala (1993), Jordan (1994), Malawi (1994), Mozambique (1992), Pakistan (1997), Senegal (1997), Sri Lanka (1995), Uganda (1997) and Zimbabwe (1994).
- Balance of payments data from the International Monetary Fund's *Balance of Payments Statistics Yearbook 1999* and national central bank reports were used to calculate licensing payments for Denmark, Hong Kong SAR, Switzerland, Taiwan Province of China and Turkey.
- For countries that do not report technology licensing payments in their balance of payments (Indonesia, Malaysia and Singapore), a proxy value was calculated based on the ratio of licensing payments to payments for "other services" for similar economies. For Malaysia and Singapore royalty payments were assumed to be 25 percent of other services (a ratio similar to that for Taiwan Province of China); for Indonesia they were assumed to be 11 percent (the same ratio as that for Thailand).
- For countries reporting data for 1998 but not 1985, the ratio of royalty payments to other services in 1998 was applied to 1985. Data on payments for other services are from the International Monetary Fund's *Balance of Payments Statistics Yearbook 1999*.
- Data for 1985 were unavailable for Albania, the Czech Republic, Hungary, Romania, the Russian Federation, Slovenia and Yemen.

Skills

Data sources: UNESCO, *Statistical Yearbook 1994* and *Statistical Yearbook 1998*; World Bank, *World Development Indicators 2000*; and national statistical sources.

Data adjustments: Data refer to 1985 and 1997–1998 (latest year available). Where data were unavailable for those years, values for the closest year available were used.

- Data for the Harbison-Myers index in 1985 were unavailable for Albania, Bahrain, the Russian Federation and Slovenia.
- Data for tertiary technical enrolments were unavailable for Albania, Bahrain, the Czech Republic, the Russian Federation, Slovenia and Yemen.

Infrastructure

Data sources: Calculated based on data from World Bank, *World Development Indicators 2001*; OECD, *Science, Technology and Industry Statistics* (<http://www.oecd.org/statistics>); Telecordia Technologies (<http://www.netsizer.com>); and African Internet Connectivity (<http://www.sn.apc.org>).

Data adjustments: Data refer to 1985 and 1998. Where data were unavailable for 1998, values for the closest year available were used.

- Countries for which data for telephone mainlines in 1998 were unavailable and data for the closest year available were used instead are Cameroon (1997), Guatemala (1997), Jamaica (1997), Kenya (1997), Yemen (1997) and Zimbabwe (1997).
- Countries for which data for mobile phones in 1998 were unavailable and data for the closest year available were used instead are Cameroon (1997), Ghana (1997), Jamaica (1996) and Kenya (1997).
- Countries for which data for computers in 1998 were unavailable and data for the closest year available were used instead are Algeria (1997), Cameroon (1995), Ghana (1997), Jordan (1997), Kenya (1997), Madagascar (1997), Morocco (1997), Mozambique (1997), Nigeria (1997), Senegal (1997), Sri Lanka (1997), the United Republic of Tanzania (1997), Uganda (1997), Yemen (1997) and Zimbabwe (1997).
- Data for commercial energy use in 1985 were unavailable for Albania, Bahrain, the Russian Federation, Slovenia and Yemen.
- Data on Internet hosts refer to 2001 and are from Telecordia Technologies.
- Data on information and communication technology for Africa not available in the World Bank's *World Development Indicators 2001* are from African Internet Connectivity.

- Data for Taiwan Province of China are from Taiwan Province of China, Council for Economic Planning and Development, *Taiwan Statistical Data Book 1998*.

Industrial Performance Scoreboard

UNIDO's Industrial Performance Scoreboard was developed in four stages. In the first stage a database of industrial indicators (both output and input factors) for 1985 and 1998 was created for as many countries as possible. Indicators were chosen on the basis of the availability of cross-country data. Four performance indicators—MVA per capita, manufactured exports per capita, the share of medium- and high-tech activities in manufacturing production and the share of medium- and high-tech products in manufactured exports—were chosen for the competitive industrial performance (CIP) index.

In the second stage individual indices of performance $I_{j,i}$ were standardized according to the general formula

$$I_{j,i} = \frac{X_{j,i} - \text{Min}(X_{j,i})}{\text{Max}(X_{j,i}) - \text{Min}(X_{j,i})}$$

where $X_{j,i}$ is the i th country value of the j th performance variable. Therefore the highest country in the ranking has a score of 1 and the lowest a score of 0.

The third stage consisted of testing the feasibility of computing a composite index based on the four performance indicators selected. Positive and statistically significant correlations between the four performance variables confirmed that a composite index could be constructed as a proxy for overall industrial performance.

The CIP index was constructed using the standardized values of the four performance indicators, according to this general formula:

$$CIP_{(\alpha)} = \left(\frac{w_1 I_{1,i}^\alpha + w_2 I_{2,i}^\alpha + w_3 I_{3,i}^\alpha + w_4 I_{4,i}^\alpha}{w_1 + w_2 + w_3 + w_4} \right)^{\frac{1}{\alpha}}$$

where $I_{j,i}$ represents the i th value of the four individual indices, w_n the weights given to the indices and α a parameter to control how the variations and weights in the individual indices affect the CIP index.

Initially, a different weight w_j was assigned to each performance indicator $I_{j,i}$. Stability tests confirmed that the weights did not significantly affect ranks, however, so equal weights were allocated to the four performance indicators. With $w_1 = w_2 = w_3 = w_4 = 1$, the general formula then became the following:

$$CIP_i(\alpha) = \frac{1}{4} \left[I_{1,i}^\alpha + I_{2,i}^\alpha + I_{3,i}^\alpha + I_{4,i}^\alpha \right]^{\frac{1}{\alpha}}$$

To further simplify, $\alpha = 1$ was chosen, and the result is the simple arithmetic mean of $I_{1,i}$, $I_{2,i}$, $I_{3,i}$ and $I_{4,i}$. Thus,

$$CIP_i = CIP_i(1) = \frac{1}{4} \sum_{j=1}^4 I_{j,i}$$

Cluster analysis

Cluster analysis is a statistical technique for identifying relatively homogeneous groups of cases according to their quantitative features. The version used for the report is K-means cluster analysis, which is used to cluster large numbers of observations, with squared Euclidean distance (the sum of the squared differences over all the variables) employed to identify a specified number of clusters. The algorithm used for determining the membership of clusters is based on nearest centroid sorting. The values obtained for each cluster are simply the standardized average values of the variables for cases in the clusters. However, data presented in the report have been de-standardized to show averages of real values.