APPENDIX I
METHODOLOGY AND PRINCIPLES OF ANALYSIS

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What is the World Competitiveness Yearbook?

The IMD World Competitiveness Yearbook (WCY) is the world's most thorough and comprehensive annual report on the competitiveness of nations, published without interruption since 1989. It is considered to be the first access point to world competitiveness, providing objective benchmarking and trends, as well as a worldwide reference point to statistics and opinion data that highlight the competitiveness of key economies. The WCY analyzes and ranks the ability of nations to create and maintain an environment that sustains the competitiveness of enterprises. An economy's competitiveness cannot be reduced only to GDP and productivity because enterprises must also cope with political, social and cultural dimensions. Therefore nations need to provide an environment that has the most efficient structure, institutions and policies that encourage the competitiveness of enterprises.

This year, the WCY provides extensive coverage of 55 economies, all key players in world markets. In this 2008 edition, we have added Peru as an additional country. All economies are chosen because of their impact on the global economy and the availability of comparable international statistics.

Over 300 competitiveness criteria have been selected as a result of extensive research using economic literature, international, national and regional sources and feedback from the business community, government agencies and academics. The criteria are revised and updated on a regular basis as new theory, research and data become available and as the global economy evolves. A long-established collaboration with our Partner Institutes worldwide also helps ensure that the data is reliable, accurate and as up-to-date as possible. This year, we have the privilege of collaborating with a unique network of 52 Partner Institutes.

Who uses the World Competitiveness Yearbook?

The WCY is an invaluable, dynamic and constantly updated benchmark for decision-makers. The business community uses it to help determine and validate investment plans and to assess locations for new operations. Governments find important indicators to benchmark their policies against those of other countries, to evaluate performance over time and to learn from the "success stories" of nations that have improved their competitiveness. The academic world also uses the exceptional wealth of data in the WCY to better understand and analyze how nations (and not only enterprises) compete in world markets.

TABLE I ● Competitiveness Factors	
Economic Performance (80 criteria)	Macro-economic evaluation of the domestic economy: Domestic Economy, International Trade, International Investment, Employment and Prices.
Government Efficiency (73 criteria)	Extent to which government policies are conducive to competitiveness: Public Finance, Fiscal Policy, Institutional Framework, Business Legislation and Societal Framework.
Business Efficiency (70 criteria)	Extent to which the national environment encourages enterprises to perform in an innovative, profitable and responsible manner: Productivity and Efficiency, Labor Market, Finance, Management Practices and Attitudes and Values.
Infrastructure (108 criteria)	Extent to which basic, technological, scientific and human resources meet the needs of business: Basic Infrastructure, Technological Infrastructure, Scientific Infrastructure, Health and Environment and Education.

How does the World Competitiveness Yearbook measure Competitiveness?

During the past two decades, the methodology to assess the competitiveness of nations has constantly been fine-tuned to take into account the evolution of the global environment and new research. In this way, the WCY keeps pace with structural changes in national environments and the rapidly changing technological revolution. We made these changes gradually so that we could continue to compare the results from year to year and highlight the evolution of an economy's performance relative to the competitiveness of others. Based on analysis made by leading scholars and by our own research and experience, the methodology of the WCY divides the national environment into four main Competitiveness Factors: Economic Performance, Government Efficiency, Business Efficiency and Infrastructure. Each of these four factors has been broken down into five sub-factors, each highlighting different facets of competitiveness. Altogether, the WCY features 20 such sub-factors. (See Tables 1 and 2).

Some of these sub-factors have been further divided into categories that define competitiveness issues more explicitly. All criteria have been grouped into these sub-factors and categories. However, each sub-factor does not necessarily include the same number of criteria (for example, it takes more criteria to assess Education than to evaluate Prices). Each sub-factor, independently of the number of criteria it contains, has the same weight in the overall consolidation of results, that is 5% (20 x 5 = 100). This allows us to "lock" the weight of the sub-factors regardless of the number of criteria they include. We believe that this approach improves the reliability of the results and helps ensure a high degree of compatibility with past results. Statistics are sometimes prone to errors or omissions… Locking the weights of sub-factors has the same function as building "fire barriers"; it prevents problems from spreading in a disproportionate way. In addition, the past five years' results are calculated for every economy covered by the WCY, in order to highlight the evolution of competitiveness.
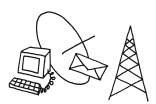
The WCY uses different types of data to measure quantifiable and qualitative issues separately. Statistical indicators are acquired from international, national and regional organizations, private institutions and our network of 52 Partner Institutes worldwide. These statistics are referred to in the WCY as Hard data and include 131 criteria used to determine the overall rankings and 77 criteria presented as valuable background information but not used in the calculation of the rankings. The 131 Hard criteria represent a weight of approximately two-thirds in the overall ranking. An additional 123 criteria are drawn from our annual Executive Opinion Survey and are referred to in the WCY as Survey data. The survey questions are included in the Yearbook as individual criteria and are also used in calculating the overall ranking, representing a weight of approximately one-third.

Executive Opinion Survey

Every year, we conduct an Executive Opinion Survey in order to complement the statistics that we use from international, national and regional sources. Whereas the Hard data shows how competitiveness is measured over a specific period of time, the Survey data measures competitiveness as it is perceived. The survey was designed to quantify issues that are not easily measured, for example: management practices, labor relations, corruption, environmental concerns or quality of life. The survey responses reflect present and future perceptions of competitiveness by business executives who are dealing with international business situations. Their responses are more recent and closer to reality since there is no time lag, which is often a problem with Hard data that shows a "picture of the past".

The Executive Opinion Survey is sent to executives in top- and middle management in all of the economies covered by the WCY. In order to be statistically representative, we

TABLE 2 ● The Breakdown of Competitiveness Factors

Economic Performance	Government Efficiency	Business Efficiency	Infrastructure
Domestic Economy			Basic Infrastructure
	Public Finance	Productivity	Technological Infrastructure
International Trade	Fiscal Policy	Labor Market	
International Investment	Institutional Framework	Finance	Scientific Infrastructure
Employment	Business Legislation	Management Practices	Health and Environment
Prices	Societal Framework	Attitudes and Values	Education

select a sample size which is proportional to the GDP of each economy. The sample of respondents should be representative of the entire economy, covering a cross-section of the business community in each economic sector: primary, manufacturing and services, based on their contribution to the GDP of the economy. The survey respondents are nationals or expatriates, located in local and foreign enterprises in the country and which, in general, have an international dimension. They are asked to evaluate the present and expected competitiveness conditions of the country in which they work and have resided during the past year, drawing from the wealth of their international experience, thereby ensuring that the evaluations portray an in-depth knowledge of their particular environment. We try to contact most IMD alumni and all responses returned to IMD are treated as confidential. The surveys are sent in January and are returned in March; in 2008, we received 3,960 responses from the 55 economies worldwide.

The respondents assess the competitiveness issues by answering the questions on a scale of 1 to 6. The average value for each country is then calculated and converted into a 0 to 10 scale. Finally, the survey responses are transformed into their standard deviation values, from which the rankings are calculated.

How are the rankings computed?

The essential building block for the rankings is the standardized value for all the criteria, which we call the STD value. The first step is to compute the STD value for each criterion using the data available for all of the economies. (For more details, see Data Processing Methodology that follows). We then rank the economies based on the 254 criteria that are used in the aggregation, 131 Hard and 123 Survey data. The additional 77 criteria are presented for background information only. They are not included in the aggregation of data to determine the overall rankings. In most cases, a higher value is better, for example, for Gross Domestic Product; the economy with the highest standardized value is ranked first while the one with the lowest is last. However, with some criteria the inverse may be true, where the lowest value is the most competitive, for example, Consumer Price Inflation. In these cases, a reverse ranking is used: the economy with the highest standardized value is ranked last and the one with the lowest is first.

Since all economies' statistics are standardized, they can be aggregated to compute indices. We use these index values, which we call "scores", to compute the following rankings: the Overall Scoreboard, Competitiveness Factor rankings

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TABLE 3 ● Computing the Rankings
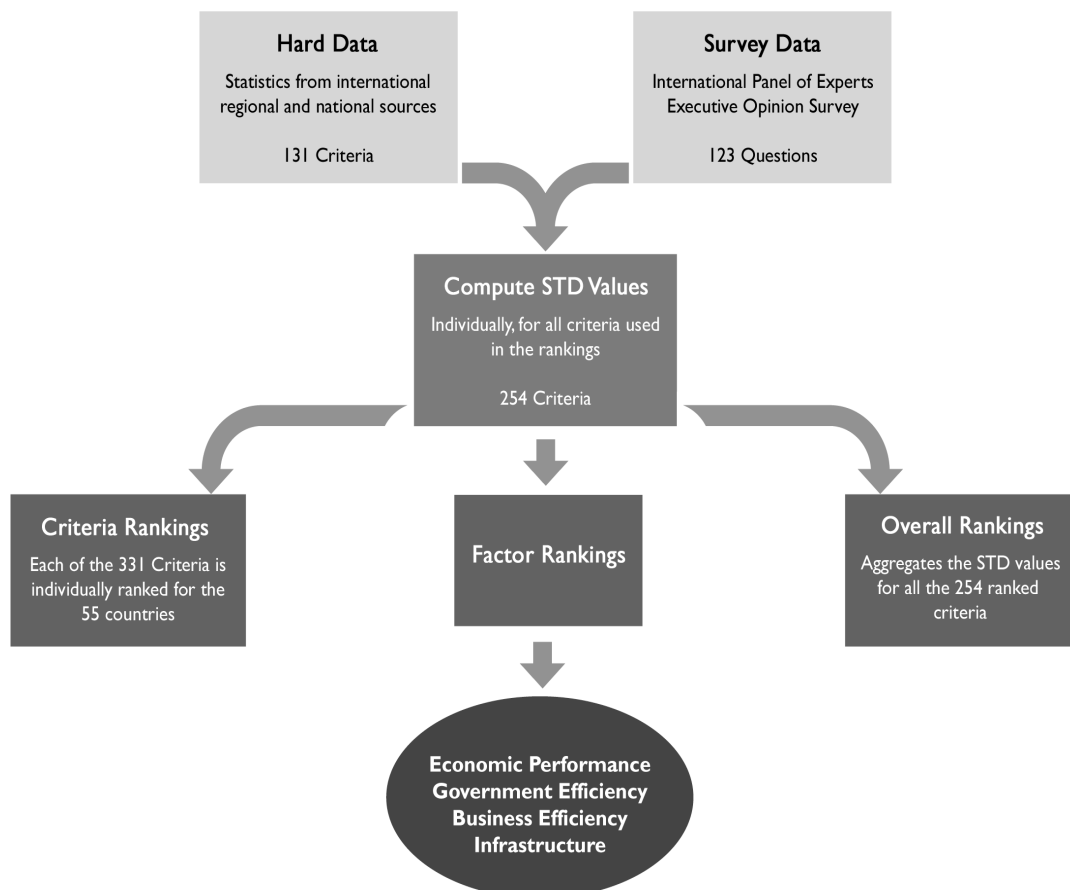
and Sub-factor rankings. When data is unavailable or too old to be relevant for a particular country, the economy appears at the bottom of the statistical table for the criterion being measured and a dash is shown. In the aggregation of the statistics, all missing data is replaced with a STD value equal to zero. Although this might lead to an overly optimistic view of the competitiveness situation of an economy, we believe that it is the fairest method to use. See Table 3: Computing the Rankings.

Data Processing Methodology

There are 331 criteria in The World Competitiveness Yearbook, of which 254 are used to calculate the Overall Competitiveness rankings. The remaining 77 criteria are presented as background information only.

Every economy's performance is assessed for each criterion using the Standard Deviation Method (SDM) which is described below. In most cases, a higher value is better, for example, for Gross Domestic Product; the economy with the highest standardized value is ranked first while the one with the lowest is last. However, with some criteria, the lowest value is the most competitive, which is the case for Consumer Price Inflation. In these cases, a reverse ranking is used: the economy with the highest standardized value is ranked last and the one with the lowest is first.

Standard Deviation Method

As most of the criteria are scaled differently, a comparable standard scale is used to compute the overall, factor and sub-factor results. The Standard Deviation Method (SDM) is used. It measures the relative difference between the economies' performances; therefore, each country's relative position in the final rankings is more accurately assessed.

First, for each criterion, we compute the average value for the entire population of economies. Then, the standard deviation is calculated using the following formula:

$$S = \sqrt{\frac{\sum (x - \overline{x})^2}{N}}$$

Finally, we compute each of the 55 economies' standardized values (STD) for the 254 ranked criteria. The STD is calculated by subtracting the average value of the 55 economies from the economy's original value and then dividing the result by the standard deviation.

The STD value for criteria i is calculated as follows:

$$(\text{STD value})_i = \frac{x - \overline{x}}{S}$$

Where:

x = original value
$\overline{x}$ = average value of the 55 economies
N = number of economies
S = Standard Deviation

Aggregation of Data and Rankings

First, for each individual criterion, the economies' standardized values are calculated based on the STD Method described above. Based on the results, the economies are shown in ranking order for each of the 254 ranked criteria. A high STD value can reflect good or bad performance; again, this depends on what the data is intended to measure and which competitiveness factor it is in.

The sub-factor rankings are then determined by calculating the weighted average of the criteria STD values that make up the sub-factor, excluding the background criteria. All the hard data have a weight of 1. The survey data are weighted so that the survey accounts for one-third in the determination of the overall ranking. Thus, for 2008, each survey criterion has a weight of 0.5. When data is unavailable for particular economies, the missing values are replaced by a STD value equal to 0. The weighted average for each sub-factor enables us to "lock" the weight of the 20 sub-factors independently of the number of criteria they contain so that each sub-factor has an equal impact on the overall ranking, that is 5%.

Next, we aggregate the sub-factor average STD values to determine the Competitiveness Factor rankings which are shown in the Competitiveness Factors section. Only ranked criteria are aggregated to obtain these rankings.

The STD values of the Competitiveness Factors are then aggregated to determine the Overall Scoreboard. All the ranked criteria comprised in the four competitiveness factors are thus included in the consolidation of data.

The 77 remaining criteria are presented as background information only and are not included in any aggregation of data to determine rankings. Some background data are presented in ranking order while others are shown alphabetically, depending on what the data is meant to measure.

Since all of the statistics are standardized, they can be aggregated to compute indices. We use these index values, which we call "scores", to compute the rankings for the four Competitiveness Factors and the Overall Scoreboard.

It should be noted that across the four Competitiveness Factors, only one economy will have a value equal to 100 and

one economy will have a value equal to 0. To calculate the Overall Scoreboard, we take the average of the four Factors' scores and then convert them into an index with the leading economy given a value of 100.

Survey Criteria

Each year we conduct a survey to quantify issues related to competitiveness for which there are no hard statistics, or for data that are available with a time lag. The survey is an in-depth 123-point questionnaire sent to top- and middle management in the 55 economies covered by the WCY. The distribution reflects a breakdown of industry by sectors: Agro/Extracting, Industry/Manufacturing and Services/Finance. In order to be statistically representative, we select a sample size which is proportional to the GDP breakdown of economic sectors of the economy.

In 2008, we had 3,960 executives respond to the survey for an average of approximately 72 per country. The target list is determined by IMD and has been developed over many years with the collaboration of our Partner Institutes worldwide. Confidentiality is ensured and the list is revised and updated every year. The questions only concern the country in which the executives work and have resided for the past year; therefore, the results reflect widespread knowledge about each economy and draw on the wealth of their international experience.

The respondents assess the competitiveness issues by answering the questions on a scale of 1-6, with the response 1 generally indicating a negative perception and 6 indicating the most positive perception. The WCY calculates the average value for each economy, then the data is converted from a 1-6 scale to a 0-10 scale. Finally, the survey responses are transformed into their standard deviation values, from which the rankings are calculated.

Trends

A trend or growth rate, while offering a more dynamic assessment than absolute values, is meaningful only if a economy's actual comparative advantage or disadvantage at one point in time is also measured. The formulas used to calculate trends and growth rates are explained below:

1. Annual real growth rate (i = inflation rate):

$$\left(\frac{value_{2008}}{value_{2007} \left(1 + \frac{i_{2008}}{100} \right)} - 1 \right) \times 100$$

2. Average annual percentage growth rate (n = number of periods):

$$\frac{\dfrac{value_{2008} - value_{2007}}{value_{2007}} + \dfrac{value_{2007} - value_{2006}}{value_{2006}} + ...}{n - 1} \times 100$$

But growth formulas may have shortcomings. The average annual growth rate fails to reveal the real extent of changes, as it flattens or inflates year-to-year growth rates. For example, an average growth rate over two years might be calculated at 15 percent, while in reality there was 5 percent growth between the first and second years, and 25 percent between the second and third years. The average annual growth is used only when data vary widely in the middle years of a period, and less widely between the first and last years of the period. It is also used in cases where it is impossible to combine negative and positive initial and final values. This approach gives a more accurate picture than does the compound rate under these circumstances.

Deflated values

The following formula is used when calculating real growth rates from nominal values, because it takes into account cumulative inflation (e.g. real growth in Private Final Consumption Expenditure). The final deflated value is then used to obtain the annual real growth rate.

Taking a 5-year time span as an example:

Deflated final value (i = inflation rate):

$$\frac{value_{2008}}{\left(1 + \frac{i_{2004}}{100} \right) \times \left(1 + \frac{i_{2005}}{100} \right) \times ... \times \left(1 + \frac{i_{2008}}{100} \right)}$$