

## **THE WORLD INPUT-OUTPUT MODEL (WIOM)**

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### **Summary**

The WIOM (World Input-Output Model) was constructed in the 1970s. It was first made public at the IIASA Global Modelling Symposium in 1977. The purpose of the model is to depict images of the future world economy with the constraints of resources, energy, and environment under alternative policy scenarios for the UN International Development Strategy. It classifies the world into 15 regions where each regional model has 45 sectors of economic activities. Based on policy simulation results of the model, this study reveals a broad global framework of sustainable development of the world economy.

### **1. Historical Background of WIOM**

The UN General Assembly adapted the International Development Strategy in 1970, which expressed concerns with environmental questions. That document said that efforts at both national and international levels should be intensified “to arrest the deterioration of the human environment and to take measures towards its improvement, and to promote activities that will help maintain the ecological balance on which human survival depends.” Numerous other undertakings by the UN amounted to higher level of awareness of environmental concerns. In accordance with principles adopted in resolutions for economic development and the environment, the UN initiated a study in 1973 to analyze the future impact of prospective economic developmental issues and those policies cited in the International Development Strategy.

Under such circumstances, an integrated global model is needed to show the various possible interrelationships between environment and other economic policies for sustainable development over future decades. Wassily Leontief, who created the first input-output analysis and had been developing the input-output table since 1932, together with other economists developed the first World Input-Output Model in 1977 for the UN International Development Strategy. The global input-output model analysis is a methodology that emphasized the importance of systematic relationships between various economic activities and environmental issues at regional and global levels.

The primary objective of the study was to construct a long-term, global economic forecasting model to investigate the interrelationships between future global economic growth and environmental questions. Global sustainable development issues include availability of natural resources, the degree of pollution associated with the production of goods and services, and the economic impact of abatement policies. Considering complex international relationships, changing economic and environmental conditions through technological progress and policy measures, and so on, it is indispensable for policy decisionmakers to have an understanding of the impact of policies on the world economy by making use of long-term economic forecast simulations. The future of the global economy's state of affairs could be elucidated through policy exercises by simulations of the World Input-Output Model (WIOM).

WIOM classifies the world into 15 regions where each regional model has 45 sectors of economic activities. Based on policy simulation results of the model, this study reveals a broad global framework of sustainable development of the world economy. Thus, the model shows the possible direct or indirect impact of a given region's sustainable development policies on other regions of the world.

After multiregional and multisector economic relations are depicted by WIOM, a number of policy scenarios are then created. The differences in scenarios are basically assumptions about the future growth rate of population, per capita gross domestic product, and some examine the implications of various sets of income targets and the alternative means by which they can be effectively attained. The model is run under various economic and environmental policy scenarios. Based on these policy scenario simulations, one can see the consequences of alternative policy exercises. The model's practical application lies in comparisons of policy implications made clear by making simulations of alternative policy scenarios.

## **2. Scope and Methodology**

The scope of the World Input-Output Model covers such issues as environment, foods and agriculture, mineral resources, pollution and pollution abatement, structural changes in the economies, exports and imports, balance of payments, ODA (Official Development Assistance), and changes in international economic relations. The cross-sectional time span for projections was set at 1970, 1980, 1990, and 2000.

WIOM divides the world economy into fifteen regions as follows:

1. North America: Canada, US
2. Latin America (medium-income)

3. Latin America (low-income)
4. Europe (high-income)
5. Europe (medium-income)
6. Soviet Union
7. Eastern Europe
8. Asia (centrally planned): China
9. Asia (high-income): Japan
10. Asia (low-income)
11. Middle East/Africa (oil producers)
12. Africa (arid)
13. Africa (tropical)
14. Africa (medium-income): South Africa
15. Oceania: Australia and New Zealand

In accordance with the economic types and systems, there are three categories: developed market countries, developing countries, and centrally planned countries. Six regions are included in the developed market countries category such as North America, Western Europe (high-income), Western Europe (medium-income), Japan, Oceania, and Africa (medium-income), meaning the country of South Africa.

Developed centrally planned regions include the Soviet Union and Eastern Europe. Furthermore, developing countries are classified into two groups, namely group II and group I. Developing group I covers those nations that are rich in resource endowment. They are Latin America (low-income), Mid-East Africa (oil producers), and Africa (tropical). Developing group II includes resource-poor developing countries: Latin America (medium-income), Africa (arid), Asia (low income), and Asia (centrally planned).

The primary criterion employed in the classification scheme is the level of economic development as measured by per capita income levels and the share of manufacturing activity in total GDP. Also, identification of certain variables was important for the study. Other economic considerations guided principles for classification such as major oil-exporting countries being grouped together.

For African nations, a distinction was made between those receiving less than ten inches of rainfall annually and those receiving more. In general, the regional groups respected continental boundaries. Exceptions were made for the oil-producing countries of the Middle East and Africa, which were grouped into one region. In a few other instances, geopolitical considerations overrode the economic basis for aggregation.

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## Biographical Sketches

**Wassily Leontief** was educated at the University of Leningrad. He got his Ph.D. from the University of Berlin in 1928. He received honorary doctorates from York University, England, 1967; University of Louvain, 1971; University of Paris, 1972; University of Pennsylvania, 1976; University of Lancaster, England, 1976; and University Cordoba, 1990. He worked as a research economist at the Institute Weltwirtschaft, Kiel University, Munich, Germany, 1927–1928. He was assistant professor at Harvard University, Cambridge, Massachusetts, US, 1933–1939, associate professor, 1939–1946, professor, 1946–1975. Then he became professor of economics at New York University, 1975–1999. He was Founder of the Institute of Economic Analysis, 1978–1985; Consultant to the US Department of Labor, 1941–1947; US Office of Strategic Services, 1943–1945; UN, 1961–1962; US Department of Commerce, 1966–1982; US Environmental Protection Agency, 1975–1980; UN, 1980. Professor Leontief is well known as the author of *The Structure of the American Economy, 1919–29*, Second Edition, 1976; *Studies in the Structure of the American Economy*, 1953, Second Edition, 1977; *Input-Output Economics*, 1966, Second Edition, 1986; *Collected Essays*, 1966; *Theories, Facts and Policies*, 1977; *The Future of the World Economy*, 1977. He was a member of the Commission to Study the Organisation of Peace, 1978, and trustee, North Carolina School of Science and Mathematics, 1978, and on the US Committee for National Security, 1980. He was a decorated officer of the Order Cherubim of the University of Pisa, 1953; Legion of Honor (France), 1967; Order of the Rising Sun (Japan), 1984; French Order of Arts and Letters, 1985. He was recipient of the Bernhard-Harms prize in economics from the Federal Republic Germany, 1970, and received the Nobel Prize in economics, 1973.

**Akira Onishi** is Director, Centre for Global Modeling, Japan, professor emeritus, former Vice-President of Soka University, and an economics and global modeling educator. His academic background is in both economics and systems engineering. He has a Ph.D. in Economics from Keio University and a Ph.D. in Systems Engineering from Tokyo Institute of Technology. He had the opportunity to work at the UN ESCAP and the ILO, 1966–1970. Then he served at Soka University, Tokyo, as Dean, Department of Economics, 1976–1991; Dean, Graduate School of Economics, 1976–1991; Director, Soka University Institute for Systems Science (SUISS), 1990–2001; Dean, Faculty of Engineering, 1991–1995; Dean, Graduate School of Engineering, 1995–99; Vice President, 1989–2001. He served as President of the Japan Association of Simulation and Gaming, 1993–1997. He has received many academic awards: the International Biographical Roll of Honor to the Global Modeling Profession from the American Biographical Institute, US, 1989; the first Supreme Article Award from the Japanese Association of Administration and Planning, 1991; the 20th Century Award for Achievement from the International Bibliographic Centre, Cambridge, England, for Global Modeling, 1993; the Excellent Article Award from ECAAR, 1997; the Japan Association Simulation and Gaming Award, 1998; 2000 Outstanding Intellectuals of the 20<sup>th</sup> Grand from the IBC, 1999. He was selected as one of the First Five Hundred in 2000 for service to Economic Science by the IBC. Professor Onishi has made a large contribution to global modeling through numerous articles and conferences. He is well known as an original designer of the **FUGI** (*FU*tures of *G*lobal *I*nterdependence) model. The UN Secretariat, Department of International Economic and Social Affairs, adopted this model for long-term projections and policy simulations of the world economy from 1981 to 1991. During the period 1985–1986, he designed the Global Early Warning Systems for Displaced Persons (FUGI-GEWS) under the auspices of the UN Independent Committee of Human Rights. The UNCTAD Secretariat has officially adopted the FUGI global modeling system (FGMS200) for projections of the world economy and policy scenario simulations since 2000. The FUGI Model 9.0 M200 as an integrated global model can provide not only global information on the sustainable development but also on displaced persons or refugees that might be seen as serious global issues in the 21st century.