MILLENNIUM
I N S T I T U T E
promoting systems literacy and dynamic modeling tools for sustainable development worldwide

ECONOMY · ENVIRONMENT · SOCIETY

T21

INTEGRATED DEVELOPMENT MODEL

Introduction and Purpose of Threshold 21

Need for Comprehensive, Integrated Planning

When envisioning a progressive future with comprehensive development, countries generally emphasize the process of economic development and target higher Gross Domestic Product as an outcome. Yet, countries also want to see the environment stay healthy so that there is clean air, clean water, plentiful energy, and biodiversity. They also understand the importance of addressing education and health care, lowering unemployment, and reducing poverty. These goals may sometimes be seen as conflicting, where addressing one will complicate the other. Yet ways can be found to ensure that progress can be made on all goals.

In developing comprehensive national plans, countries formulate strategies to achieve these visions. Examples include Poverty Reduction Strategies (PRSs) and plans to meet the Millennium Development Goals

(MDGs). These strategies must then be converted into operational plans and budgets. The plans, strategies, and budgets must be comprehensive and be underpinned by rigorous quantitative analysis to ensure that resources are allocated effectively.

In brief, planning must take into account the interdependent and integrated nature of economic and other development processes. Economic growth, for instance, requires a healthy and educated workforce. A healthy and literate workforce requires adequate investment in social services. If planning does not consider the links between economics, society, and the environment, opportunities will be missed for yielding the desired results within real budget and time constraints. Unintended impacts may stifle progress and cause a country to move away from its vision rather than toward it.

Socio-economic systems are complex. A mental representation of the reality cannot adequately comprehend all of the elements involved. The use of sectoral models in isolation can provide preliminary material for a comprehensive plan but still need to be integrated in a robust analytical framework. Typically, each agency or stakeholder participating in the planning process will have its own model, focusing on their own priorities and sectors, and rarely considering the impact on, or needs of the other sectors. Building a framework that considers the full range of interconnected factors that can help decision-makers evaluate different options and compare results is a major challenge to effective planning. When implemented, such a framework forms the basis for rational discussions among stakeholders, and provides a common framework or 'language' for examining the implications of the different approaches. National development planning efforts such as MDG-based PRSPs, all require such an integrated approach.

T21: Analytic Support for Comprehensive, Integrated Planning

Threshold 21 (T21) is designed to support comprehensive, integrated planning and is a valuable quantitative tool for policy testing, monitoring, and evaluating results. Once a country identifies its vision,

and key goals are determined, T21 generates scenarios describing the future consequences of the proposed strategies. Users can quickly trace changes in outcomes back to the assumptions and polices that produced those changes. This capability helps users identify vital leverage points and key assumptions.

T21 supports comparative analysis of different policy options, in order to identify the set of policies that tend to move the system more rapidly towards the stated goals. This process also deepens understanding of development challenges in the different sectors and how they interact, so that planners can better explain what is likely to happen, and why. Several countries have already adopted T21 as the best tool to support their PRS analysis and to design strategies to achieve the MDGs.

Features of Threshold 21

T21 is built to support an integrated and comprehensive medium to long-term planning process. The model is customized for a country based on the T21 Starting Framework, which can be readily modified and adapted to address country-specific issues. The Starting Framework has been developed and field tested for more that twelve years, and has the following key characteristics:

- integrates economic, environmental and social elements using a system dynamics approach;
- helps create sustainable development strategies and policies by simulating possible impacts of alternative policy choices and strategic options;
- facilitates transparency, participation, and consensus building by encouraging open consultations with diverse stakeholders and external development partners within a common framework and an easy-to-understand interface;
- flexible and can be customized to address the unique needs of individual countries through the use of a modular design where existing sectors can be modified and new sectors can be added;
- produces output for policy documents including a national budget, national development plans, the Country Assistance Strategy (CAS), the Poverty Reduction Strategies (PRSs) or UN Development Assistance Framework (UNDAF); and
- generates nearly all of the MDGs indicators.

In order to facilitate full appropriation of the tool, the Millennium Institute builds local capacity for continued use of T21 for development analysis and planning through a process of training and partnership
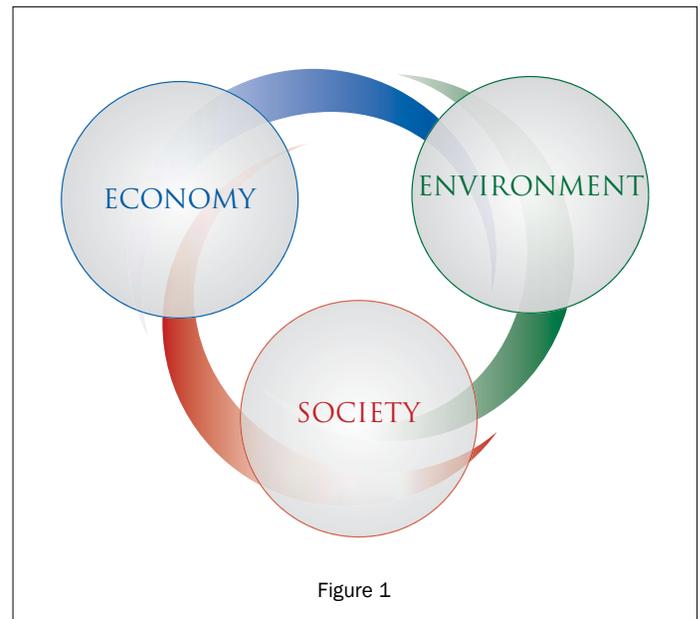
based on technology that is easy to understand, use and adopt.

Design of Threshold 21

T21 has evolved over the past 25 years from extensive research and application by the Millennium Institute. It is based on the best and/or most broadly respected sector models, which have been adapted and integrated in its framework.

Independent reviews confirm that T21 possesses sound economic foundations and performs better than the other integrated models currently available. Experts at the World Bank, UNDP, and The Carter Center examined T21 closely and determined it is very well suited for MDG analysis and PRS and other planning exercises.

Figure 1 presents a conceptual overview of T21, with linkages between the economic, social, and environmental spheres. Within each sphere are sectors that interact with each other and with sectors in the other spheres.

Figure 1

The **Economy** sphere contains major production sectors (agriculture, industry and services), which are characterized by Cobb-Douglas production functions with inputs of resources, labor, capital, and technology. Specific issues, such as the sugar industry, micro-credit, transportation, agricultural extension, livestock, and hydro power, are included production sub-sectors. A Social Accounting Matrix (SAM) is used to elaborate the economic flows and to balance supply and demand in each of the sectors. Demand is based on population and

per capita income and distributed among sub-sectors using Engle's Curves. This helps calculate relative prices, which are the basis for allocating investment among the sectors. The government sector generates taxes based on economic activity and allocates expenditures by major category. Public expenditure impacts on the overall economic performance and on the delivery of public services. Standard IMF budget categories are employed and key macro balances are incorporated into the model. The Rest of the World sub-sector comprises trade, current account transactions, and capital flows (including debt management).

The **Social** sphere contains detailed population dynamics by sex and age cohort; health and education challenges and programs; basic infrastructure; employment; and poverty levels and income distribution. These sectors take into account, for example, the interactions of income, healthcare and adult literacy rates on fertility and life expectancy, which in turn determine population growth. Population determines the labor force, which shapes employment. Education and health, together with other factors, influence labor productivity. Employment and labor productivity affect the level of production from a given capital stock. An HIV/AIDS sector is also included, which shows the possible evolution of infections, the impacts of the disease on population and productivity, and the effects of different treatment programs. Food sufficiency and nutrition, reproductive health, and vocational training are also addressed.

The **Environment** sphere tracks pollution created in the production processes and its impacts on health, and eventually on production. It also estimates the consumption of natural resources – both renewable and non-renewable – and can estimate the impact of the depletion of these resources on production and other factors. It also examines the effect of soil erosion and other forms of environmental degradation and their impact on other sectors, such as agricultural productivity and nutrition. Additional issues addressed are fossil fuel use, forest depletion, land and water degradation, air and water pollution, and greenhouse gas emissions.

Customizing T21 for a Country

T21 country models are customized based on the T21 Starting Framework, a set of interconnected sectors combined into a rigorous macroeconomic framework. The sectors and their interrelations aim at representing the fundamental mechanisms that are responsible for socio-economic development.

T21 is highly flexible and can be easily adapted to address country specific issues during the model's customization process. This customization takes place in close cooperation with a team of country experts from the office or agency where the model will be institutionalized, and often from other groups (usually civil society or academic institutions) that are also interested in contributing to the analysis. This assures that the design of the model structure and calibration represents the local understanding of the socio-economic system and the primary issues for strategic analysis.

The interactive customization process helps build domestic capacity and transfer full use and management of the model to the country. The process unfolds over about one year or more, with the first three or four months devoted to the initial customization of T21 for country review during a capacity building workshop. Through several iterative stages of model refinement, capacity building, and consultation, the country has a chance to shape the model, add and modify sectors, and integrate the use of the model into key policy analysis, planning, and consensus-building processes.

T21 Application Experiences

T21 has been applied effectively in several countries, including Jamaica, Ghana, Malawi, Mali, Papua (Indonesia), Mozambique, Bhutan, Cape Verde, and more. International Development agencies such as UNDP, UNEP, CIDA, the World Bank, Conservation International, and the Carter Center supported these country projects. Some recent application of T21 examples include:

China: T21 was first customized for China in 2005 to examine the impacts of rapid economic growth on resource demand and agriculture. Specifically, the model looked at the impact of international oil price shock, exchange rate shock, and bad loan shock. The analysis showed that with China being such a

big player in the world economy, moderate shifts in import demands (e.g. grain, oil) have the potential to have a huge impact on trade and demand on external resources. Similarly, internal shifts in population growth and the banking sector reform can have very large impacts on prospects for growth and living standard improvement.

More recently, MI and the Institute of Scientific and Technical Information of China jointly expanded the China model to focus on traditional and renewable energy (including wind, solar, hydro, and nuclear), and generate different impact scenarios based on policy choices, including energy policy choices. The model runs from 1990 to 2030.

A similar activity is being undertaken with World Wildlife Fund (USA) to examine different policy choices that improve carbon trading with developing countries to take better account of industry and sector approaches to introducing new technologies.

Lolland, Denmark: The goal of this project was to develop a model to examine the impacts of mega projects in renewable energy on the local economy and environment. Lolland Municipality (island in Southern Denmark) is a showcase example of the regeneration of a remote and peripheral area through renewable energy technologies. Over the years the Municipality has been developed many renewable energy projects that have contributed to the economic recovery and social improvement of the island, by attracting cleantech businesses and various green energy projects.

The model has proved to be a useful tool for evaluating the impact of the various energy initiatives on the territory, and relative link to the economic sector and local community. The tool is currently in use in the Lolland Municipality in support of local decision-making, with a view to incorporate it into educational projects, as well as to develop further energy-related and economic scenarios.

Jamaica: T21 was customized for Jamaica in 2007 to undertake comprehensive development policy analysis, report on key indicators under different policy scenarios, and expand understanding of the inter-sectoral linkages. In addition to the standard sectors in the T21 SF, the model included sectors the following sectors: crime, tourism, migration, disaster impacts, water pollution, access to safe drinking water, climate change, land ownership and management, and sugar.

Analysis conducted with the model pointed out areas for concern such as the possible impact of HIV/AIDS on life expectancy, the productivity of the labor force, and power demand, and vulnerability to oil shocks. The Jamaica government has given approval to use the model to guide preparation of Vision 2030 Jamaica, a 25-year national development plan expected to put Jamaica on a path to achieve developed country status by year 2030.

Mali: T21 was first customized for Mali to support development of the national poverty reduction strategy and a preparing a PRSP. Priority issues analyzed in the model were poverty, cotton, gold mining, deforestation and desertification. One of the objectives of the exercise was to determine the most effective use of aid and minimizing the implementation cost within the planned expenditure. To accomplish this objective, background scenarios for the PRSP were generated with the model, which provided a series of policy alternatives which were used in stakeholder consultations, and helped to set priorities for the PRSP. The PRSP has been approved by the government and has been submitted to the World Bank. More recently, T21 was used to analyze the determinants of poverty in Mali, specifically, to determine the consistency between the national poverty reduction strategy and the Millennium Development Goals.

United States of America: The T21-USA model provides an analytical framework under which the debate about America's energy future can take place in an unbiased, transparent and easy-to-understand manner. It retraces the last 25 years of socioeconomic and environmental development in the United States, and tests and compares policies that could change its development path. T21-USA addresses issues such as energy efficiency, pollution and greenhouse gas emissions, population dynamics, public deficit, and social services.

The model has been customized for specific applications – for waste management in Ohio; studying energy-intensive manufacturing industries by the National Commission on Energy Policy (NCEP – Bipartisan Policy Center); for use in the U.S. Congress to promote bipartisan dialogues on energy policies, with particular attention to demonstrating how the increase in the CAFE standard would lead to more rather than less growth. It is also being used a teaching tool on college campuses.