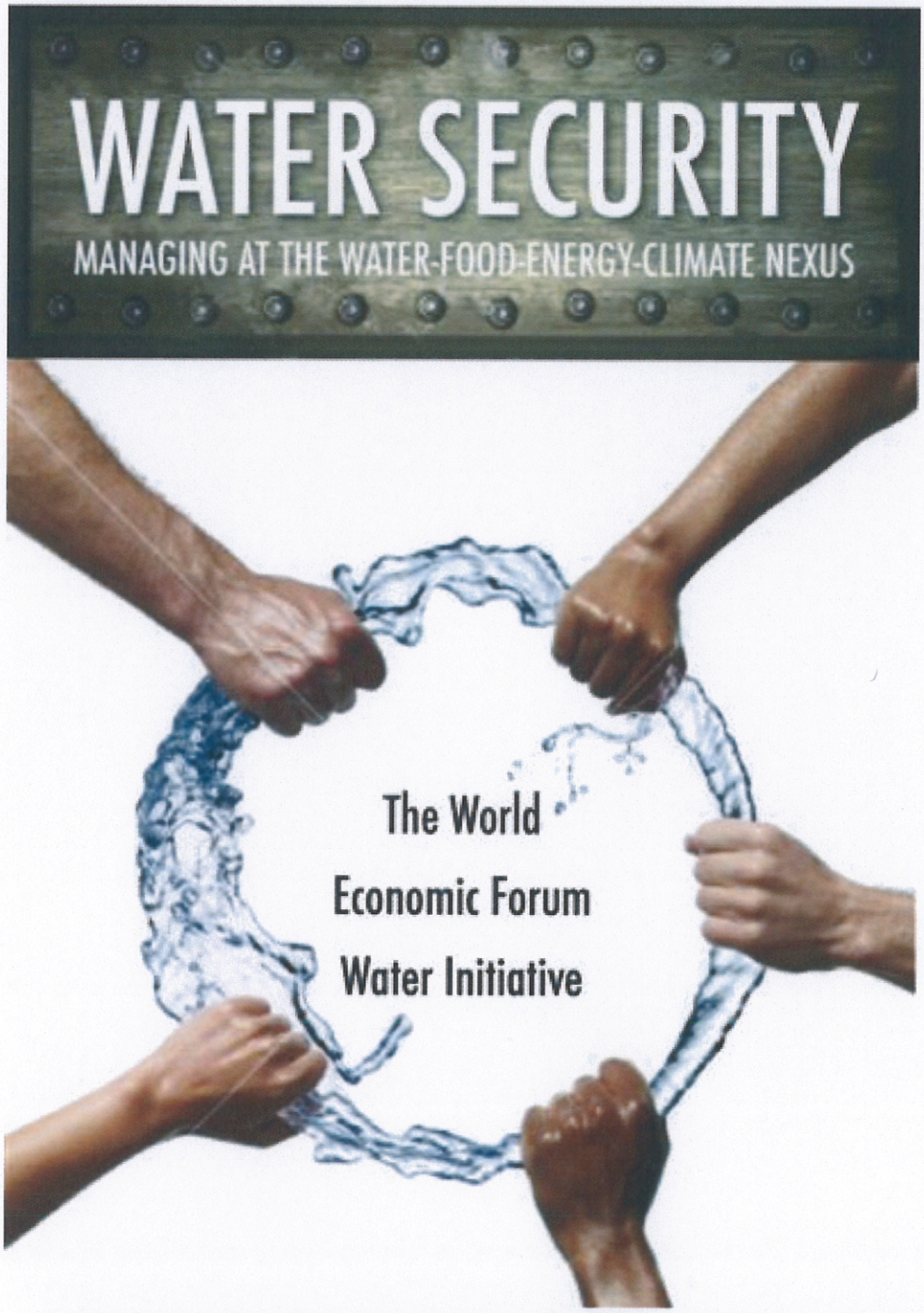

"The World Economic Forum's effort to develop the economic and geopolitical forecast on water is essential.",
Ban-Ki Moon, Secretary General, United Nations

introduction of C2C solutions, the boundary of the problem was re-defined and conceptualised. Application of the C2C solutions approach resulted in development of control rules for upstream groundwater flow augmentation as a replacement water resource, and relocation of the treated wastewater downstream of the raw water intake. Unit wastewater treatment costs were halved as a result.

The Cloud to Coast concept is a new and powerful decision framework.

Perspective: Systems to Manage Future Water Trends : An Integrated Sustainability Index for Effective Water Policy by Rabi H. Mohtar, Director, Global Engineering Program. Professor, Environmental and Natural Resources Engineering, Agricultural and Biological Engineering Department, Purdue University

The inter-linkages of the water system with other systems such as food, energy, climate change, and the economy, must be explicitly defined to enable the exact quantification of their interlinkages with each other. This will then allow for comprehensive, integrated management systems to emerge. For example, development of a 'water value' for all sources of water (sea, surface fresh, deep aquifer, recycled water, etc.) to feed into such a system, would include the cost associated with transporting the water to a specific destination for a certain need; it would also consider the environmental quality associated with the use of this specific water, such as long term soil quality, pollution risk, etc.

Even though specific metrics exist which can address the status and progress of water resources, a wider benchmarking tool that can address multi-dimensional water systems and their inter-relations to food, energy, and other closely-related systems is yet to be established. Water data attributes identified in relation to these interlinkages and their multi-scale processes are needed. These attributes should include, but not be limited to: water values, water pricing, water

laws, environmental impacts, energy impacts, food security, ecological impacts, biodiversity, and air, soil, and water quality.

As we explore the architecture and the implementation possibilities of such an interlinked water system (perhaps better described as an integrated sustainability index for effective water policy), various types of data will help us to connect and define the interface between its separate components. These data types include system *input data*, such as weather/climate with its spatial and temporal variability in the short and long term; polices, etc; *system* data, such as soils, landuse, geomorphology, socio-economics, land management and tenure, governance system, social structure, indigenous knowledge, etc; and system *output data / indicators*, such as robustness of the system, well being of people being served and implications on food security, health, energy security, etc. Likewise, the development of an early warning system will also require system input and system parameters data; and for system sensitivities and evaluation, system output data is needed. A critical issue here is the quality of data, the standards/format, and its accessibility.

Figure 10.6 below is a simplified system for the elements of sustainability and includes explicit inter-linkages. This system can be a starting point toward sustainable water, food, energy systems.

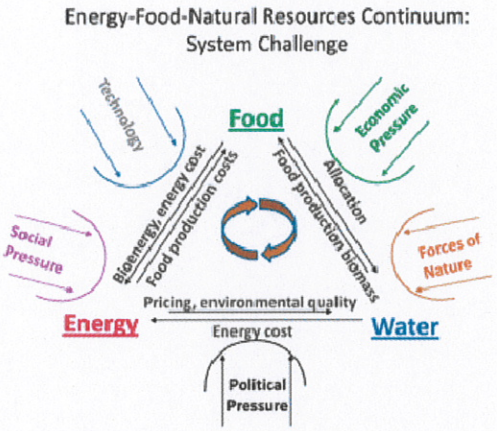

Figure 10.6: Energy-Food-Natural Resources System(s) and the inter-linkages

It can be seen that a comprehensive, interlinked water security strategy will be complex and difficult to achieve. It can be attempted, however, using the perspective identified above, and based on relatively simple, key principles that focus on:

1. multi-scale dimensions,
2. metrics that are easily obtained, and
3. achievable benchmarking targets.

To obtain the data to underpin the activities, a *water knowledge virtual hub* which can integrate new and existing knowledge (from research centers, universities, industrial and private patents) as well as effective rural community indigenous knowledge, is a good starting place. As well as developing a suite of water knowledge hubs (domestically or regionally) to help pool and sift interconnected data, a comprehensive state-of-the-art model design excersise should be

explored to identify the various areas in interlinked water-food-ennergy policy making, where these tools/frameworks can be of most help.

Perspective: Systems to Manage Future Water Trends: Water Skin - A multi-scale river basin decision-support framework for adaptive water management from the Planetary Skin Institute by Juan Carlos Castilla-Rubio, President of Planetary Skin Institute and Managing Director of Cisco's Sustainability and Resources Innovation Group

Two powerful trends are re-shaping the world. The first trend is *resource scarcity*, the result of explosive demand growth for resources (for water, energy, food, land resources, etc) driven by growing populations and economic development. The second trend is *information abundance,* driven by huge but silo-ed datasets and increasing information processing capabilities, sensor networks and emerging information and communication technologies.

Planetary Skin Institute (PSI) aims to address the challenge posed by the first trend with the opportunity presented by the second In March of 2009, Cisco and NASA agreed a multi-year R&D public private partnership to pool their R&D capabilities and assets in a partnership based on joint and open innovation. Cisco has embedded the fruits of this partnership in the PSI, which was named one of TIME Magazine's 'Top 50 Inventions of 2009'. PSI is a unique partnership between leading corporations, government agencies and research institutions around the world.

PSI's nonprofit status is intended to facilitate cooperation across institutional, disciplinary, and national boundaries and to create a space for flexible pooling of assets and ideas between stakeholders. PSI has recruited a Global Advisory Council consisting of thought leaders in science, technology, economics and innovation to guide this work.

PSI is currently working with selected corporate, government and academic partners in the US, EU, India and Brazil to build working prototypes of resource and risk management *decision support tools* that have the potential to increase food, water, and energy security and