Cybernetics and Systems: An International Journal, 21:99–108, 1990

STRATEGIES FOR REGULATING THE GLOBAL ECONOMY

STUART A. UMPLEBY

Department of Management Science, George Washington University, Washington, D.C., U.S.A.

A task as large as influencing the global economy requires that some thought be given to suitable strategies. Recent work in the science of cybernetics has identified four separate strategies for regulating complex systems composed of thinking participants. By using these strategies as a foundation, this paper reviews the history of the global economy, summarizes current concerns, and then identifies several possible courses of action.

USEFULNESS OF THEORIES

The current discussions of the global economy remind me that we are living in a time when people feel that progress is possible and that each individual can make a difference. These are quite modern beliefs. It is also apparent that many people sincerely would like to devote at least a part of their lives to improving life for other people. I am told by friends in Europe that the willingness to express this goal publicly is a peculiarly American trait. As we approach the task of redesigning the global economy, I think it is important that we understand the frame of reference from which we view the task and also that we be aware of the extent to which our frame of reference is shared by other people.

I consider myself a social scientist, but I am not an economist. In addition to economics, I suggest that we focus our attention on the general process of regulation. By "regulation" I mean what cyberneticians call "con-

An earlier draft was prepared for a conference on the Global Economy held at George Washington University, December 8–9, 1988. This paper will also be published in *Futures*.

trol'' or interacting with a system so that it does what we want it to do. Instances of regulation include driving a car, managing a corporation, or influencing the global economy.

Incidentally, when I talk about theories, or science, I do not mean something abstract, difficult to understand, or remote from human experience. Rather, I think of science as an aid to thinking, in somewhat the same way that binoculars are an aid to seeing. With the aid of binoculars we can view a larger landscape and thereby improve our sense of where we are, where we have been, and where we may want to go. Science fulfills a similar function and also helps us to anticipate what actions may produce the results we desire.

In this paper I shall present a general theory of regulation. I shall illustrate it with a brief description of the development of the global economy. Finally, I shall use the theory to suggest several strategies that we might employ to bring about the changes we desire in the global economy.

LAW OF REQUISITE VARIETY

The theory of regulation that I have in mind is based on the law of requisite variety. This law was formulated by the cybernetician W. Ross Ashby in the early 1950s (Ashby, 1952, 1956). The law states that in any regulatory process the variety in the regulator must be at least as great as the variety in the system being regulated. As an example, suppose we are in the market to buy a computer. First we estimate the size or complexity of the task to be performed and then we buy a computer at least that big. It would not make sense to buy a smaller machine.

The implication of the law of requisite variety is that whenever we are confronted with a situation more complex than we can cope with, there are only two ways to approach the problem: either increase the variety in the regulator (usually by hiring staff or buying computers) or reduce the variety in the system being regulated. The first impulse is usually to increase the variety in the regulator. This approach has the side advantages that it increases one budget, staff, and bureaucratic power base. It also increases costs. I intend to illustrate the advantages of the second approach (reducing the variety in the system being regulated). This approach is possible because of the nature of knowledge. Although we often speak as though the systems with which we interact are given or fixed prior to our arrival on the scene, in fact we choose what we want to pay attention to. What I am suggesting is that there is great power in reconceptualizing the system we are trying to

regulate. I shall illustrate what I mean by defining four strategies of regulation. Creation of the four strategies described in this paper was stimulated by pages 111–112 of Beer's book, *Platform for Change* (1972). Beer does not present the strategies in this way. He uses different names and does not compare the strategies quantitatively.

AMPLIFYING REGULATORY CAPABILITY

The first strategy is "one-to-one regulation of variety." An example would be a football game. In a football game all the players on one side are trying to defeat the other side. Each side must match each of its opponent's moves with a move of its own. See Table 1.

The second strategy is "one-to-one regulation of disturbances." An example is crime control. When attempting to control crime, it is not necessary to watch every move by every citizen. Because most people cooperate with the law, it is only necessary to control criminals. In most cities around the world there are about two policemen for every thousand citizens. Hence, by relaxing the variety we attempt to control (from all citizens to just criminals), we can achieve an amplification of regulatory capability of about a factor of a thousand. By deciding to regulate less, we achieve more.

The third strategy is "ecological regulation." An example is government regulation of industry. When the government controls the activities of people in business in the United States, most of the regulation is performed by the competing companies. They are constantly comparing their products and services with those of their competitors. The government only makes occasional adjustments in the rules of the game, for example by outlawing price-fixing and agreements in restraint of trade. If one estimates the number of anti-trust lawyers in the Justice Department and the Federal Trade Commission and the number of businesspersons in the country, the ratio is

TABLE 1. Four Strategies of Regulation

Strategy	Example	Amplification
One-to-one regulation of variety	Football game	1/1
One-to-one regulation of disturbances	Crime control	2/1000
Ecological regulation	Anti-trust regulation	1/640,000
Regulation of ideas	The Club of Rome	12/4 billion

approximately one to six hundred and forty thousand. Hence, we have again amplified our regulatory capability by about a factor of a thousand.

The fourth strategy is "epistemological regulation." An example is the change in world view that occurred in the early 1970s when we stopped seeing the world primarily in terms of an ideological struggle with an associated military balance of power and instead focused on population, the environment, and natural resources. The fourth strategy entails not just an adjustment in the rules of the game but rather changing the game itself. As an example of this conceptual shift, recall the first report to The Club of Rome (Meadows et al., 1972). Approximately 12 people produced this report. Directly or indirectly it affected the lives of all the earth's people, about 4 billion at the time. Hence, by shifting from institutions to concepts we further amplify our regulatory capability by about a factor of a thousand.

These four strategies are recursive; that is, they can be used at any level of analysis, from managing our daily lives to attempting to influence the global economy. The point I want to emphasize is that there are different types of regulatory strategies, and, depending on what we are trying to regulate, certain types of strategies may be required.

To illustrate how these four strategies work together to control a complex system, consider the political regulation of the United States. Begin with a change in values, for example the civil rights movement, the environmental movement, or the women's movement. These can be thought of as the fourth strategy or "changing in the game." Different people are then elected to Congress who design new institutions such as the Food and Drug Administration, the Environmental Protection Agency, and the Occupational Safety and Health Administration. These institutions are new players in the "institutional ecology." Their establishment is an example of the third strategy or "changing the rules of the game." As the new agencies carry out their mandate, they regulate deviant behavior (the second strategy). Eventually, private citizens see the results in their daily lives (the first strategy) and may decide on a new change in values (for example, a desire for less government interference). At each stage in the process, requisite variety is controlled but not necessarily by the same people.

One implication of this theory of regulation is that ideas can change society. However, ideas do not emerge from nowhere. Ideas are developed to deal with new problems or situations. Hence, there is a dialogue between ideas and society. Just as new ideas change society, changes in society lead to new ideas.

IDEAS THAT HAVE SHAPED THE GLOBAL ECONOMY

I now turn to the development of the global economy. My account will illustrate the fourth strategy or how the global economy has been shaped by ideas. Of course, at each stage of development all four strategies are used. But, when writing a brief overview, ideas and key events are the most fruitful things to focus on. Table 2 presents an outline of ideas and events that have shaped the global economy. The table suggests the role of ideas, but it falls far short of capturing the complexity of the phenomenon. History is not a simple sequence of ideas and events. It is the result of complex interactions among events, institutions, ideas, technologies, political movements, and even personalities. My purpose here is merely to provide an overview to illustrate the role of ideas.

The crusades, which began in 1096, exposed Europeans to other societies and the ruins of earlier, more advanced civilizations. These experiences increased interest in the wisdom of ancient civilizations and stimulated interest in trade.

Marco Polo's first journey to China from 1271 to 1295 initiated trade between Europe and Asia. Trade led to the spread of innovations and the accumulation of wealth. The Europeans wanted silk and spices. The Chinese wanted gold. The difficulties and hazards of the land routes to Asia promoted European interest in sailing and navigation. Trade routes were developed and fought over by nation-states that sought to increase their military and naval power. The interest in navigation stimulated interest in astronomy and science. In 1492 Columbus encountered the New World while searching for a shorter sea route to Asia. The initial exploration of the New World was largely a search for new sources of gold. Apparently, the Europeans thought that even though the new land blocked the sea route to the spice islands, perhaps it was good for something.

The desire for goods obtained through trade led to an interest in wealth accumulation. Wealth was measured by gold reserves. In 1776, Adam Smith published his inquiry into the nature and causes of *The Wealth of Nations*, which suggested that a nation's wealth should be measured not by the amount of gold stored in its treasury but rather by its productive capacity (roads, canals, factories, skilled workers, etc.). If a nation could produce desirable goods, it could always exchange these for gold. Smith's ideas promoted the growth of industry. The result was a society of workers and capitalists.

TABLE 2. The Interaction Between Ideas and Society

Ideas	Events
	1096 First Crusade
Interest in trade and in ancient learning	
	Marco Polo's trip to China
Science and technology stimulated by desire to improve trade	
	Traders accumulate wealth, nation-states develop and protect trade routes
The idea of progress, people strive to produce more than mere subsistence	
	Industrial Revolution in England
Adam Smith's *The Wealth of Nations*, 1776	
	Capital accumulation, urbanization, growing gap between rich and poor
Marx and Engles, *The Communist Manifesto*, 1848	
	Revolutions in Europe, demands for more equal distribution of wealth
Social reform movements in industrializing countries	
	World War I and the Great Depression
Keynes's theory justifying government intervention in the economy	
	World War II, World Bank and IMF established, decolonialization of the Third World
Friedman's monetary policy	
	Oil crisis in 1973 leads to abandonment of gold standard and fluctuating exchange rates
Environmental movement and futures research movement, many conferences on the "world problematique"	
	Economic progress in Asia, liberalization of communist regimes

The concentration of wealth in the hands of a few led to concerns about fair distribution. In 1848, revolutions and civil disturbances occurred in most European countries. In 1859, Karl Marx published his *Critique of Political Economy,* the same year that John Stuart Mill wrote his essay *On Liberty.* In 1864, Marx found the First International Workingmen's Association in London and New York. The first volume of *Capital* was published in 1867. By the end of 1917 the global economy was divided into two political factions. One faction was composed of the followers of Adam Smith, who emphasized wealth production and innovation. The other faction was composed of the followers of Karl Marx, who emphasized wealth distribution and personal economic security.

As international trade increased, the values of the various national currencies were determined by how much gold they could buy. In the economic turmoil at the end of the First World War, most nations went off the gold standard, but they saw this as a temporary step. The 1929 stock market crash was followed by several mistakes in financial management such as higher tariff barriers. The Great Depression was the result. In 1935, John Maynard Keynes published *The General Theory of Employment, Interest, and Money,* which recommended that recovery could be stimulated by government deficit spending.

In July 1944, before the end of the Second World War, experts from 44 governments met at Bretton Woods, New Hampshire, to plan the post-war global economy. The economic instability in Germany after the First World War was seen as one cause of the Second World War. Hence, in the 1940s a stable international economic system was viewed as important in preventing both depressions and wars. The participants in the Bretton Woods conference thought that a stable, progressive global economy could be produced by the right combination of institutions and policies. They designed the World Bank and the International Monetary Fund, which were established in 1946 and 1947. Also, in 1947 the General Agreement on Tariffs and Trade (GATT) was drawn up in Geneva. In the post-war period these institutions and aid from industrialized countries, together with the end of colonialism, helped to generate economic growth in Third World countries. The 1964–1967 Kennedy round of tariff reductions went beyond specific commodities and reduced tariffs on whole classes of industrial goods, further stimulating the global economy.

The 1973 energy crisis with its dramatic jump in oil prices led to the abandonment of gold as a medium of exchange and produced a monetary system based on fluctuating exchange rates. By the 1970s, trade and interde-

pendence had increased to such an extent that speed in the markets that adjusted relative values had become important. In 1976, Milton Friedman won the Nobel Prize in economics for his theory (developed in the 1950s and 1960s) of the importance of the money supply as a factor to be regulated in national economies.

In the early 1970s, classical ideas about economics were broadened substantially. Nicholas Georgescu-Roegen (1975) published his book, *The Entropy Law and the Economic Process*. Also, in the 1960s, strategic thinking about nuclear war had led to the development of an academic field called peace research, which became one origin of the field now called futures research. The peace researchers wanted to be *for* something, not simply against war. The first public conference on futures research was held in Oslo, Norway, in 1967 with a second in Kyoto, Japan, in 1970. Futures research conferences were held almost every year during the 1970s.

Meanwhile, the United Nations responded to these ideas with its own conferences among government officials. Conferences were held on the environment in Sweden in 1972, on population in Romania in 1973, on food in Italy in 1974, on women in Mexico in 1975, on habitat in Canada in 1976, on water in Argentina in 1977, and on science and technology in Austria in 1979. During this period the world seemed to be organizing itself. In 1975 there was a north–south conference, and, in 1976, a Third World conference. In 1976 the leaders of the United States, Canada, Japan, Britain, France, Germany, and Italy began holding annual meetings. By the end of the 1970s, the global agenda had been broadened from political and economic considerations to include ecological and social concerns as well.

In the early 1980s, international financial interdependence was reemphasized by the Third World debt crisis. China began a series of economic reforms. In the late 1980s the most dramatic development has been the desire of the Soviet Union to join the rest of the global economy.

Looking back at this history, the major trends have been the growth of trade and the spread of the desire for economic development. These trends have stimulated science and technology and shifted power toward secular institutions. In recent years the increasing destructiveness of military technology seems to have persuaded national leaders and the general public that economic competition should be managed more through market forces and trade agreements than through military power. Whereas prior to the Second World War institutional innovation occurred primarily within countries, in recent decades there has been an increase in institutional innovation among countries. Global institutional innovation has been motivated by desires to

reduce the risk of war, reduce spending on armaments, share the benefits of technology and economic development, make more efficient use of resources, and stop the destruction of the environment.

As the fourth strategy of regulation suggests, effective ideas sooner or later influence policy makers and the general public. However, the rate at which ideas are put into practice can be accelerated by paying attention to the basic cybernetic ideas of communication and control. That is, the new ideas need to be communicated to office holders and the public, and implementation needs to be monitored. From time to time, additional ideas and new means of implementation will need to be developed.

THEORETICAL STRATEGIES AND EFFECTIVE ACTIONS

What does the theory of regulation, outlined above, suggest about how we should approach the modification of the global economy at this period in human history? Given the size of the system we are trying to influence, attention should probably be focused either on new ideas (the fourth strategy) or on institutions to implement those ideas (the third strategy). I think that several activities would be useful.

1. Further develop new theoretical ideas about economic systems. The biological foundations of economic systems and questions about how to combine global equity, efficiency, and cultural preservation are promising lines of inquiry.
2. Popularize and disseminate the new scientific knowledge.
3. Design or redesign institutions to regulate human activities in accord with the new thinking. The new organizations arranging East–West exchanges would be examples here.
4. Monitor the performance of existing institutions relative to the new ideas. I think that this activity might be particularly promising. As an example of what I mean, the Worldwatch Institute annually "gives the Earth a physical" and thereby reports our progress on environmental and natural resource issues. Amnesty International monitors and seeks to influence the human rights policies of countries. An annual report presenting global social indicators might be prepared that would report on economic development, housing, education, weapons production, trade, life expectancy, infant mortality, etc. In the late 1960s, much work was done on developing social indicators (Bauer, 1966; Sheldon and Moore, 1968; Olson, 1969). Indicators are most useful when ac-

companied by theories linking measurement with action and by institutions capable of formulating policies and initiating appropriate actions (De Neufville, 1975).

Any new conceptual system requires a control system for implementation. A control system requires a set of indicators so that we can know whether we are making progress and, if so, how much. Creating new ideas is only part of the process. We also need to devise means to ensure that the new ideas are acted on.

REFERENCES

Ashby, W. Ross, *Design for a Brain: The Origin of Adaptive Behavior,* 2nd ed., Chapman and Hall, London, 1960.

Ashby, W. Ross, *An Introduction to Cybernetics.* John Wiley, New York, 1956.

Bauer, Raymond A. (ed.), *Social Indicators,* MIT Press, Cambridge, Mass., 1966.

Beer, Stafford, *Platform for Change,* John Wiley, New York, 1972.

De Neufville, Judith Innes, *Social Indicators and Public Policy: Interactive Processes of Design and Application,* Elsevier, New York, 1975.

Georgescu-Roegen, Nicholas, *The Entropy Law and the Economic Process,* Harvard University Press, Cambridge, Mass., 1971.

Keynes, John Maynard, *The General Theory of Employment, Interest and Money,* Harcourt, Brace, New York, 1935.

Meadows, Donnella et al., *The Limits to Growth,* Universe Books, New York, 1972.

Olson, Mancur (ed.), *Toward a Social Report,* U.S. Government Printing Office, Washington, D.C., 1969.

Sheldon, Eleanor Bernert, and Wilbert E. Moore (eds.), *Indicators of Social Change: Concepts and Measurements,* Russell Sage Foundation, New York, 1968.

Request reprints from Stuart A. Umpleby, Department of Management Science, George Washington University, Washington, DC 20052.