A strategy for the development of India

by Uwe Parpart-Henke

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Let me say at the very outset that while it is clear that the economic problems faced by the developing and advanced-sector nations are different in certain regards, one of the fundamental things that is wrong in much of the economic thinking today, is that it is somehow assumed that the principles of economic science applied to the advanced-sector and developing-sector economies are different. I don't think they are different. I think that what works in the advanced sector can work equally well in the developing sector, in most cases. The only thing that makes a significant difference is manpower development.

When we refer to India in particular, therefore, there is no reason why, in principle, the same types of technologies should not come into the production process rapidly and at the same time as they are coming on line in the advanced-sector nations, because by and large the manpower potential exists in India, quite uniquely among all developing-sector nations, to do that.

The principal way in which this distinction has come to figure in economic and scientific considerations, is because of the use of certain types of methods in economic analysis which I regard as entirely inadequate and highly problematical—even highly biased in certain cases. If you look at the use of econometric models in the analysis of any economy, almost all models—with the exception of the LaRouche-Riemann model which we developed since 1979—are based upon certain economic equilibrium assumptions.

In all these models, the assumption is that there are two fundamental categories that are in competition with each other—population growth and a certain resource base, which at the outset is at a fixed positive level, and which in the course of economic development gets exhausted on an exponential scale. The assumption is that sooner or later we have to reach some point of intersection of the curves showing depletion of the resources and the growth of population, and under these circumstances we enter into the kind of critical phase that the Club of Rome and other such organizations have been predicting for some time.

All of these equilibrium-type models that predict disaster ignore two absolutely critical assumptions: first, that *resource* is not an absolute category; and, second, that *population* is not to be defined as a population of consumers, but populations of producers and potential producers. . . .

The actual picture of human development is quite different from what the equilibrium models present, and is best perceived if we look at certain levels of population-density potential, different levels which are technologically determined. How many human beings at any given point in time, and with a given technology, can be supported by one square kilometer of land?

In the earliest periods of human history, when we did not even have agriculture as a technology available, historical and anthropological research has shown that in the hunting and gathering mode, we needed about 13 square kilometers to support one human being. The total world habitable land surface being about 130 million square kilometers, we can say that the population potential in the hunting and gathering mode would have been in the vicinity of only 10 million people. And if some clever fellows had not found a way of developing agricultural methods, even primitive ones, then even at that very early point, with only 10 million people, we would have run into a population crisis.

Well, that did not occur. The first Club of Rome-types or Malthusians of that period were proven wrong. . . .

The level of technology determines population potential, and the policy problem—the worldwide economic policy problem we have today—is very simply that at this point the highest technologies are confined to relatively small sectors of the world population and have not been successfully spread or allowed to be spread to the rest of the world.

The LaRouche-Riemann model

In the econometric model that we have developed, we therefore had to take into account the fact that the actual story of human economic history is not a linear continuous function, but is in fact a discontinuous step-function, and that the process that fundamentally underlies economic development, is not an equilibrium process but, thermodynamically speaking, the opposite—a process which is characterized by having its most important development defined by non-equilibrium assumptions.

In particular, we had to analyze the relationship between technology and productivity from a physical standpoint—not just from the standpoint of making some financial calculations about how much a certain technology costs and what that will get you in terms of output per manhour. In order to make sure that the argument does not become circular, you have to find a physical characteristic that defines productivity from the standpoint of technology. This is accomplished in terms of a quantity which I will explain to you momentarily, which we call *energy flux density*.

And secondly, it becomes necessary to focus on the fact that in order for human populations to overcome the potential points of intersection at any given level, it cannot be truly the case that there is no change at the given level. There has to be, at any given level, a certain amount of slower, though not necessarily the same kind of dramatic technological change, which is sufficient to produce what in physical terms we might call the *free energy*—that is to say that energy which can do net work; it is not reabsorbed in the process of the economic cycle. It is what for an individual business is simply called profit, that which you can reinvest to expand your business.

I want to go into this question of energy flux density with some emphasis. Energy flux density is defined as the amount of energy, either in megawatts or any other way in which you want to look at energy, that flows per square meter in unit time—say, per square meter in seconds (m^2/sec). You can look at any number of production facilities and grade them from that standpoint.

We look first of all at energy flux density in the energy sector itself. There are essentially three types of energy systems that exist today in various forms.

First there are solar energy systems—everything from windmills, to biomass, to solar cells, solar cookers, and anything that anybody has dreamt up (and there are many that have been dreamt up, unfortunately). The big problem with any solar energy system, is that it is limited in efficiency by the fact that the amount of sunlight that arrives at the surface of the earth is diffused, and it arrives at an average energy flux density of 10 to the minus 3 MW/m^2.

When you look at the traditional fossil fuel systems, you are talking about an energy flux density 10,000 times more energy dense than solar energy systems, and you will see how that fact translates immediately into a dramatic productivity gain.

Then, finally, you have the nuclear energy systems which concentrate energy 20 times more than most fossil systems.

These figures do not translate into productivity figures directly, but indirectly via a notion that we call *energy payback time*. Any time you build an energy system, you spend a certain amount of energy in the construction process. So we can calculate, for each of these energy systems, how much energy is necessary to make it. Then we can ask ourselves how long we will have to operate the system until it at least recovers the amount of energy that was necessary to build it.

In the case of solar energy, with the presently available solar cells, payback time is 20 years. There is no solar cell that lasts that long anywhere in the world. Anytime anyone today produces a solar cell for energy production, he is simply wasting net energy, and that's the end of it. Anytime you produce in India a solar cooker, you're wasting net energy. You are, in fact, using precious energy resources of the nation to produce something that can never recover the amount of energy that was necessary to make it—unless you can keep a solar cooker alive for 20 years. I defy you to do that! The same thing is true for other solar systems. And the solar cells are the "best case" scenario. Everything else—biomass and so forth—is much worse, in terms of its energy payback time.

The fossil systems, since there is a factor of 10,000 in difference in energy flux density, are expected to perform somewhat better, and they do. The ordinary lifetime of a fossil fuel plant is about 25 or 30 years, so after a year and a half, taking into account the entire fuel cycle, that plant is in fact doing something for your economy. From that point on it is producing more energy than it actually took to build. Nuclear power plants are somewhat better still.

That is the way of assessing what kind of energy systems you should use in your economy, where you should put your investment, where you should make your research work, in what direction you should look.

If you look at the efficiency of agricultural production, it is equally determined by the energy flux density. Compare the energy used in rice production in India, the United States, and Japan. These are the categories that define the actual energy input: installed horsepower per hectare, farm operation, total irrigation and fertilizer, and then the important category, the amount of energy input per hectare. Japan is the highest, and as a result, rice yield in Japan is also the highest.

When we refer to India, there is no reason why, in principle, advanced technologies should not come into the production process rapidly and at the same time as they are coming on line in the advanced-sector nations.

Now look at this from the standpoint of productivity and efficiency. How much energy is necessary to produce one ton of rice? In India, you need three times as much energy to produce one ton of rice as in the United States and Japan. The waste of energy, again, comes in precisely as a result of using energy in an unconcentrated form. It is only through the efficient concentration of energy, that is to say, through energy flux density, that you can make the system efficient.

The fundamental point to be made, is that an improvement in production technology is in fact best defined as an improvement in the level of energy concentration or the capability of concentrating energy. That capability in turn directly translates into the possibilities of improving the productivity, the output per manhour of every individual worker.

India's future

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Until the year 1850 or so, the only part of the electromagnetic spectrum that was really used was the part that is defined by the infrared—which essentially means heat—for industrial processes. And then in both power generation and in a whole variety of different industrial applications, we began to exploit other parts of the spectrum, both in terms of the longer wavelengths and shorter wavelengths.

The most important, still relatively recent advances—our ability to go into the atomic range and ultimately into the higher levels of that, the x-ray range—are in the application of laser devices. The laser devices concentrate an enormous amount of energy over an extremely short period of time very precisely, essentially onto a point, or onto as small a point as you want. That capability of concentration of energy depends on making use of highly coherent and relatively short-wavelength parts of the electromagnetic spectrum.

What we are talking about here are productivity jumps through the introduction of high-energy lasers and these so-called plasma-based technologies. Productivity jumps not of 2%, 3%, or 5% per year but productivity jumps in the order of magnitude of tens of thousands of percent. If you look at it from the standpoint of many developing-sector economies, rather than investing money in development of machine tools which are already outmoded, what I would do is as quickly as possible develop a laser research institute. I would find, anywhere in the world, my people, who may be scattered or have run away to greener pastures, and tell them to come back, work at home, get involved in this laser research institute. I would tell them, we will transform that into a machine-tool industry, and we will be able to skip an entire stage of technology rather than repeating every foolish mistake that has been made in the advanced sector.

That opportunity is now uniquely open to almost all developing-sector nations that have the initial manpower capability of handling these types of systems. We are not talking about a massive amount of investments. We are not talking about huge commitments. We are talking about making a concentrated government decision to create the relevant research institutes, to put some money into making this thing work, and then to assure that there is the speediest possible transfer of technology from the research sector to the actual applications in production.

The laser is going to be the single most important machine tool of the future. Already now, at its early stage of development—and even scientifically it was not even invented until 20 years ago—lasers last year accounted for about 5% of total machine-tool sales in the U.S. That is not a small amount of money; it represents several hundres of millions of dollars. We are already beginning to spread these high-productivity machine tools into many sectors of the economy.

I can see absolutely nothing that would prevent that same process from happening in India. The one aspect of it that is problematical from the standpoint of your technology—and which is in fact more difficult to handle than the laser technology itself—is the control technology for these systems. But even there, in India, at least—from the standpoint of space systems, from the standpoint of nuclear systems—you have developed the control capabilities to handle these kind of machine-tool systems as well.

These productivities are reachable and possible. The productivity of agriculture and the productivity of industry *determine* the rate at which you can transform your population from a largely rural agrarian base to an industrial base. And the rate of introduction of technologies in India in agriculture and in industry has unfortunately been so slow, that in the 20 years between 1960 and 1980, the percentage change in composition of your labor force was very, very minimal. In 1960 you employed 74% in agriculture; in 1982, 71%. And the industrial employment made a percentage gain of only 2%. That signifies low productivity and a very slow rate of diffusion of modern technology into the various sectors of agriculture and industry.

If I were an Indian planner, the thing that I would focus the greatest attention on, is how to concentrate on certain key projects in the energy sector, in the water sector—in particular, those two—and in the high-technology machine sector, to make available a concentrated breakthrough for the transformation of the population on a much more rapid scale. If the current rate of population change is maintained, you are surely headed for a very difficult time in the future. On the other hand, countries like Korea, in that same period of time, accomplished a percentage change of 32%—that is to say, they cut their agricultural population in half over that same period of time.

When you do these things right, then your agricultural workforce disappears, and properly so. That is what happened in the United States from the year 1800 to the year 1960. We had more than 80% of our population in agriculture in the year 1800; we had less than 10% in agriculture in the year 1960; and, today, in the year 1980, we have about 4% in agriculture. Those 4% of the U.S. population, if they were to operate at full capacity, could feed almost the entire world. . . .

Precisely to the extent that you accomplish that, and only to the extent that you accomplish that, are you going to be able to ever raise the standard of living of your population substantially. Without the productivity impact of high technology, as well as infrastructure projects associated with that, nothing of this sort can be accomplished. All you will gain is stagnation and a waste of resources.

The most dramatic waste of resources occurs when you do not concentrate them on a point. That is the single most important lesson to be learned, both from the standpoint of industrial technology and from the standpoint of economic planning.