

## WHAT IS THE RIGHT SIZE?

An address to the  
ROYAL CANADIAN INSTITUTE TORONTO  
by  
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Mr. President, Members of the Institute, Ladies and  
Gentlemen,

It is really a great honour for me to speak to you tonight and I am delighted to be able to be able to speak on a topic which relates to the role of Science and Technology in society rather than some particular aspect of science.

There is no doubt of the need to bring man and technology into a more harmonious relationship and your Institute plays a key role in promoting an awareness of Science and Technology.

I would like to take this opportunity to congratulate the Council and the Members of the Royal Canadian Institute for their active support of this very important goal. I sincerely hope that we might look into the possibility of a branch operation in PEI.

In preparing this talk, I had to make a choice between concentrating on one particular aspect such as energy or non-renewable resources or touching very lightly on a wide variety of subjects in order to give a view of the whole. I have chosen the latter knowing full well that the talk may appear quite superficial simply because there is not enough time to go into detail. But I hope that you will bear with me and that you will share the excitement I have found in discovering a convergence of concern in what appear at first to be widely separated developments.

In this talk, I would first like to survey very quickly the evidence that fundamental changes are occurring in a wide variety of fields and that there are common patterns emerging in these changes which suggest that we might be undergoing what could be called a change in paradigm.

Next, I hope to show how size runs as a common theme throughout these many variations. and that the hard battle lines are being drawn over questions of size.

In order to understand the trends to larger scale, we will next examine some of the forces which move us in that direction. Then, let us extrapolate the trends to their ultimate limits and try to find out what problems are inherent in very large scale systems. I would then like to outline an alternative scenario and some of the most recent indications that such an alternative might well be viable and acceptable.

Finally, I would like to discuss various possibilities for moving to such an alternative should it appear desirable.

## EVIDENCE

One indicator of change in any field is the amount of material published. First, the literature abounds with attempts to analyze and understand the various problems. Then, after the synthesizing new idea is put forward, much more is published applying the new fundamental idea to specific situations.

Over the last decade, we have been inundated with publications outlining the problems facing society today. Michael Marien has published an extensive, annotated bibliography of nearly 1000 publications in his book "Societal Directions and Alternatives".

Much has been written about the problem of pollution. Then, in 1972, Meadows et. al. made one of the first attempts to look at a number of problems simultaneously in their world models reported in the book "Limits to Growth". Much has been written in response to this pioneering work including Oltmans' "On Growth" and "Thinking About the Future-A Critique of The Limits to Growth" by H.S.D. Cole et. al. Laszlo has tried to explore what is happening in his "Goals for Mankind" and "A Strategy for the Future". The problems of food are carefully examined in Lester Brown's "By Bread Alone". Barbara Ward and Rene Dubois have summarized many of the problems in "Only One Earth". Garrett Hardin and John Baden have put together a number of papers on "Managing the Commons". The "Blueprint for Survival" begins with the terse but devastating comment, "The principal defect of the Industrial way of life with its ethos of expansion is that it is not sustainable" It then proceeds to outline a strategy for arriving at a sustainable civilization.

Others, such as Illich, Mumford and Ellul, blame our technological approach. Schumacher's "Small is Beautiful" is the strongest statement so far on the question of size. These concerns, together with a disenchantment with conventional approaches to development in the third world, have given rise to an interest in what is sometimes called "Appropriate Technology".

One of the main driving forces in the seventies has been the energy crisis. Barry Commoner's "The Poverty of Power" and the National Academy of Science report on "Energy for Rural Development" are only two of many excellent publications showing how the energy problem is related to many of the other problems we face.

And last, but certainly not least, there are many books dealing with business. Heilbroner, a well known economist, writes about "Business Civilization In Decline". Cornuelle left his job as Vice President of the National Manufacturers Association to rediscover America and concluded that it needed to be Demanaged. Rein Peterson of York University has done an excellent study on the viability and importance of small business. Even John D. Rockefeller writes about "The Second American Revolution".

But let me assure you that these concerns are not confined to North America I have found them right around the Globe. For example India has many active programs in appropriate technology and small business.

The general public is becoming more aware and more involved. In November, 1976 over 4000 teachers from across Canada attended the Man Environment Impact conference here in Toronto. I have seen the St Lawrence Hall filled to hear talks on related themes. There is widespread interest in the work of the Royal Commission on Electric Power Planning and the Science Council report on the Conserver Society. Last year some 15000 Californians turned out to hear Cousteau talk about the need for new environmental ethics.

Common patterns can be discerned in all these areas. These patterns point to a need for a change in our basic paradigm. Harman has pointed out that "While many of the social problems associated with these dilemmas are tractable if taken singly, they cannot be solved collectively in the present paradigm precisely because their origins lie in the fabulous success of that paradigm. A solution in one area simply worsens the troubles in another." The Futurist p5, Feb. 1977.

The main thesis I would like to develop in this talk is that size should be thought of as a fundamental parameter which underlies many of these concerns and that one of the key questions we must ask in thinking about the future is "What is the Right Size?"

The question is not new. Even Aristotle was concerned with the size of cities and wrote, "The best limit of the population of a city then is the largest number which suffices for the purposes of life and can be taken in at a single view."

Now, what are some of the clues today that lead one to think of size as a fundamental parameter? One of the most obvious can be found in our cities that have grown to megalithic proportions. Lewis Mumford points out in his book "The City In History" that "... what some have called the urban explosion is in fact a symptom of a more general state- the removal of quantitative limits. This marks the change from an organic system to a mechanical system, from purposeful growth to purposeless expansion". A recent study by the Stanford Research Institute carefully analyzes the generally negative correlations between city size and quality of life.

Concern with the size or scale of our technology is another clue. Lewis Mumford has very eloquently labeled our preoccupation with large scale the "Myth of the Megamachine." Schumacher calls for an increased emphasis on what he calls intermediate technology. There are many names such as appropriate technology, people's technology soft technology and even tools for conviviality. But the theme is very similar. It is a cry from deep within us for a technology which is more human in scale.

Another clue can be found in the concern with pollution and waste expressed by environmentalists and proponents of the conserver society. A most intriguing definition of waste is: WASTE IS RESOURCE IN THE WRONG PLACE. The point is that the

waste is generated too far from a place where it could be used as a resource in an industrial process. So even this problem can be characterized by scale.

Size has long been a matter of concern in business and industry. Governments have anti-trust or competition legislation and it has long been held that our economic system depends on not having the market dominated by a single supplier. More recently there have been heated debates about Multinational Corporations.

It is interesting to see how the battle lines are being drawn up over questions of size. The book *Global Reach* quotes Carl Gerstacker: "It has been abundantly proved that size is often a gigantic advantage, and often for certain tasks, a necessity. The problems of our times will require greater bigger organizations than we now have rather than smaller ones, for their solution... We must cast aside our outmoded notions of size and our fear of bigness..."

On the other hand, Lawrence O'Brien, Chairman of the McGovern Shriver campaign wrote in the *Wall Street Journal* that "we have created a situation in which tens of millions of Americans, young, old black, white, poor and rich- feel a deep discontent with the basic patterns of their lives. They feel that their inherent dignity as human beings is being squeezed in a tightening ring of big institutions- big schools, big business, big unions, big cities, big government- over which they have no control..(they feel) that somehow we have taken the wrong path."

## FORCES

One of the first things we must do if we are to try to answer the question "What is the Right Size?" is to try to understand the forces which move us to larger and larger scale.

One of the most obvious forces is the economy of scale. We have heard argument so often, it doesn't need to be repeated here. There is even mathematical proof based on queuing theory that as long as you neglect distribution costs, bigger will always be better.

But there are several points to keep in mind. The first is that the distribution costs that are usually neglected are now rapidly increasing in importance because of energy costs. A second is that the argument is usually applied to a subsystem rather than looking at the total system of which the subsystem is a part.

A good example of this can be found in power generating stations. There is no doubt that a 400 megawatt unit is more efficient than a 4 megawatt unit in terms of cost per kilowatt at the plant. But when one adds in the cost of transmission lines and the lost revenue from the waste heat, (roughly twice the energy in the electricity produced) because the larger plant has to be located well away from civilization, the economies of scale are not so obvious.

There are many other examples of the need for this broader kind of cost benefit analysis and much more work has to be done to analyze total system costs rather than subsystem

efficiencies.

A third point is that the economy of scale curve flattens off very quickly at sizes which are smaller than most of us would suspect. Some recent work by the University of Massachusetts indicates that the most efficient plant size for 70% of all US industry would have no more than 250 employees.

But even if we were to show quantitatively that there really was very little to be gained from economies of scale past a certain point, nothing would likely change because our deep rooted underlying value system which influences our day to day decisions is inherently biased toward larger scale. There are many examples of this but there isn't time to go into them so let me simply use Mumford's phrase "The myth of the megamachine" to describe this very important force that moves us to larger scale

Societal rewards are very definitely and sharply skewed to large scale. Just look at the rewards we heap on entertainers and athletes who reach large audiences. The same is true of the corporate world. The more you control the more you earn. Can you seriously imagine a senior executive arguing with his colleagues against a takeover or merger which would leave them in control of more? We are in awe of those we see as having made it to the top and the larger the organization they command, the greater the awe.

But there are signs that executives are no longer responding to these rewards. Other values are creeping in and influencing their decisions more and more. People are saying no to promotions that mean moving their families. What happens if such rewards are no longer effective?

There is no doubt that we perceive opportunities in larger scale organizations. One of the major factors in the growth of cities has been identified as the perception that there are greater employment opportunities. This perception draws more people into the city and increases the labour force. This in turn attracts more industry because the labour force is perceived to be larger and more diverse. So the two perceptions reinforce each other in a self-fulfilling prophecy and urban sprawl with all its problems is the result. Again it would be very difficult to bring about any real change in this pattern of behaviour even if solid research were to show that indeed the employment opportunities in Toronto were not on the average any greater or even less than in Kingston. Perception is a much stronger influence on behaviour than fact.

The young person starting out on a career often sees more potential opportunity with a large firm than a small one. This point was really brought home to me during a visit to a training center in a very successful industrial park near Delhi in India. After a tour of the very impressive facilities of the training center, I asked the Director what happened to the graduates of his programs. Did they in fact stay on with the small scale industries in the industrial park from which they had been carefully selected for the training programs. The answer was that they tended to go to large industries where they perceived the opportunities to be greater. Even though the chances of moving very far up the hierarchy

may be very small, it appears that it is very important to us that the chance exist. I have often wondered if such tendencies have anything to do with the incredible success of lotteries all over the world.

There is no doubt that we also perceive fewer risks in large scale enterprises. Insurance works because we average it over large enough numbers. But it is interesting to note that many of our technological achievements have become too large even for our insurance companies. The coverage for large airplanes like the 747 and DC10 is spread over many companies because a claim like that on a single company would likely break it.

One of the reasons we have become such incredible producers of waste is our drive to become a culture of convenience. I don't believe that waste has been our goal. Rather, waste has been the by-product of our major goal of maximum convenience. This desire for convenience shows up in many ways. I believe it is the major reason people take their own cars rather than use public transport or form car pools. Convenience has had a profound influence on the food industry. There is no doubt that electricity is the most convenient form of energy. And our demand for it knows no bounds.

Convenience is a major factor in our quality of life and I would suggest to you that it also plays a significant role in our economy. But the more convenience we gain, the more control we lose. We try to regain control through political means such as Royal Commissions, Legislative Committees etc. But this is simply leading to what I like to call Participatory Paralysis. What we don't seem to realize is that we have voted with our purchasing power to trade off control for convenience.

This externalization of control, which goes hand in hand with an externalization of responsibility, means that an important constraint on size has been removed. Now I am not suggesting as some are that we go back to a situation in which we do everything ourselves. Rather we need a size which prevents control and responsibility from being too far removed from our ken.

The very structure of our society tends to favour larger scale. In some cases the effects are obvious. For example, the structure of our cities tends to make it very difficult to walk or use bicycles rather than use cars. But there are many very subtle influences. In fact, I would suggest that the structure of our society is imbedded in a whole net of very complex feedback loops which cause the elements to reinforce each other and spiral to larger and larger scale. The next figure shows a very simplified sketch of one of these feedback loops.

Each of the long boxes on the right hand side of the diagram should be thought of as a scale or spectrum which we can use to represent the distribution of something like our technology according to some parameter such as size or degree of centralization. We would then place small scale or decentralized technologies on the left hand side of the spectrum and large scale or centralized technologies on the right side. There is absolutely no connection with left and right ends of the political spectrum. There is little doubt that the emphasis has been on developing large scale technologies. That is where the research

and development effort has gone and where the greatest challenges and rewards have been for many years. The scale of our technology cannot help but affect the scale or degree of centralization of the structure of our society. I am using both technology and structure of society in their broadest sense. One can think of the large city both as an example of a large scale technology and as an example of a large scale structure in our society. Our large scale production technologies have led to much larger scale industrial organizations. One can give many examples of this but let's continue around the loop. The structure of society, along with many other factors which I have left out in order to simplify this feedback loop, affects very much our quality of life. It also has a direct influence on the decisions each individual makes. One of the prime examples of this is the influence that the average size of automobiles and the kinds of roads would have on an individual's decision whether or not to use a bicycle or even to buy a small car. These individual decisions add up to a market, and this market, together with the quality of life and the structure of society, very much determine the decisions made by governments and private business.

These decisions of government and private business affect many areas, but for simplicity, I have shown only one, the funding for research and development. If the market for small cars is perceived to be small, then there is little point in putting scarce research and development funds into creating small cars. It appears to be easier for large scale organizations or projects to find funds either in the form of grants or loans than it does for those of smaller scale. Whether this is the influence of the structure of society or some inherent human characteristic is not clear. The result is the same. More funds go into large scale research and development than into the other end of the spectrum. Nicholas Jequier estimates in his OECD publication, "Appropriate Technology Problems and Promises", that of the sixty billion dollars spent on research and development in 1975, only ten million was spent on the small scale end of the spectrum. I was also interested to learn that Australia spends only \$600,000 per year on research and development in solar energy where it has been extraordinarily successful, compared with \$25 million per year on research and development related to nuclear power even though it has made a political commitment not to use nuclear power. There are also stories about the lack of funds to implement a change in the design of cooking stoves in India at the cost of a few rupees per stove to save enormous amounts of cooking fuel, compared with the money being spent on large scale dams and nuclear power.

There is little wonder then, in the fact that the kinds of technologies that get developed and put into use tend to crowd at the large scale centralized end of the spectrum. We are back at the starting point because those large scale technologies exert a very considerable influence on the structure of our society.

The last major factor is our habit of solving problems through growth. When there is intense competition for a larger share of the pie, the easiest solution is to let the pie get bigger and then everyone perceives they are getting more but in fact they may not be getting a larger share of the pie. If labour wants higher wages or the government wants more taxes, it is easier to try to satisfy these demands by increasing sales or growing in

some other way than it is to try to take the money from some other sector.

But in many businesses, the growth syndrome is even more deeply ingrained, and emerges in such mottos as "Grow or Die". Many multinationals see growth as important a goal as profit. We even see this syndrome in Brian O'leary who recently told the annual meeting of the American Association for the Advancement of Science in Washington last month that we must colonize space or die.

But obviously there has to be some limit. The question is, where is that limit? What is the right size and how should it be determined?

## SCENARIO 1

Let's extrapolate the current trends to what would have to be their ultimate limit, at least until we colonize the solar system, and that is to being global in scale. We could use McLuhan's term "Global Village" to describe such a scenario. I think we can envisage a scenario that would warm any multinational's heart.

In this scenario, all manufacturing would be done by Multinational Corporations which would rationalize production capacities. There would be enough variety to ensure that competition would still be effective, but the market would be the entire globe rather than just a nation.

Productivity would have increased to the point where only one or two percent of our social effort would need to be directly involved with production and manufacturing. The rest of the population would be involved in the service sector. Note that I have also included food production in the production controlled by the multinationals.

Considerations such as pollution, energy to drive the machines and quality of urban life would have forced the multinationals to locate their plants in remote areas while the cities concentrated on the cultural and service sectors of the economy.

But would that mean that two percent of the population would have to be banished to these remote plants? Not necessarily. If we look at recent trends toward early retirement and multiple careers, we could envisage most of the population spending one or two years in the plants and then returning to the cities for the rest of their careers.

I can even see that in the process, much of the undeveloped world being rapidly industrialized. But I can also see that labour would have to move to world scale organizations. With world scale business and labour, can Government be far behind? It doesn't take too much imagination to envisage a world scale government just to cope with labour and business.

Now what could possibly be wrong with such a scenario? In fact, many aspects sound very much like what many people have been advocating for several years. There are indeed many benefits to be gained and I think it would be possible to find solutions to

many of the problems that one normally thinks of in connection with such scenarios. What I would like to discuss in this talk are some of the problems which I believe are intrinsic to large scale systems, particularly in regard to the potential mismatch with the characteristics and needs of man.

Perhaps the most important problem with large scale systems is that the feedback loops become very long and the signals very noisy. Feedback has been identified as an absolutely essential component in any stable system. In fact, some people think feedback may be one of the most important concepts developed in this century.

The point can best be illustrated with an example. Imagine a factory on the bank of a river which flows into a very large lake. One day the manager of the factory decides to let the effluent from a new industrial process flow into the river. At the time, very little is known about pollution and no-one worries about the effluent because it is, after all, a very large lake. But after fifty years of pouring effluent into the lake, the contamination reaches levels that start to poison the fish in the lake which in turn poison the workers who live near the lake. By the time the unforeseen effect is discovered, the people who made the original decision have long since left the factory and can in no way be held responsible for their actions. The lake is large and very polluted and will take enormous amounts of taxpayers money to clean up.

The traditional government response is to set up a monitoring agency to enforce effluent regulations. This works as long as the companies don't let effluent into the river when the inspectors are not there. If you don't think that happens, you haven't seen the story of the developers in California who hire biologists to go around identifying, digging up and destroying plants that appear on the endangered species act so they will not appear on the environmental impact statement. This approach leads to regulation after regulation, and endless amounts of red tape and bureaucracy and complaints about the over-regulation of society.

There is another approach which has apparently been taken by some countries, notably West Germany. There the response is not to set up an effluent monitoring agency but to set up a self regulating system by insisting that the effluent pipes from the factory are put upstream from the intake pipes. This apparently has an enormously beneficial effect on what the factories dump in the river!

But there is a very important lesson to be drawn from this example. What has really been done is to change the design philosophy, and reduce the scale of the system so that the feedback time is greatly reduced. The danger signals are loud clear and immediate and are delivered right back to the source.

## ADAPTABILITY

The biological sciences have taught us the importance of adaptability to long term survival. It is a well established fact that very large scale systems have great difficulty in adapting to unforeseen circumstances. That is not to say that large scale systems cannot

change quickly if such changes are carefully planned: It is the unforeseen event that plays havoc. Of course one can argue that small scale systems tend to be ultra conservative, but this once again raises the question "What is the right size?"

The inability of large scale systems to adapt to unforeseen circumstances is not all we need to be concerned about. It is ironic that at the same time we worry about the inability of large scale systems to adapt to unforeseen circumstances, we should also worry about the inability of human beings to adapt to the rapid changes being brought about in the world by the specialization and mechanization of our industrialized society. Toffler has pointed out that this is the first time in man's history that he has been able to experience his own future. The rate of change is so rapid that we may be experiencing what he calls future shock. But rapid changes in one industry can result in future shock for other industries as well. If an industry is too large it may find great difficulty in adapting new technologies and this can create enormous strains in the fabric of society.

There are many examples of this. The Post Office has just spent well over a billion dollars on automatic mail sorting equipment. Will this enormous investment be recovered before electronic mail becomes a reality or will we continue our legislation against electronic mail to protect vested interests? In fact, I believe that business may be getting quite leery of large capital investments not just because of uncertainties created by governments but because of uncertainties over being able to recover the investment before a new technology renders them obsolete.

I have the feeling that as long as the technology is human scale and can be handled by the vast majority, human beings will be able to adapt. But I believe we will find it enormously difficult to adapt to that which we cannot understand or know.

It is also well known in Biology that large scale systems are inherently unstable. They certainly appear to be more stable than small scale systems but it seems that when things start to go wrong, the system very rapidly collapses. Among the reasons for this phenomenon are the lack of adequate feedback to maintain stability and inadequate ability to adapt to unforeseen circumstances. One might argue that on average, small firms have shorter lifetimes than large firms, and that in fact large firms appear to be more stable than small firms. Perhaps the best analogy is with pebbles and large boulders on the side of a steep hill. It is certainly easier to start a small pebble rolling down the hillside but it soon stops whereas the large boulder continues right to the bottom even though it may be more difficult to get started.

## ALIENATION

Alienation surely must be inherent in large scale systems where the mismatch with the individual becomes too great. However, even Schumacher argues that we might be able to reorganize large scale systems so that they appear to be small scale. The results of alienation range all the way from a retreat into apathy to a violent lashing out at the system. Newsweek surveys in the U.S. have found a growing number of people who feel that, "What I think doesn't matter any more". The tragedy of the large scale welfare state

was vividly brought home to me by the Swedish woman who is reported to have said, "They take care of you but nobody cares".

We have not yet learned that caring is one of those things that cannot be quantified. Yet the larger the scale of the system, the more we are driven to quantification.

The desire to quantify everything finds its roots in the fabulous success of the Scientific method. But many small businesses have been run quite successfully without excessive quantification.

I have begun to wonder if the problem of scale and quantification might not be related to the recently discovered roles of the right hand and left hand hemispheres of the brain. It is now widely believed that the left hand hemisphere of a right handed person is linear, quantitative and deductive while the right hand hemisphere is qualitative, inductive creative and in particular possesses the capability of recognizing patterns. A Princeton psychologist, Julian Jaynes has just published a book tracing the origin of human consciousness to a dominance of the quantitative left hemisphere.

It is interesting to speculate about the effects of scale on the ability of both hemispheres to relate to the real world with which the person has to deal. We know people can suffer from information overload, but I don't believe much is known about the effects of continuously trying to relate to large scale organizations on the left hand hemisphere. Let me speculate on the possibility that our reaction might be to rely more and more on quantitative factors rather than try to take it in "at a single view" as Aristotle would say.

If we are to rely on quantitative measures, we must construct models of what we think reality is like. We must create categories and try to discover relationships between them. In business, some of the simple categories are sales, profits, inventory etc. But the latest attempts at social accounting are trying to take into account a variety of other previously unquantified elements such as the dollar value of the human capital one has in the firm, or the negative environmental effects of the firms operations.

In his Presidential address to the Society for General Systems Research in 1971, Stafford Beer wrote about the "Surrogate World We Manage." One of the main points he makes is that the model is often behind reality, and the larger the scale of the system we are trying to model, the more behind it will be. He also points out that there is a real danger in mistaking the model for reality and trying to manage the model instead. As an example, he tells of a petition from the residents of a small town to put on a train at three o'clock. The railway company had a model of the line and had even done an empirical study to verify the model.- The reply the residents received said that the Railway had undertaken a survey and there was no one waiting for a train at three o'clock. Apparently it actually happened in Sussex.

ECOLOGICAL DECISION MAKING

The last problem I have listed, and these are only a few, has to do with ecological decision making. There is no doubt that Adam Smith's division of labour and our society's emphasis on specialization have brought us a long way. But I think something happens when the scale of the system becomes so large that the specialist labouring in one corner can no longer have even an awareness of what the rest of the system is like. We end up managing a whole series of subsystems and optimizing them but lose sight of the impact on the system as a whole.

I think this can best be illustrated by the story of the tragedy of the Commons. There was once a very fertile pasture on which a hundred farmers grazed their cattle. All was well until one of the farmers decided to increase the size of his herd by one cow in order to make a bit more money. It was not long before other farmers followed suit. Naturally, the next step was to increase the herds still further. Finally, the commons was over grazed and there was no more food and all the cattle died.

There are tragic real examples of this phenomenon all over the world. The advance of the Sahara desert in Africa is not only due to drought. It is due to the stress put on the border lands by people retreating from the last advance. The overgrazing results in complete destruction of the land cover, the ability to retain moisture and then the winds come to remove the fertile soil. In Bangladesh, the need for firewood is stripping the mountains bare of trees resulting in floods that leave untold destruction and death in their wake.

Some would argue that the only way that we can get truly ecological decision making is to go to a Global Village. Others would argue that what we need is stricter regulations. But surely it comes down once again to a question of structure and size.

## ALTERNATIVES

A growing number of people have decided to opt out entirely from large scale society. In a recent study of this trend to what is now called "Voluntary Simplicity", the Stanford Research Institute estimates that 4 to 5 million adults in the U.S. had fully adopted voluntary simplicity by the middle of the 1970's. In essence, these people have opted for as small a self sufficient structure as one can get, namely something about the size of the family or a little larger. But at the same time they were giving up many of the things that we have come to regard not just as luxuries but as necessities. What is even more significant is that the researchers see the numbers who opt for this mode of life growing over the next few decades.

Is it so impossible for us to imagine a structure which is characterized by a size somewhere in between these extremes of family units and a Global Village? Let's for a moment imagine a Globe of Villages rather than a Global Village. Let's assume that each of these villages is large enough to be reasonably self sufficient yet small enough to be "taken in at a single view". Let's also suppose that each village constitutes what is essentially a closed system. Each village is responsible for getting rid of its own garbage and pollution and making the most of its own resources including its waste. But lets also

assume that we have a global communications network interconnecting these villages and that people can travel freely.

There isn't time to explore such a model in detail, nor is it desirable. We don't need to construct any more Utopias because the philosophers have already constructed just about every one imaginable. But I would ask you to think about what is happening in Quebec and indeed many other parts of the world in these terms. The old, far flung empires are rapidly being replaced by smaller and smaller nations. It also seems as if the political trends are in direct opposition to those of technology and business. Again the battle lines seem to be drawn up over the question of size.

## WHY NOW

No, the idea of a globe of villages is not new. Nor are many of the problems we face today. If we are not to delude ourselves completely, we should ask what is different now. Why should we even think that it might be possible to create a sustainable society when everything else we know has a finite lifetime. We are at a unique point in man's history. Never before has there been such widespread awareness that there are finite limits to the Earth's resources and its capability to absorb our waste. Never before has man had so much knowledge about nature. We no longer have to depend on chance discoveries. We have enough knowledge to be able to design the kinds of technology that we think will best serve our purpose. Never before have we had such a detailed knowledge and understanding of systems. Dr. James Miller, president of the University of Louisville, has just published a major work called "Living Systems" which draws parallels between seven levels of systems all the way from the cell to the supranational governments. I am convinced that we will be able to use such ideas in helping to solve our problems, and to create homeostatic structures with feedback and adaptability.

Never have we been so aware of man's needs and characteristics, and been so willing to maximize the potential of all human beings.

Never before have we had the information technologies that we have today. And the exciting thing is that we have only seen the tip of the iceberg. We truly have the potential for a global communications network to interconnect a Globe of Villages.

## TRENDS

There are some trends that are important indicators that these ideas may not be so far fetched as they seem at first sight. The first is that there are signs that multinationals may have reached their limits. Some countries are making it very hard for them to expand their operations. For example, India recently ordered Coca Cola out of the country.

There are many important changes in the patterns of international trade. One of these changes is represented schematically in the figure which illustrates four major ways in which two countries, A and B, can exchange goods and information. The first category of trade or aid involves the exchange of commodities which are directly consumed such as

food clothing etc. It also includes raw or semi-processed materials such as metals, gas and oil.

Over the years, increasing emphasis has been placed on another form of trade which I have labeled tools. Countries receiving aid in the form of food began to recognize the difficulties inherent in that sort of dependency and began to ask for the tools such as tractors in order to grow their own food and make their own clothing. Countries which rely heavily on the export of raw materials began to insist that more of the processing and fabrication be done in those countries

In recent years, countries which have found themselves saddled with inappropriate tools which they cannot support without outside assistance, or felt that they would like to be even more self sufficient have begun to want to design and build their own tools rather than rely on imported technologies designed for other climates and conditions. This trend places increased emphasis on a third category of trade or aid which I have labeled "Know-How" and is evident in increased consulting and licencing activities.

I have distinguished between Know-How and basic Scientific and Technological Information,(STI)since the latter flows relatively freely among countries through conferences, journals and books. But STI alone is not enough to apply technology to societal needs. One needs "Know-How" and there appears to be a rapidly growing desire to trade in "Know-How" rather than commodities or tools. But it is important to realize that just as a country needs "Know-How" to support even imported tools, it will also need a well developed scientific and technological infrastructure to support and make good use of trade or aid in "know-how"

#### HOW DO WE GET THERE?

In the last part of my talk, I would like to explore very briefly how we might try to get to such an alternative. The diagram showing the feedback loop in society is useful in illustrating the various schools of thought. The trick is to break the feedback loop somewhere.

The radical revolutionary usually wants to attack the structure of society directly. They claim it is impossible to change anything until the old institutions are torn down. Others have laid most of the blame at the door of our technology and many of them would like to see us throw away a lot of our existing technology and move back to basics. There are those who feel that we must have much stronger government control. Some even talk in terms of something like a dictatorship if the problems get bad enough. And there are those who feel that we must strengthen private enterprise in order to get us of the mess we seem to be in. Personally, I think we might be able to do something by putting more funds into research and development in the small scale end of the spectrum. But even that won't help unless there are major changes in the underlying value system.

As I mentioned before, there are those who have simply opted out of the feedback loop and adopted Voluntary Simplicity.

There is yet another possible course of action and that is what Theodore Roszak calls "the creation of flesh and blood examples" He goes on to say that " no amount of argument or research will take the place of such living proof."

That ladies and gentlemen, is what I see happening on Prince Edward Island. Confederation started there. Why shouldn't a prototype of one of the Global villages start there today?

Thank you.



