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Population, Technology, and Resources in the Future International System

The population problems of the future are commonly discussed in terms of overcrowding and such basic needs as food, water, urban housing and services, and health. There is scattered evidence to suggest, however, that population levels and growth rates may also be important elements affecting war, peace, and man's patterns and styles of social, economic, and political organization.

Historians have frequently referred to population and its growth (or decline) as causes of great migrations, territorial expansions, wars, conquests, changes in the pattern or volume of trade, and industrial growth

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(or stagnation). Few efforts have been made, however, to explain the causal connections in a consistent way or to develop a unified theory. This essay will suggest several of the ways in which world population levels and rates of growth may combine with other variables to influence future human institutions and behavior.

In an effort to meet their needs and demands, human beings use knowledge and skills in order to improve their access to resources. Toward this end they make tools and machines which may be viewed as auxiliaries to the human mind and body in the performance of certain functions, but these also require resources. Hence, the more advanced the level of technology among a given population, the greater is likely to be the range and quantity of resources needed to sustain and advance that technology. Advancing knowledge and skills also alter a people's perceptions of what they "need" and consequently their demands are likely to increase.

The application of knowledge and skills, like biological metabolism, depends upon complex energy transformation chains.[1] Each transformation of energy for such applications involves some amount of degradation from an available, concentrated form to an unavailable, dispersed form. During earlier stages of history and prehistory man could only gradually utilize energy-rich materials. Later, as his knowledge and skills increased, he learned to make increasingly complex alterations and transformations. He learned to unlock larger amounts of resources from the environment and to turn them to useful purposes.[2]

None of this transformed energy came free. At the very least a human being had to expend some amount of his own energy in order to obtain resources and extract a greater amount of food or mechanical energy from the environment. More complex transformations required the investment of considerable amounts of stored mechanical energy in order to generate larger amounts of applicable energy and to maintain it ready for use. Each transformation and application of energy thus tended to exact a toll upon the environment. For example, the excessive exploitation of a forest not only exhausted the local supply of trees, but also encouraged erosion and contributed to floods. In terms of human energy expended, materials consumed, wastes accumulated, and damaging side effects, some types of energy transformation were more costly than others. Over

[1] Howard T. Odum, *An Energy Circuit Language for Ecological and Social Systems: Its Physical Base.* Progress Report to the U.S. Atomic Energy Commission, Appendix 1, Based on Studies Supported by the U.S. Atomic Energy Commission of Biology and Medicine, Contract At-(40-1)-3666, November 1969.

[2] For a discussion of food chains, see Odum, "Energetics of World Food Production," *op.cit.*

much of human prehistory and history, however, the earth was so large and bountiful compared to the number of people and their resource requirements, that depletion and waste had only local significance.

In nation-states and empires, population and technology combine multiplicatively to produce human demands for resources. Such demands may be generated among the ruling elite or among the general populace or among both. They may be partially satisfied by the acquisition of resources either from original sources or through trade. Hence, the scarcer the resources relative to population and level of knowledge and skills, the greater will be the level of unsatisfied demands. This proposition can be broadly summarized in the following equation:

$$\frac{\text{Population X Technology (Knowledge and Skills)}}{\text{Resources (Ecology and Environment)}} = \text{Demands}$$

This formulation applies to a local situation or to a nation-state, an empire or to the whole world. Not only does technology create demands for resources, but advances in knowledge and skills also tend to increase the array of items which people *think* they need.

Over the course of man's prehistory and history certain processes of socio-cultural learning (together with increases in his numbers) have given rise to remarkable changes in his ways of living. These changes include not only the development of powerful tools, weapons, and machines capable of spectacularly altering the environment, but also the devising and operating of new methods of social, political, and economic organization. In general, the higher the level of socio-cultural learning (knowledge and skills) in a given society, the greater the advantage enjoyed by that society in gaining access to (or controlling) energy-rich substrates. Over long periods of time certain crude analogies are evident between organic evolution and socio-cultural "evolution." To the extent that technology develops in a given society, "an evolution in the direction of better fit to the selective system becomes inevitable."[3] The concept of "fit" should be viewed reciprocally, in terms of the environment fitting people just as much as people fitting the environment.[4]

Given a natural propensity for environmental change—alterations in the physical environment as well as in human environments with which a given human being or interpersonal organization is interacting—it is

[3] Joseph Needham, "Evolution," *Encyclopedia of the Social Sciences,* Vol. 5 (1957), p. 652.

[4] Donald T. Campbell, "Variation and Selective Retention in Socio-Cultural Evolution," *General Systems: Yearbook of the Society for General Systems Research,* Vol. XIV (1969), p. 73.

probable that eventually a previously adaptive pattern of behavior will cease to be adaptive. It will no longer "fit." We may expect, then, that ". . . at many levels of cultural development, and for organic evolution, variation is at the expense of jeopardizing the already achieved adaptive system." When appropriate learning and adaptation fail to take place in a given society, a severe strain is likely to be felt.[5]

The efforts of people over many millenia to organize in order to perform certain functions resulted in greater centralization of decision and control, a general increase in reliance upon coercive institutionalized sanctions, more reliance on technology, and a more complex division of labor. The emergence of the state as the virtually universal mechanism of organization, unification, and integration in human society represents a stage in socio-cultural evolution that is qualitatively different from earlier stages such as band, tribe or chiefdom. What, then, distinguishes a state? According to Elman Service, "A true state, however underdeveloped, is distinguishable from chiefdoms in particular and all lower levels in general by the presence of that special form of control, the consistent threat of force by a body of persons legitimately constituted to use it."[6] This decision and control apparatus—based upon a recognized, "legitimatized" monopoly of force which claims to oversee all other institutions within its boundaries—may be displayed in a variety of particular forms by quite disparate societies with small and large populations.

Much of the cohesion and effectiveness of a state also tends to emerge from the popular internalization of authority symbols, the sharing of values and expectations, the inculcation of loyalties and a sense of duty, and the concern of the head of state and the elite with mediation among components of the society, with the performance of ceremonial and often religious functions, and with the fulfillment of a variety of protective and even benevolent roles. National leaderships operate to minimize or close one (or a combination) of three types of gap. A gap between resources that are demanded or "needed" and resources that are actually available is the most basic.[7] The second is the gap between an expectation and the reality that materializes (as when climbing productivity begins to decline).[8] The third is a gap between the state's level of resources, growth

[5] *Ibid.*, p. 73.

[6] Elman R. Service, *Primitive Social Organization* (New York: Random House, 1962), p. 171.

[7] This concept can be broadened to include social demands or "needs" and other benefactions.

[8] Cf. Raymond Tanter and Manus Midlarsky, "A Theory of Revolution," *The Journal of Conflict Resolution,* Vol. XI, No. 3 (September 1967).

or production rate and that of a rival.[9] The behavior of a state at any given time may be understood largely by the existence of one or a combination of such gaps. Gaps in military and naval power, prestige, and status may exacerbate related resource gaps or create new ones.

The first gap involves biological necessities such as food, water, air, and some amount of territory. A people must have access, directly or through trade, to materials which provide the minimal energy they require for survival. Beyond this, the first gap involves the resources that are required for the application of their knowledge and skills, and also the resources that are demanded in order to supply them with whatever additional goods they think are immediately necessary. The second gap refers to expectations of future growth. Societies that have been achieving increments of growth year by year come to expect further increments in the future.[10] Hence, if the growth rate declines, national leaders and much of the populace may develop feelings of uneasiness, dissatisfaction, or frustration. The third gap emerges from situations of competition where one country begins to compare its capabilities and growth in agriculture, commerce, industry or military power with the capabilities and growth of another country. Absolute levels of population, technology, territory, resources, and trade affect a nation's overall capabilities, power, prestige, and status. Moreover, rates of change along these dimensions shape a nation's predispositions and behavior.

If a society's population is too large relative to its level of knowledge and skills, demands are likely to be high, but the people will in large part lack the capabilities to meet them. Such a society will confront difficulties in locating, extracting, and processing scarce resources. It may have difficulty in maintaining domestic communications, cohesion, order, and effectiveness. It will also be vulnerable to economic, political, and military penetration, exploitation, and domination by stronger powers. To maintain itself, the populace should be able to produce at a volume and rate considerably above its level and rate of consumption. Favorable trade can add to the level of available resources in the denominator of the demands equation, but a society cannot be really powerful unless the level of knowledge and skills is raised commensurately with the growing population.

In their efforts to close gaps between what is available and what is needed (or demanded), both individuals and interpersonal systems tend to

[9] Cf. Alan Howard and Robert A. Scott, "A Proposed Framework for the Analysis of Stress in the Human Organism," *Behavioral Science,* Vol. X, No. 2 (April 1965).

[10] Tanter and Midlarsky, *op.cit.*

allocate certain proportions of the resources available to them for the development of specific capabilities. These special capabilities may involve methods of hunting, trading, agriculture, warfare, and industrial production. The general nature of a society's institutions and government is likely to reflect the social requirements of the technology that prevails within it. Similarly, in modern cases, the distribution of the budget of a state or empire is a good indicator of the society's operational, as opposed to its professed, values.

Population, technology, territory-resources, and trade can be combined in the following ways to yield characteristic patterns and predispositions:

moderate, stable population; high, growing technology, favorable trade; "adequate" territory, resources	→	prosperous, progressive, non-aggressive society; high standards of public welfare (Sweden today)
large, growing population; low, lagging technology; "inadequate" resources; large underdeveloped territory; low or unfavorable trade	→	high basic demands, low capability, mass society near subsistence; disintegrated political, economic systems; "warlordism"; external penetration by aggressive, high lateral pressure states (China, 1912-1924)
large, rapidly growing population and technology; "inadequate" resources; limited territory; inadequate trade relative to demands	→	centralized, aggressive, militaristic society; likely to feel "surrounded," blocked; likely to expand opportunistically (Japan, 1930)[11]
large, growing population; high, rapidly developing technology; high level of resources but needing particular external resources; large territory (or colonial holdings); high, favorable trade	→	Great Power with much lateral influence, pressure; strong generator of energy; engaged in Great Power competitions, arms races, (pre-World War I U.K.; U.S., U.S.S.R. today)

Some technologies have a high degradation/effectiveness ratio, that is, they render large amounts of energy non-available and useless or contaminating to life while "producing" relatively little. Their implications are entropic for the social system. Military applications tend to be especially illustrative. A major purpose of other applications—such as a water

[11] Japanese trade during the 1930's might be viewed as high, but insufficient for the rapidly increasing demand for resources.

filtration system—is to refurbish demands. The critical question is, does a particular application of technology refurbish sufficiently more than it "consumes" or degrades? The difficulty of the old dream of pumping water out of the ocean, desalinating it, lifting it over the mountains, and using it to make the Sahara Desert bloom involves the current high cost in terms of degradation for each unit of environmental (denominator) refurbishment.

This consideration raises difficult problems of means and ends. Means for achieving desirable ends differ substantially in their degradation/effectiveness ratios, some giving off much larger amounts of polluting effluents than others, and some "costing" the environment much less for each unit of benefit. What is a "benefit" on one dimension may not be on another, however. Thus, the manufacture and use of DDT eradicated malaria in many parts of the world, but had a "degrading" effect on a wide range of animal life via the food chain; and the application of bombs and defoliants to the Vietnamese countryside may be considered a "benefit" to U.S. foreign policy, but in ecological terms this use of technology adds up to almost utter degradation of energy, almost total "cost" and destructiveness. A waste water filtration plant, on the other hand, exacts some cost in degradation but yields vast amounts of cleaned, refurbished water—a vital resource to man and other forms of life.

As world population grows and technology advances, a major policy question *eventually* is going to be how to discourage applications of technology which severely degrade the denominator (ecology, resources) and develop other applications that meet demands at low cost to the environment. Clearly, this will involve a very considerable change in the nature of human demands.

There is another serious consideration, however. Up to now, much of the concern over population, ecology, and environment has focussed on (a) the problem of supplying adequate amounts of food; (b) ways to avoid depletion of other basic resources; (c) preservation of adequate living space; and (d) the control or elimination of certain types of pollution. We propose two further concerns that are interrelated and also of great importance for man's future: (e) the uneven access to basic resources of different societies and states; and (f) the contributions of differentials in population, technology, and access to resources to international conflict and violence (itself a great depletor of resources, especially in an era of defoliants and nuclear weaponry).

We have asserted that rising population, advancing technology, and "inadequate" or lagging access to resources create demands which a society

then tries to meet by developing specialized capabilities. This also involves further considerations: the combination of demands and specialized capabilities (whether in agriculture, commerce, industry, military power) gives rise to what might be called lateral pressure. We use lateral pressure as a neutral term to express a society's tendency to exert efforts in one mode or another, or in a combination of modes, ever farther from its natural or original borders. This can occur as an attempt to meet demands for resources (and/or markets), or because a society has generated surplus capital for investment, or for other reasons. Lateral pressure may be generated in either public or private sectors and by "socialist" as well as "capitalist" states, and it can be expressed in terms of exploration, foreign trade, investment, conquest, acquisition of territory, domination over other societies, or even journeys to the moon. This concept can be expressed in an oversimplified way by the following formulation:

$$\text{Demands X} \left\{ \begin{array}{c} \text{Specialized capabilities} \\ \text{in agriculture, commerce, industry,} \\ \text{investment, military power, etc.} \end{array} \right\} = \begin{array}{c} \text{Lateral} \\ \text{Pressure} \end{array}$$

Because they generate rapidly increasing needs and demands for resources and are also likely to produce highly specialized capabilities, a growing population combined with an advancing technology is likely to give rise to increasing lateral pressure expressed in one mode or another, and often even in a combination of different modes. During the late 19th and early 20th centuries, colonial expansion was a characteristic mode of lateral pressure by the Great Powers which thereby acquired vastly more than their proportionate shares of access to resources and markets.

Since World War II the possibilities for colonial expansion have been severely limited, and lateral pressure has been expressed much more in terms of trade and aid programs, military assistance to client countries, the establishment of bases, and the stationing of troops overseas. The size of the colonial population no longer serves as a viable indicator of the expansion of a country's interests. Control is frequently exerted now through a variety of means other than direct rule. Sometimes these influences are quite subtle. It has been argued that Great Powers tend to concentrate their trade with smaller states in an attempt to use commerce as an indirect means of control. Nazi Germany's harsh trade relations with the countries of Eastern Europe have been interpreted in this light.[12] Gen-

[12] Albert O. Hirschman, *National Power and the Structure of Foreign Trade* (Berkeley: University of California Press, 1945). It is not the *amount* of trade a small state devotes to a larger Power that is important in this respect, but rather the *proportion* of trade with the

erally it is the more technologically advanced polities that are capable of pressuring, influencing, and controlling less effective societies.

By yielding resources, trade has the possibility of alleviating demands (adding to the resource base of the society). A high lateral pressure country may in fact use trade as a means for dominating a low capability country, but this need not be so. Although there are undoubtedly numerous exceptions, the trend seems to be in the direction of high capability countries getting stronger and richer (and consuming a greater proportion of the world's resources) relative to the low capability countries. This trend is likely to become exacerbated as nuclear reactors and other tools of technology require larger and larger bases of specialized knowledge and skills.

Some countries have consciously developed commercial capabilities in preference to political expansion or coercion. In this respect the Scandinavian countries stand in sharp contrast to the Great Powers: commerce—not conquest, expansion, or warfare—has provided the dominant mode of external behavior. However conscious this decision may have been on the part of the national leadership, it is nonetheless a reality that these countries had neither the manpower nor the accompanying rate of growth that would sustain a more belligerent international posture. In 1960 the combined populations of the four Scandinavian countries amounted to approximately ten million less than the population of Great Britain one century earlier. Furthermore, rates of growth were almost one and a half times lower than those of Great Britain.

As a nation-state or empire extends influence (and hence its interests), a feeling frequently tends to develop among the elite (and often among the populace) that this influence and the expanding interests (whether public or private) ought to be protected. Where feasible, powerful states and empires tend also to inhibit their rivals or enemies from extending their interests into new territory. These tendencies may give rise to the extension of military or naval forces, the development of a tendency to police areas beyond the legal boundaries of the state or empire, and a feeling of responsibility for regional or even world "law and order."

During the 19th and early 20th century, Great Britain played such a role *par excellence,* and it was this British advantage that German leaders were increasingly inclined to challenge. Similarly, after World War I, an aspiring Japan (with her rapidly growing population and technology) saw Great Britain and the U.S. defending an advantageous status quo at her expense. With the disintegration of the British and French empires after

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larger Power in relation to the total amount of trade undertaken by the smaller state that is an indication of the degree of penetration by the larger.

World War II, the U.S. came to occupy the position in the world which England had previously occupied, steadily assuming responsibility in the Far East, Indochina, the Middle East, and elsewhere for old British and French functions which it performed, frequently, in new styles and modes. The desire to achieve and maintain law and order (as defined by the national leadership) and protect national and private interests in far off places may lead to wars against indigenous tribes, chiefdoms, petty principalities or low capability states in an effort to attract, equip, and partially finance client chiefs, princes, warlords or other rulers or ruling groups.

The Roman Empire, the British and French Empires of the 19th century, the U.S., the U.S.S.R., and other powers have all displayed this tendency. Of the 21 wars between 1870 and 1914, each involving Richardson scale casualties between 3,000 and 31,000, almost all emerged from the extension or maintenance of colonial domain. Only three involved direct confrontation among the powers. More frequent were collisions between Great Powers and client states.[13] Since World War II client states have played a major role in the waging of cold wars. To the extent that two (or more) countries with high energy levels and high lateral pressure tendencies extend their interests and psycho-political borders outward, there is a strong probability that sooner or later the opposing perimeters of interest will intersect at one or more points. There is often a feeling on the part of an aspiring but weaker or less prestigious power that it is being "encircled" by its rivals. When this happens, competition will intensify and result in a conflict, "cold war," or an arms race. Crises are likely to emerge around such intersection points.

These tendencies often lead to wars between either the two or more high lateral pressure nations or their local clients or both. The French and Indian wars in North America (during which Algonquin tribes were clients of the French and Iroquois tribes were clients of the British) and French-English clashes in India (and clashes between British and French client rajahs and sultans) during the 18th century offer classic examples. More recently, the Vietnam War and the Middle East situation provide additional illustrations of these dynamics, complicated, of course, by the intricacies of local conflicts. That both the level and the rate of increase of the Egyptian population are so much higher than those of the Israeli population is undoubtedly a critical consideration in Israeli defense calculations—much in the same way, perhaps, as the vast technological su-

[13] Lewis F. Richardson, *Statistics of Deadly Quarrels* (Chicago: Quadrangle Books, 1960), pp. 52-69. These comparisons are made *only* on the basis of wars involving one or more of the Major Powers.

periority of Israel features prominently in Egypt's own military calculations. The Middle East situation provides one of the most clear-cut cases of the interdependence and extreme salience of population dynamics and technological advancement. In many ways these considerations set the parameters within which psychological, sociological, and political factors come into play. It is self-evident that Soviet and American involvement in the area raises the probability of a global conflagration. In many respects contemporary Indochina can be viewed as a locus of intersection of U.S., Soviet, and mainland Chinese interests, complicated by strong North Vietnamese (and some South Vietnamese) lateral pressure.

On a fundamental level (and ignoring cultural ties), Russia's support of Serbia in 1914 against pressures from Austria-Hungary can be assessed in terms of increasing militarism in Europe. Each Power predicated its own defense calculations on those of its "adversaries"—either perceived, potential, or actual—and any increase in one nation's defense budget was matched by a comparable, though by no means identical, increase in the defense budgets of its "adversaries." But such competition becomes salient only to the extent that basic differentials in population growth, technological advancement, and access to resources have already become considerable and are perceived as such by all sides.[14]

In sum, levels and rates of growth of population and technology have political as well as ecological and economic implications. Uneven rates of growth of these dimensions and grossly unequal access to resources (and uneven capabilities for processing and applying them) give rise to the political and economic (and sometimes the military) penetration of low capability societies by high capability countries, and to international competitions, conflicts, arms races, crises, and wars.

Differentials in world and regional consumption of fuel energy offer a rough indicator of the spread between high capability and low capability countries:

	Total Energy Consumption Per Capita 1951[15]	*Total Energy Consumption Per Capita 1967*[16]
World	1070	1647
North America	7486	9665
Western Europe	2092	3148
Caribbean America	507	998
Other America	372	618
Africa	203	285
Far East	151	378

[14] Kendall D. Moll, *The Influence of History Upon Seapower, 1865-1914* (Menlo Park, California: Stanford Research Institute, September 1968); Richard P. Lagerstrom and Robert

Some gains were thus made by the less industrial regions of the world, but they were not spectacular. In 1951 the world per capita level was 7 times the per capita level in the Far East, and the North American per capita level was nearly 50 times that of the Far East. By 1967, the world level was somewhat more than 4 times, and the North American level was a little less than 30 times, the Far Eastern level. If the world were forced to depend on fossil fuels as its primary source of industrial energy, there would be little probability of "significantly improving the standard of living by industrialization of the so-called underdeveloped regions of the world" or of maintaining, on an unequal basis, the activities of the highly industrialized areas "at anything like present levels for more than a few centuries." There are even possibilities that shortages might develop "before the end of the present century." The only remaining source of energy "that does have the proper magnitude and does lend itself to large industrial uses is nuclear."[17]

In many respects the industrial superpowers are like huge vacuum cleaners sucking up resources from all over the world in order to maintain productivity, military capabilities, and consumer demands. In 1960 with 6 per cent of the world's population, the U.S. consumed approximately 30 per cent of the world's total production of minerals at that time. If the whole world had been industrialized to the same level, the annual drain in 1960 would be about 5 times what it actually was. At current population, technological, and consumption growth rates in the U.S., northwestern Europe, the U.S.S.R., Japan, and a few other industrialized regions, there is likely to be sharper competition for resources over the next 50 years unless a more rational and just distribution can be achieved.[18]

We have emphasized that high capability, high lateral pressure powers, in expanding their interests, obviously often dominate less developed countries. Frequently there is a feeling that such interests ought to be de-

C. North, "An Anticipated Gap, Mathematical Model of International Dynamics," Institute of Political Studies, Stanford University, April 1969 (mimeo.); Nazli Choucri and William C. Mitchell, "Armaments Behavior Among Competing Nations Simulating the Naval Budgets of Major Powers: Europe, 1870-1914," Department of Political Science, Massachusetts Institute of Technology and University of Chicago, October 1969.

[15] United Nations Statistical Papers, *World Energy Supplies,* Series J, No. 3, 1955-1958, Table 1, pp. 3, 4.

[16] *Ibid.,* No. 12, 1964-67, Table 1, pp. 10, 11.

[17] *Energy Resources,* A Report to the Committee on Natural Resources, National Academy of Sciences, National Research Council, Washington, D.C., 1962, pp. 132-133. See also Palmer C. Putnam, *Energy in the Future* (Princeton: Van Nostrand, 1953).

[18] *Energy Resources, op.cit.,* pp. 131-132.

fended. We have also underscored the fact that when the perimeters of interest of two (or more) high capability powers *intersect,* confrontations may develop, and the two powers may see themselves as competitors for influence and control. Each is likely to do what it can to deny the other the access it would like to resources, markets, and political and economic control of the low capability region.

Until the 20th century the world was much larger, relative to the number of people, and many societies were buffered from each other by time and space. Now, increasingly, we live elbow to elbow, cheek to jowl. As national populations increase, and as the technological capabilities of a few Great Powers create new demands, current intersections are likely to become exacerbated in the future. With greater reliance on electrical energy generated by nuclear plants, and as transportation and communications are further improved, the location of highly developed technologies is less likely to be determined by the immediate availability of the necessary raw materials and more by the availability of appropriate knowledge and skills. A few Great Powers are likely to enjoy considerable advantage in the development of breeder reactors and other transformers of energy, whereas low capability countries may suffer. These considerations suggest the potential for an even more subtle type of domination by strong countries over weaker countries.

Beyond this, the influence of population, technology, and access to resources raises troublesome questions about the control of international conflicts and the avoidance of war. It suggests that mediation, conciliation, adjudication, the development of international law, and other alternatives to war are not in themselves likely to be sufficient for the preservation of peace. On the contrary, the basic "causes" of war seem to reside in the uneven development of national dimensions and attributes over which, in the past, national and international political processes have had very little control. One might conjure up a somewhat oversimplified picture of a dozen nuclear missile establishments zeroed in on each other with the trip wires attached to a multivariate threshold involving differentials of population, technology, and access to resources and markets. This suggests the need for a whole new set of worldwide investigations into the nature of these inequalities and uneven distributions of resources and capabilities. It suggests that the environment, resource allocation, the characteristics of different ecologies, and the "sovereign" state as a basic unit of political and economic organization are important starting places for research not only into the causes of war, but also for designing and putting into effect a more peaceful and effective alternative international system.

It suggests the encouragement of "social learning" and "social invention" to ensure a better "fit" between mankind and his environment—with attention to the interests and integrity of the individual.

These observations raise the question of whether ways can be found to guarantee low capability countries a fair share not only of food and other basic resources, but also of access to nuclear and other energy transferring modes free of Great Power control, domination, competitions, and conflicts. This also requires access to related communication and transportation facilities. It points toward the development and control of such technological complexes by international public agencies through which low capability countries of the world are enabled to participate and maintain their rightful shares of decision and control.

Closely associated with this is the need for continuing research into the social, economic, and political "costs" of new technologies as well as into their more narrowly and technically defined effectiveness and efficiency. For each unit of output, how costly is a given technology in terms of depleting the resources denominator of the demands equation and in terms of damage to the quality of human living? Some application of knowledge and skills—for which DDT might become a model—may imply both gains and losses to human life on the planet. In even more fundamental terms, modern military establishments should come under close scrutiny with respect to their effects on the environment and on future human life as a whole—in addition to their immediate casualty-producing implications.

All these considerations have implications for conservatives, liberals, and radicals alike. Preservation of the status quo is likely to lead to a series of disasters; reliance on "good will," exhortation, and "faith in mankind" is not likely, in itself, to move men to make the changes that are required; and the substitution of a new elite, a new ideology, or a new political system will also be useless in the long run unless careful provision is made for investigation into these deep, underlying problems and for the identification and carrying out of alternatives that will ameliorate problems which, so far, virtually no ideology or political system has taken into sufficient account. First, the most pressing needs are to identify (and develop) promising organizational, procedural, and technical alternatives and second, to employ our pedagogical and communications skills to educate the people of the world about the crucial tasks that lie ahead.