LIMITS TO NATIONAL DEVELOPMENT
RESOURCES OR RESOURCE ALLOCATION PROCESSES?

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ABSTRACT

This paper re-examines the economic development problem and establishes that organizational arrangements underlying resource use at the social, political, and ecological levels, not shortage of resources *per se,* or their inefficient employment, are responsible for creating conditions of underdevelopment and for the failure of the well-intentioned economic development efforts made in the past. Three levels of national organization are examined: the social level which is concerned with the production and distribution of income among various cross-sections of society; the political level where decisions are made to allocate resources to public welfare or to maintaining control over the public; and the ecological level where a resource mix is selected for use on the basis economic and technological considerations. The analysis is based on three separate formal system dynamics models of the resource allocation processes dealing with each of the three levels of national organization discussed above. Appropriate institutional arrangements for fostering sustained national growth are explored.

1. INTRODUCTION

Although there have been variations on this theme, the economic development effort to date has mostly attributed the constraints on national growth to a shortage of capital and other material resources and their inefficient employment. Consequently, the economic development policy design has emphasised growth in renewable capital and the introduction of modern technologies for improving efficiency of employment of resources as well as increased exploitation of the natural resource base [Lewis 1984]. The policies thus issued not only appeal to the moral conscious of the governments concerned, they also call for large scale interventions by these governments. This requires that the governments be concerned with public welfare and that they exercise a high degree of control over the national resources [Friedman 1978].

Unfortunately, in a number of cases, the past economic development effort has not only been unsuccessful, but has also led to the creation of a number of social, political, and environmental catastrophes which have caused much suffering to large groups of people. The social problems created include worsening of income distribution and aggravation of poverty and hunger [Griffin, 78]; the political problems include an increase in despotism within nations and worldwide expansion of military arsenal [Nabe 1983]; and the environmental problems manifest themselves in the rapid depletion of the natural resource base and the decaying quality of the physical environment [Picardi 1976].

Apparently, these problems were created because the development effort ignored existing social, political, and ecological arrangements of the systems which were responsible for creating undesirable economic conditions in the first place. As a result, this effort was spent mostly on working against the internal forces of the system without ever hitting at the causes of the problems it attempted to alleviate. In this process, the system forces responsible for the problems were further strengthened, which contributed to the worsening of the survival conditions of the populations affected.

This paper re-examines the economic development problem and establishes that organizational arrangements underlying resource use at the social, political, and ecological levels, not shortage and inefficient use of resources *per se* are responsible for creating conditions of underdevelopment and for the failure of the well-intentioned economic development efforts made in the past. Three levels of national organization are examined: the social level which is concerned with the production and distribution of income among various cross-sections of society; the political level where decisions are made to allocate resources to public welfare or to maintaining control over the public; and the ecological level where a resource mix is selected for use based on economic and technological conditions.

The analysis is based on three separate formal system dynamics models of the resource allocation processes dealing with each of the above three levels of national organization. The sub-systems represented in these models are parts of a hierarchy which determines survival conditions for society. These models are further elaborated in Saeed 1985a, Saeed 1985b, and Saeed 1986. The technical details of these models are available from the author on request. At the outset, the ultimate availability of resources is determined by a process of selection of resources from the ecosystem,

while limits to improving the well-being of society arise, in the first instance, from the working of the political system and are further modulated by the working of the economic system which regulates production, consumption, and income distribution dicisions.

2. THE ANATOMY OF LIMITS

The traditional perception of limits to improving the well-being of a society, which is to view these in terms of resource inadequacy, incorporates the fundamental implicit assumptions that the social system being dealt with is static and that the condition of resource inadequacy being experienced is given. When distributional aspects of resources are also considered, the social classes which claim various shares of income are taken as given, as if they came into existence by acts of fate. Figure 1 shows an integeration of the various propositions which one comes across in the literature striving to explain the poor economic conditions in the developing countries.

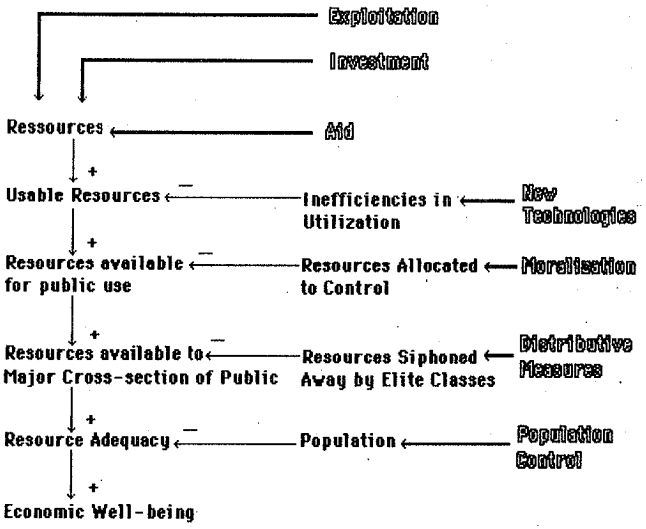


Figure 1: Static Views on Economic Development and Interventionist Policies

According to these, the poor economic conditions arise in the first instance from inadequacy of resources which is attributed to many factors. The most widely discussed of these are are as follows: high population growth rates which increase population to levels for which available resources are inadequate; the inequalities of income distribution which allow a large portion of the resources to be siphoned away from the majority by small elite classes; the large government spending on maintaining law and order; the inefficient utilization of resources caused by employing obsolete and wasteful technologies; and an inherent inadequacy in the absolute level of resources available to the society.

When this static view of the problem is accepted, many policies to alleviate the resource shortage problem may emerge. Indeed, many policy intruments have been proposed and implemented in the developing countries for improving their economic conditions over the past few decades. These policy instruments and their targets are also shown in Figure 1. Absolute shortage of resources was to be overcome by increasing investment, increasing exploitation of the resource base, and obtaining foreign assistance. Inefficient utilization of resources was to be cured through adopting modern technologies. The governments of the developing countries were advised to keep their "non-development expenditure" low and to step up development activity. To correct income inequalities the governments, in some instances, took over private assets for purposes of redistribution or direct control. Large population control organizations were formed to implement birth control.

A common feature of these policies was the large scale government intervention they required despite the much touted truism about keeping "non-development spending" low. Thus, the role of the government and the amount of resources allocated to constructing and operating instruments of control increased concomitantly with the implementation of these policies. The inefficacy of the development effort conducted on the above lines is also quite widely recognised [Saeed 1982a].

Population growth has continued at an ever increasing rate in spite of the concerted efforts to control it. Income inequalities have become worse, while the share of government spending in the total national budget has risen considerably in most developing countries [Griffin 1978, Ball 1983]. There has possibly been some improvement in the efficiency of utilization caused by the introduction of new technologies, and an increase in the absolute amount of usable resources, but the benefit appears to have been more than cancelled out by the factors mentioned above [Griffin 1977].

Apparently, the static view of the problem adopted is quite inadequate to serve as a basis for policy design when it is quite widely recognised that social systems that have to be dealt with are dynamic and consist of actors (social as well as ecological) responding to the ever-changing pressures that shape their roles [Forrester 1971].

A society is nourished by the interplay of three imprtant organizational subsystems: The societal subsystem which, together with technological choices and economic laws determines how available resources are transformed and exchanged among various social groups; the governmental management subsystem, which determines broad allocation of national resources to producing througput for the members of the society and to exercising control over them to assure smooth functioning; and the resource subsystem, whose physics determine the ultimate conditions of survival [Miller 1982]. The interplay of these systems is illustrated in Figure 2. For continued sustenance of the society, these three subsystems must work in complete harmony. Deviations in the goals of the three can often be accommodated in the short run, but at a cost which is borne in the future. The limits to the increase in the welfare of a society arise from how these goals are determined through the resource allocation processes, not from the absolute quantity of resources in the system and their efficient utilization.

The following sections of this paper are concerned with understanding the resource allocation processes involved in the working of the above subsystems and their implications for the design of policies for improving welfare. The three subsystems are treated separately for pedagogic reasons, although, these should be viewed simultaneously for purposes of policy design.

3. RESOURCE ALLOCATION IN THE SOCIETAL SUBSYSTEM

The developing country economies are predominantly rural while they also appear to have a dualist structure consisting of a worker hiring or land-leasing capitalist sector and a self-employed peasant sector. It has also been observed that all workers, whether self-employed in tilling their own or rented land or employed as wage-workers, are members of a homogeneous socio-economic group with a common interest, which is to maximize consumption. This group also appears to be the sole supplier of labor in the economy if the small number of working capitalists is neglected. On the other hand, the capitalist sector strives to maximize

profit while it is also the sole wage-employer in the economy (Bardhan 1973).

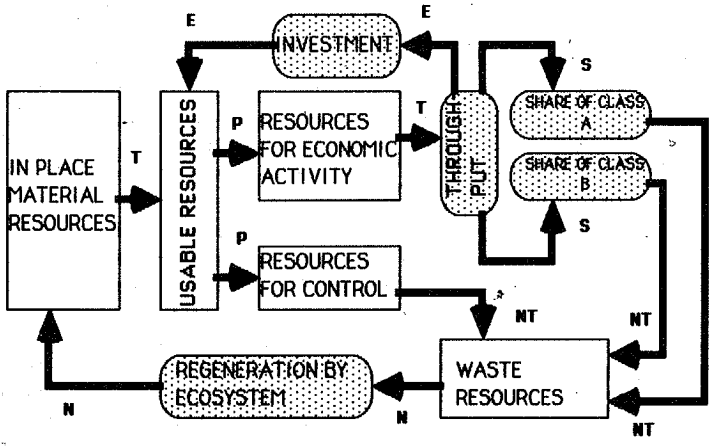


Figure 2: The Interplay of Subsystems Providing Nourishment to Society

The main accumulations and flows of a system dynamics model incorporating this dualist structure are shown in Figures 3 and 4 which, respectively, illustrate how production factors are allocated between the two sectors of the economy and how the income of the economy is distributed. The changes in the quantities of the production factors owned or employed by each sector are governed by the decisions of the producers and the consumers of output and by the suppliers of the production factors acting rationally according to their respective motivations within the roles defined for them by the system. The value of production is shared by the

households on the basis of the quantity of the production factors they contribute and the factor prices they can bargain for.

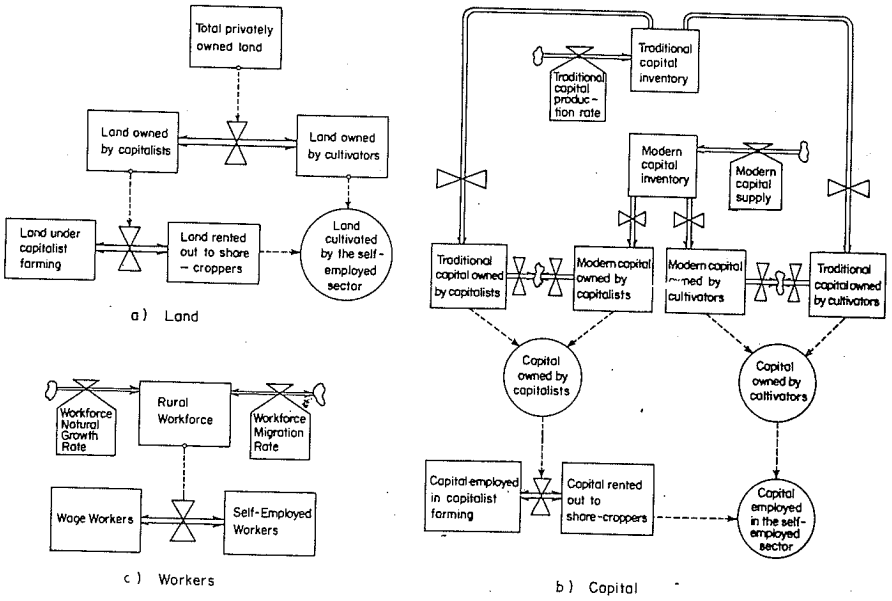


Figure 3: Allocation of Production Factors to Various Production Modes in an Agrarian System

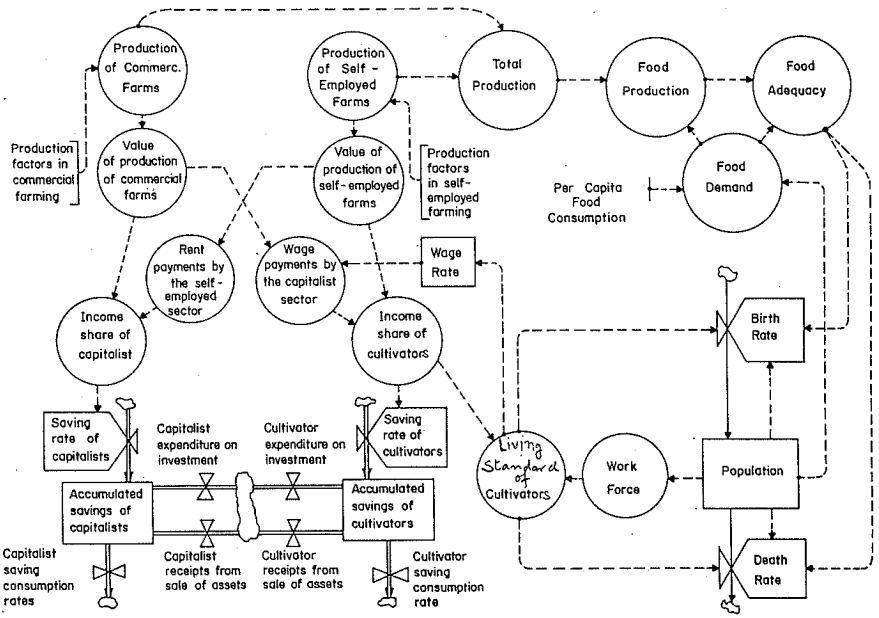


Figure 4: Disbursement of Income in an Agrarian System

The capacity allocated to production of food cereals depends on the demand for food generated by the population less food imports or food aid. Prices of output and production factors are endogeneously determined and, in turn, affect both production and consumption decisions, although, food consumption per capita is relatively inelastic. Food adequacy is determined by the supply of food calories relative to their demand, and in turn, influences birth and death rates. Income share of the workers, less any investment needed to maintain self-employment divided by the total workforce, determines average consumption per worker, which is the basis for negotiating wage rates. Wage rate affects people's standard of living. An improvement in the standard of living reduces both birth and death rates.

Such a system has an internal tendency towards concentration of resources in the capitalist sector which arises out of a goal of the system being to employ resources in the most efficient way while the ownership of those resources can only be in the hands of the sector which is the most capable financialy. If land can potentially be farmed by owner-cultivators, share-croppers and wage-workers, the presence of any wage-employment opportunities offering wages equal to income in self-employment depresses the saving rate of the self-employed. In the long run, this also decreases their ability to own land, which decreases their share of income and hence the wage they can demand.

A decrease in ownership of resources by the self-employed, in the face of a decrease in wage-employment opportunities which is caused by high labor costs, also increases demand for renting, which raises rents. This not only makes it profitable for the capitalist sector to invest in resources for renting them out, it also gives additional financial edge to this sector over the peasant sector whose savings continue to decline as its rent burden rises. Thus, even when capitalist farming is eliminated due to the high cost of wage-labor, resource ownership by the capitalist sector expands. In the resulting end equilibrium, the major share of the resources is owned by the capitalist sector and only a minor share by the self-employed while the major mode of production is share-cropping. This result is borne out by the pervasive occurrence of resource concentration experienced in most developing countries.

When the assumption of a fixed economy is relaxed and birth rate and life expectancy are assumed to be influenced by food adequacy and income level, population change in this system is not significant, although, it is characterised by a high birth rate and a low life expectancy. This is shown in the simulation of Figure 5 in which population growth assumptions were

introduced after the system settled down with its charateristic resource concentration. The stagnant scenario created describes stagnant economies of the poor countries before they engaged in serious development effort. It should be noted that the poor living conditions in this system (low wage rate, low food supply per capita, low iife expectancy) arise not from an absolute shortage of resources but from the processes that determine their modes of employment and ownership.

The long term welfare goal of this system remains quite unaffected by the standard recipes outlined in Figure 1. Introduction of modern technologies increases production and population growth simultaneously while changing the predominant mode of production from share-cropping to commercial farming but keeping resource adequacy for the major cross-sections of the public unchanged. Population control policies increase the scope for population growth, thus increasing the pressures that these policies have to fight against. Radical redistribution policies are quickly off-set by the internal forces of the system. Extending technological and financial assistance to the poor only makes the share-cropping mode more attractive than commercial farming, keeping resource distribution unchanged. The details of the simulations leading to above inferences are discussed in Saeed 1982b and Saeed 1985a.

Since the internal tendency of a system arises from the powerful feedbacks which dominate the behavior of its actors, the efficacy of a policy depends on how effectively it changes the relative strengths of those feedbacks. Figure 6 shows the important feedbacks in the in the societal subsystem. Positive feedbacks, which are self-reinforcing and negative feedbacks, which are self-correcting, are shown separately.

It will be noticed that price is not the only market-clearing mechanism in the system which strives to balance supply and demand. Population changes, which are driven by adequacy of food calories and living standards, also strive to achieve this balance. The internal forces attempting a balance are, thus, embodied in four negative feedback loops, only two of which are recognized in the models treating population exogeneously. The remaining two negative feedback loops make it difficult for the system to move away from an internal goal of equilibrating at low levels of wages, food adequacy, and life expectancy. The positive feedback loops, which are coupled with these negative feedback loops, only speed up the process of adjustment.

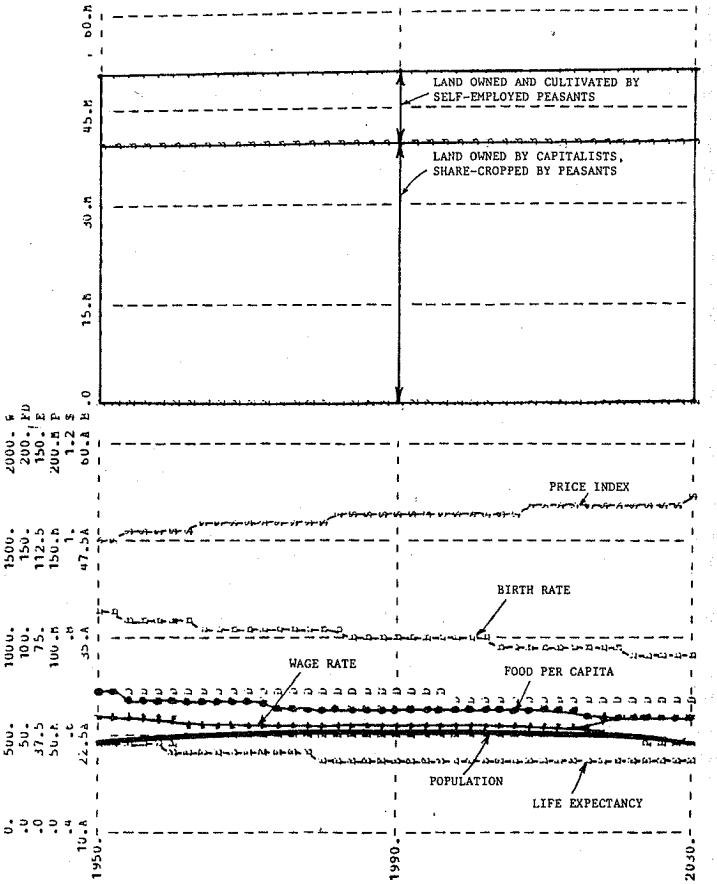


Figure 5: Stagnant Behavior of the System in the Absence of Development Effort

Unless the internal goals of the system are changed, any direct effort to increase food supply, change population, or help the poor will be resisted by the forces embodied in the feedback loops of Figure 6, although, these policies may create temporary gains. The internal goals of the system may be influenced only by changing income shares of the workers and the ambient cereal food consumption per capita, which emerge as promising entry points for directing efforts to counter-poverty and hunger.

Policies for raising incomes of the poor have been discussed in detail in Saeed 1982b. These policies, at the ouset, call for a change in the ownership pattern that should allow workers to obtain a larger share of the total income of the economy, which also enhances their wage bargaining position. This, however, may not be achieved through radical means since current ownership patterns are also the result of the system's internal tendency.

On the other hand, if the cost of being an absentee owner of the resources is increased through fiscal measures such as a heavy tax on unearned income (rents, profits), resources which cannot be employed efficiently under the commercial system are offered for sale to the self-employed sector. Purchase of these resources by the self-employed raises the entitlement of the worker households to the income of the economy, which increases their opportunity cost of supplying wage labor to the capitalist sector. This raises wage rate, which makes commercial farming even more uneconomical. Such changes spiral in the long run into transfer of a substantial amount of resources to the self-employed sector. Provision of technological, organizational, and financial assistance to small farmers accelerates this process, although without the fiscal measures which increase the cost of being an absentee owner, such assistance only results in a change in the cropping pattern.

This policy package will, however, not limit the rise in population, because, even though a higher standard of living has a limiting influence on birth rate, the temporary abundance of cereal food calories offsets this influence. Furthermore, life expectancy rises on account of a better living standard. The quality of life improves because of these changes. There is, however, little change in the trend of cereal food available per capita since the food consumption pattern continues to be economical and extra food production only leads to population growth. Thus, vulnarability to food shortages is not overcome.

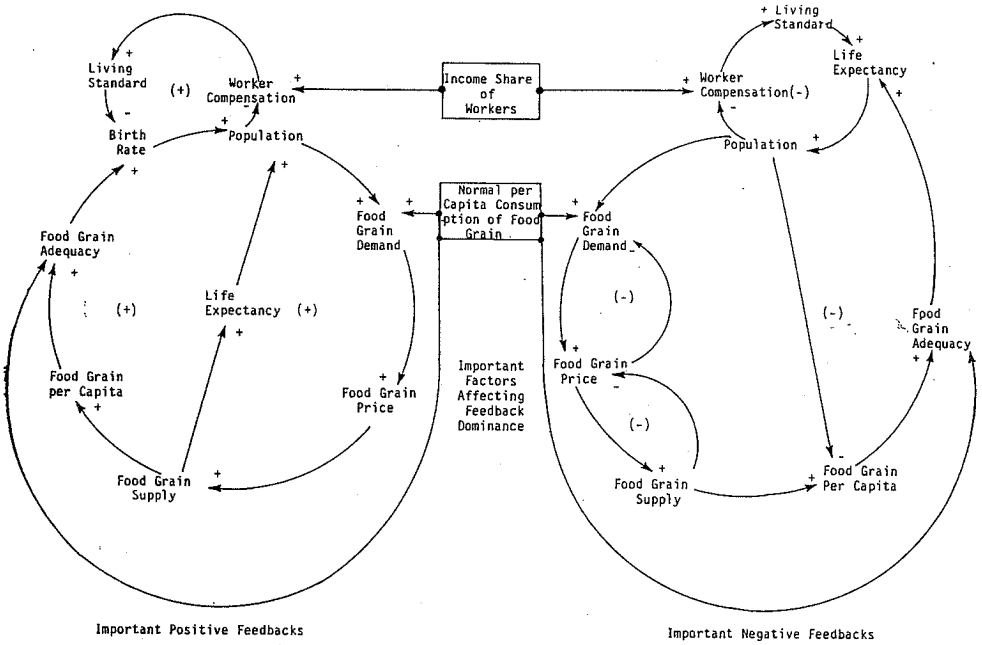


Figure 6: Dominant Feedback Loops in the System

Since the population goal of the system seems to be partly determined by food availability, a higher level of ambient per capita cereal consumption would limit population in the long run for a given level of cereal production. This policy essentially translates into shifting to obtaining food calories from animal proteins instead of cereals, which will limit availability of edible food calories for a given level of cereal production. The writings on hunger often dub this method of generating food calories as uneconomical or even decadent and moralize against it. However, it should be borne in mind that the objective of the policy is not to achieve efficiency in production of edible food calories in the short run, but to provide food security in the long run.

Figure 7 shows a simulation which incorporates a high tax on unearned income and the technological, organizational, and fiscal measures discussed above, together with a higher per capita cereal consumption . The results are quite appealing. The birth rate is reduced, and life expectancy and wage rate rise considerably. Increases in population are limited as extra cereal production is used up in generating edible calories uneconomically instead of facilitating population growth.

Thus, food cereal production per capita approaches a much higher level and a large slack is created between the cereal food calories produced and edible calories actually consumed, which reduces food vulnerability since in the event of a shortage people can always resort to more economical sources of caloric intake.

An uneconomical food consumption policy, in addittion to limiting growth in births, also raises the demand for cereals, and through prices, the level of their production. When ownership is transfered to the working households, the additional income from increased production is accrued to these households which adds to the opportunity cost of labor in the self-employment sector, thus pushing up further compensation demanded for wage-employment. A higher wage rate, in turn, further raises living standards which further limits births and raises life expectancy.

An effect similar to that of uneconomical food consumption can possibly be achieved by exporting surplus food. However, in that case, the endogenous availability of food calories would become dependent on the export market for food over which the society has little control. Shocks in the export market would mean that excess calories are absorbed at home and fuel indigenous population growth. As a consequence, the ability to export food would soon atrophy.

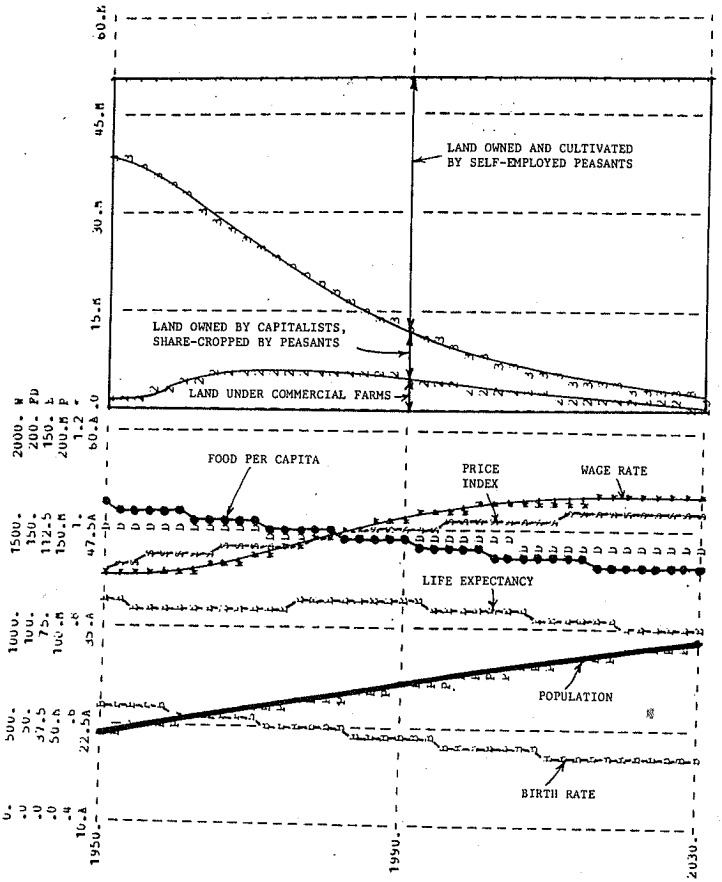


Figure 7: System Behavior with the Proposed Policy Package

4. RESOURCE ALLOCATION AND STATE INTERVENTION

If human society could be managed through a disciplinary regimen alone, it would be quite easy to design idealistic social policies and implement them through a political system which is vested with sufficient authority. This would, however, entail severely limiting individual freedom which people value highly.

Most of the development policies suggested to date have called for large scale government intervention which requires expanding the role of government. In fact, a "strong" government is viewed by many as a *sine qua non* for successfully implementing a development plan. Unfortunately, a government which may assume a powerful interventionist role may not always be expected to be concerned with public interest. Instead, it may mainly occupy itself with preserving autocratic control for which it may freely use the resources of the society. According to Popper:

> ".... Interventionism is therefore extremely dangerous. This is not a decisive argument against it; state power must always remain a dangerous though necessary evil. But it should be a warning that if we relax our watchfulness, and if we do not strengthen our democratic institutions while giving more power to the state by interventionist 'planning', then we may loose our freedom. And if freedom is lost, everything is lost, including 'planning'. For why should plans for the welfare of the people be carried out if people have no power to enforce them? (sic)." [Popper 1977]

We can, perhaps, moralize endlessly about how a government should allocate national resources. Its actual priorities will depend on the pressures it faces in its role. If it perceives a threat to its power, its concerns for maintaining control may over-ride its concerns for public welfare. Consequently, only a small proportion of resources may get allocated to developmental activities and a resource shortage may be experienced even when the level of total available resources is quite high. Detailed discussion on modelling this issue may be found in Saeed 1982c and Saeed 1986. Figure 8 shows a simplified picture of how a government will allocate resources to welfare and control activities depending on the pressures it faces.

An increase in the total resources of the system also raises the need for expanding control as some of the resources must be used to upgrade the system organization. Thus, some increase in control is inevitable when economic growth occurs. However, the proportion of total resources

allocated to economic activities depends not only on total available resources but also on the government's commitment to delivering welfare as well as its perception of the need for control. The former is kept alive by the concerns about welfare expressed by the public. The latter is determined by acts of dissidence experienced.

The public concerns for welfare surface only if adequate civil liberties exist and the public is able to register its protests freely. In the absence of civil liberties, unventilated protests breed dissidence. The public concerns are inversely proportional to the amount of welfare delivered, which depends on the resources allocated to the economic activities. This forms a major negative feedback loop which is potentially unstable.

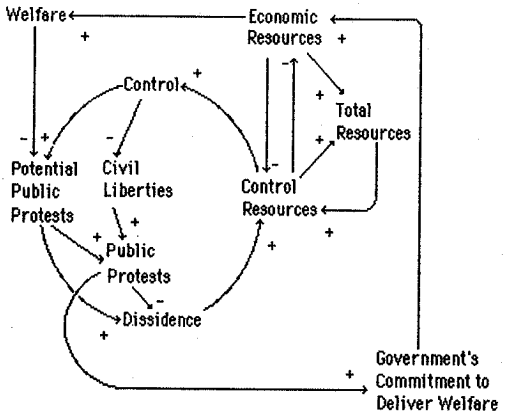
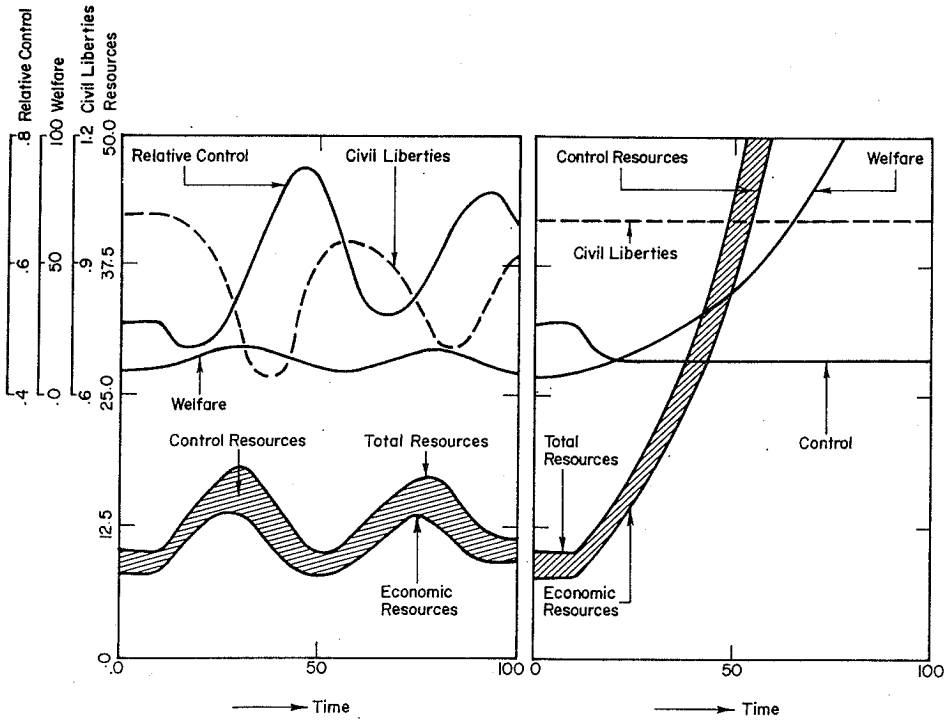


Figure 8: Resource Allocation Pressures Experienced by a Government

A rise in dissidence also calls for increasing allocations to control activities. This, on the one hand, increases control which results in suppression of civil liberties, and on the other, in reducing resources available for economic activities. Reduction in civil liberties limits public protests while reduction in economic resources limits welfare. These two mechanisms acting simultaneously create further unventilated protests that breed more dissidence. The positive feedback loops thus formed add to the instability of the negative feedback loop explained earlier.

When this system is disturbed by stepping up the economic growth rate, it begins to oscillate attempting to settle in to an equilibrium that is much lower than that which is warranted by the available resources. This is shown in the simulation of Figure 9 (a). The limits to further growth appear when resources allocated away from the economic activities for the purpose of maintaining control become large enough for their net rate of growth to fall short of their rate of expenditure.



(a) Growth and Instalbility with Control Affecting Civil Liberties

(b) Growth with Unlimited Civil Liberties

Figure 9: Behavior of the Governmental Resource Allocation System

These limits cannot be alleviated by further increasing the economic growth rate or even bringing in new resources through foreign aid. However, when the interventionist role of the government is modified so as to limit its freedom to reduce civil liberties, the same rate of economic growth yields continuing increases in resources and welfare. The simulation of Figure 9 (b) illustrates this. It may be noted that contrary to the prevalent truisms about economic growth being aided by the presence of a "strong" government that exercises a high level of control [Benoit 1978], limiting the power of the government so that it is unable to suppress civil liberties appears to be important for sustaining economic growth, although, a positive correlation exists between the economic growth and the growth in control.

5. RESOURCE SELECTION, TECHNOLOGY, AND THE ECOSYSTEM

At the level of the resource ecosystem, the assessments of the availability of material resources are found in two conflicting paradigms: the neo-classical economic theory, and the tenets of environmental movement. The former assessment assumes an unlimited future technological capability to utilize materials found on earth, and an almost unlimited supply of these, and attempts to maximize the present value of the ones which can be exploited using current technologies [Nordhaus 1979]. The environmental movement is very concerned about the finiteness of the resource base and about the technological limitations to its exploitation, and advocates conservation, often irrespective of the societal sacrifices entailed [Meadows 1971]. The two models are internally quite consistent but they appear to incorporate bounded information sets which have little overlap. Hence they issue conflicting judgements about the physical limititations of the resource system neither of which is truly valid.

The resource ecosystem of the earth is a subsystem within the universe which derives its energic inputs from the the sun. The resource ecosystem, in turn, maintains an environment from which human society obtains its energic inputs [Miller 1982]. For all practical purposes, the energic inputs from the sun to the earth's ecosystem can be assumed to remain constant over the entropic life of the sun. However, the energic inputs obtained by human society from the ecosystem will vary depending on the demands made on it and on its ability to deliver. The amount of materials actually obtained from the ecosystem at any time may be different from its sustained ability to deliver since the former depends on the cumulative stock at any time and the latter on nature's ability to regenerate. With the help of the energic inputs it receives from the sun, the ecosystem is quite capable of regenerating

resources from spent form to a usable form. In fact, given enough time, almost all the earth's resources spent over a certain period of time could be regenerated.

Thus, the survival of human society depends not on the life of the universe but on the balancing of the consumption and regeneration of resources. If all resources are converted into the spent form and their regeneration takes a few million years, human society may not live to see the regenerated resources, while the universe lives on. It may also be recognized that the classification of resources between the renewable and non-renewable categories is quite arbitrary. This is because resources are only transformed between usable and spent forms depending on usage and regeneration rates, and the only difference between the two categories is the length of their regeneration time constant, which is very long for non-renewable resources.

Therefore, from the point of view of their position in the ecosystem, the resources of the world could be placed in four categories. These are: 1) Usable Resources, which can be expended using currently available technologies; 2) Exploitable Resources, which become usable after they have been exploited; 3) Potentially Usable Undiscovered Resources, which would later become exploitable; and 4) Spent Resources, which must be regenerated by the ecosystem to become potentially usable or which are recycled by man to be directly placed in the usable category again. Figure 10 shows these categories and how resources move between them. Figure 11 shows a comparison of the different expenditure patterns corresponding to different assumptions made about the technology, which determines the resource package selected from the environment and the quantity recycled, when the demand profile is a simple trend.

The pattern associated with the pessimistic view results from the assumption that the regeneration time is infintely long and that there is no possiblility of recycling or reclassifying spent resources. These assumptions allow a temporary increase in expenditure when demand rises, but this is followed by a catastrophic decline when usable, exploitable, and potentially exploitable resource inventories decline. At the other extreme is the pattern representing the optimistic view which results from the assumption that spent resources may always be reclassified as exploitable ones when demand rises. These two patterns respectively incorporate implicit assumptions of the technological progress made by the environmental and the neo-classical economic models of resource use.

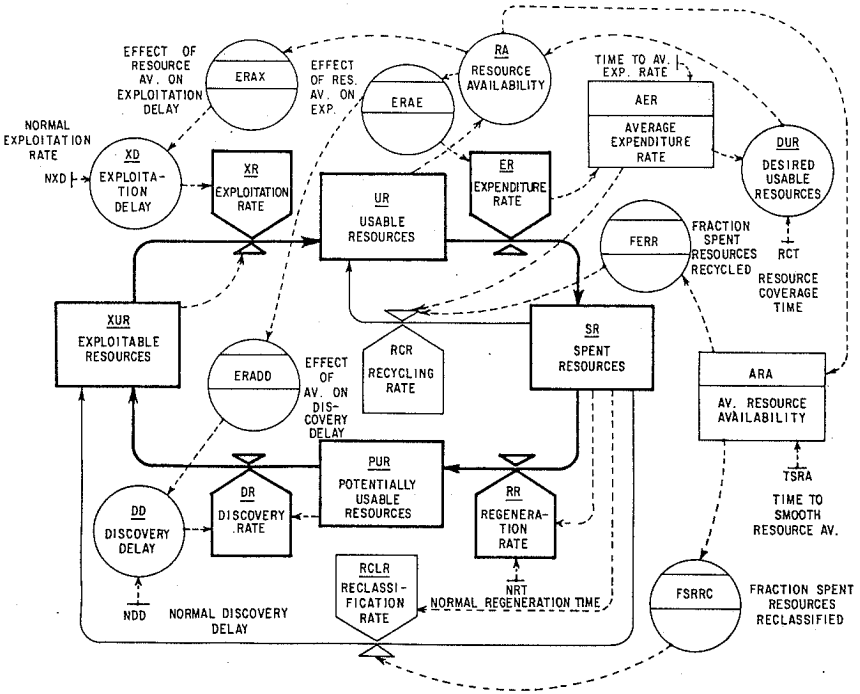


Figure 10: The Resource Eco-system

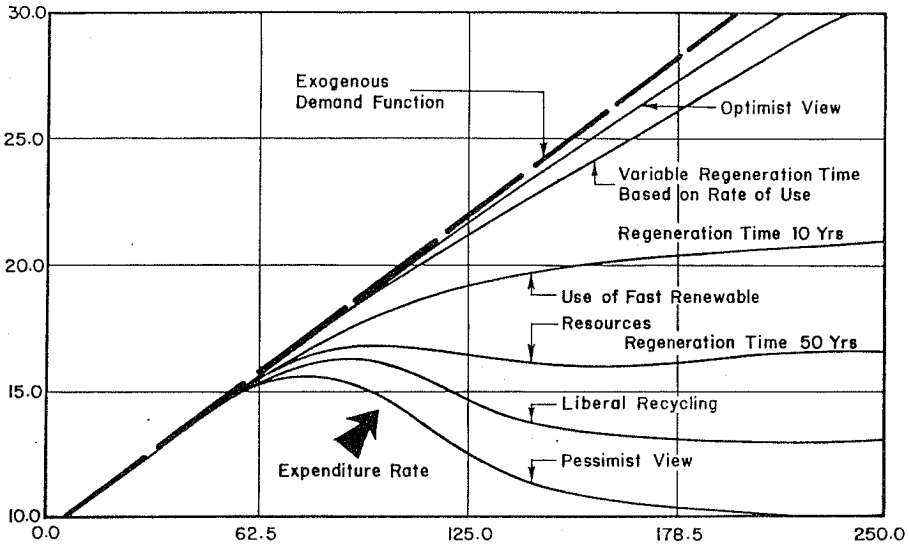


Figure 11: Behavior of the Resource System with Different Resource Selection and Consumption Policies

In between these lie the patterns corresponding to the revisionist views calling for recycling and for use of fast renewable resources. These strategies result in some increases in the inventory of usable resources and thus help to alleviate a catastrophic decline in their expenditure rate, although, they are unable to match an ever increasing demand trend. Recycling, which cannot be divorced from existing production technologies, is

limited to a fraction of the current rate of expenditure. Thus, it can have only a small impact. When usage is confined to fast renewable resources only, the expenditure rate is limited by the quantity and the frequency of resources in circulation. Thus, limiting usage to a narrow group of fast renewable resources may not necessarily allow society to take full advantage of the potential of the resource environment.

When human society is seen as an open system which receives its energic inputs from its resource environment, both the throughput and the boundary interaction with the environment appear to be important issues for the reliable functioning of society. Thus, any sensible criteria for resource use must place emphasis on continued reselection of energic inputs from the environment in such a way that both the development of society and the sustenance of its environment are assured [Katz and Kahn 1978].

The resource ecosystem of the earth contains a very large variety of substances from which we can obtain materials for our consumption. Ideally, we ought to select a resource mix from our environment whose aggregate regeneration rate matches our consumption. When consumption rises, resources with a shorter renewal time should be added to the package in use and those with a longer renewal time dropped. The remaining plot in Figure 11 illustrates implications of such a policy. As the stock of usable resources is depleted, more and more materials with a shorter regeneration time are introduced, which increases the aggregate rate of circulation of materials through the regeneration cycle of the resource ecosystem. Consequently, the stock of spent resources is more rapidly converted into the stock of usable resources. Thus, it becomes possible to sustain a higher expenditure rate. Periods of minor shortages may still be experienced, but these shortages also provide the driving force for the resource reselection process.

An ultimate limit dictated by the absolute amount of resources in the ecosystem and the maximum speed at which these can be circulated would still exist and perhaps some measure for moving towards a *steady state economy* would be in order if this limit is approached [Daly 1974]. There is, however, persuasive evidence to suggest that considerable slack exists between this ultimate limit and the current levels of consumption, provided we are able to take advantage of the variety in the resource base [Brooks and Andrews 1973, Ravelle 1973]. The immediate need, therefore, is to facilitate technological developments which may allow for the substitution of resources, which have a long regeneration time constant and which are currently being rapidly exhausted, with those which are in abundant supply and which also have a shorter regeneration time constant.

Realizing the above pattern of resource selection would require some form of government intervention despite its undesirability. The alternative to direct intervention is to delegate to a government only the power to influence mechanisms of choice through indirect means, such as fiscal measures. From the point of view of obtaining quick and precise results, this form of intervention may be less effective than direct intervention, although it may also limit the government to assuming a dysfuctional role in relation to power. In fact, indirect intervention has been widely advocated and practiced in many democratically run countries over the past few decades. Unfortunately, it has been based on somewhat simplistic models of economics and hence it has been rather ineffective [Zucker 1985].

In spite of these failures, this author is of the view that indirect intervention continues to be an appropriate form of corrective action that should be undertaken for influencing resource use, provided this action is based on a comprehensive understanding of the resource system. Perhaps, it would be appropriate to set up Natural Resource Boards at the national level that would continuously monitor the consumption and regeneration status of the natural resources and design a severence tax structure to assure that resource mix in use is continuously adjusted towards achieving a balance between consumption and regeneration rates [Page 1977]. This process can be further speeded up if the proceeds from this tax are used to subsidize the cost of appropriate, though uneconomical, resources and to support technological developments that should facilitate substitution.

6. CONCLUSION

This paper has examined social, political, and ecological processes that limit resources available to a society for improving its welfare. The limits experienced are attributed not to an absolute shortage of resources but to the resource allocation processes which are active at the various levels of the hierarchy of the system.

At the social level, the resource allocation processes appear to create large-scale income inequalities which maintain the majority of population at subsistence level. These processes are also quite capable of resisting most well-intentioned policies aimed at re-allocating resources and income. Since these policies require large scale intervention from the governments of the developing countries, having a strong and independent government is often considered important for successfully implementing any development

activity. Some of the empirical studies conducted on this subject, in fact, have gone to considerable lengths to establish that a correlation exists between the presence of a strong government and the success of the development effort.

The political performance of the developing countries where extensive development effort has been undertaken, however, clearly presents the other side of the picture. By and large, the governments of these countries appear to divert a major share of the resources to building up the military and the infrastructure for internal security. Thus, even though the absolute amount of resources at the disposal of a country may be substantial, only a small fraction of these is devoted to improving public well-being. Furthermore, the people of many of these countries have seen worst of human misery, not for lack of resources, but due to the political violence which erupts quite frequently, inspite of their governments' efforts to suppress dissident activity.

Finally, the ultimate source of nourishment of a society is its material resources which are transformed, through government actions and societal relationships, into useful throughput. The governmental and societal actions taken in pursuit of technological and material progress may bring about some affluence in the short run, although they may also result in indiscriminate consumption of the source of nourishment if the physics of the resource ecosystem are not taken into account. In the long run, it is this physics which sustains society.

Any planning for the improving welfare of a society, if it is to be successful, must take into consideration these resource allocation processes.

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