IV. From Lyndon LaRouche

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DROPPING FALSE ASSUMPTIONS

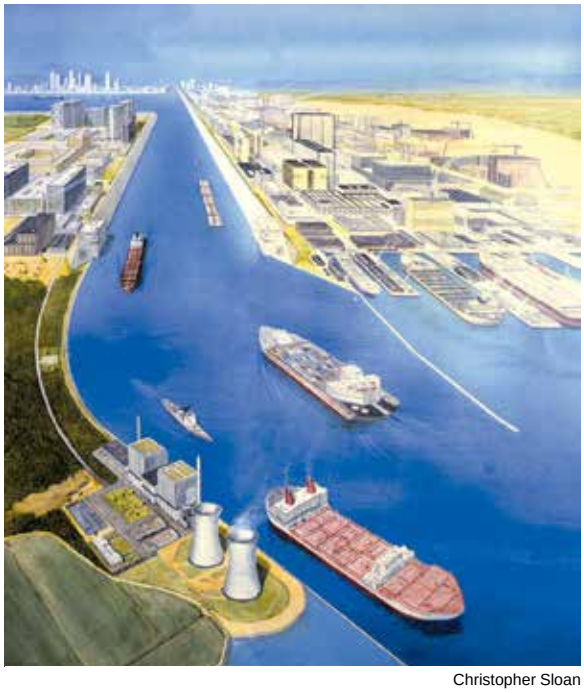
Proper Methods for Accounting Practice: Estimates of Cost and Profitability of Major Infrastructure Projects

by Lyndon H. LaRouche, Jr.

Today's widely-accepted methods of accounting, for projecting profitability of major constructions of basic economic infrastructure, are inherently misleading. At first glance, the methods employed are flawed by two kinds of devastating assumptions:

1. The wildly-false assumption that national infrastructure-building projects must be financed in every leading aspect by international financial consortia, and financed according to estimates of prevailing terms of trade and lending practices.

2. The wildly-false assumption, that the profitability of such projects must be based on treating the projected revenues of the project itself.



Christopher Sloan

Sea-level canals are the infrastructural basis for a highly profitable array of industries in their vicinity. Shown: An artist's conception of the proposed Kra Canal that is to cut through the Thai part of the Malay Peninsula.

Any accountants' projection which adapts, explicitly or only implicitly, to such false assumptions, will produce a totally false picture of the investment.

Briefly, the most obvious of the kinds of errors involved in such false assumptions, are these:

In any well-designed infrastructural program, foreign vendors contribute, at most, only a substantial minority of the total materials, supplies, equipment, and engineering employed. The majority of the cost of construction is represented by use of domestic labor and materials; in a large degree, the mobilization of these domestic resources employs domestic means which would be otherwise left idled. The domestic contribution should never be financed by foreign-based consortia.

Foreign participation in major infrastructure programs should be in the form of an enlightened "technology-transfer" arrangement. The nation must assume

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increasing responsibility for the construction: one element of "technology transfer." Foreign-based finance must be progressively liquidated over the term of operation of the completed construction; the foreign interest should be reduced to no more than a minority stockholding, or fixed-term bonded indebtedness.

To attempt to project "profitability" for an infrastructure project, is analogous to estimates of the profitability of the completed foundation of an uncompleted building. The contribution of the foundation to profitability is located entirely in the profitability of the completed building in use. If the building as an entirety in use, is profitable, then the foundation's construction is profitable; otherwise, the attempt to estimate the profitability of the foundation is both meaningless, and intrinsically a false representation.

This memorandum examines the manner in which economic science analyzes infrastructure's calculable contribution to national economies, and defines the accounting methods which will be employed in any competent feasibility-studies.

Benozzo Gozzoli

Workshop of Agnolo Bronzino

European economic science began as a collaboration between Gemistos Plethon (left) and Cosimo di Medici (right) during the middle of the 15th Century.

1. 'Economic Science' Defined

In order that the relevant features of the axiomatic errors of modern accounting practice be understood to the degree this memorandum's subject-matter requires, it is indispensable to supply a rigorous definition of the proper meaning of "economic science." The flaws in today's professional accounting, and economists' practices, are chiefly the result of the circumstance, that, although economic science was developed in Western Europe and the United States, over the period from mid-fifteenth-century Florence through the middle of the nineteenth century, for approximately the past hundred years, there has been no regular course of instruction in economic science among the leading universities of Europe and North America.

Through professionals' resulting ignorance of even the ABCs of economic science, today's accepted practices are rife with major errors of simple ignorance of elementary principles. The two cited types of errors in feasibility studies for infrastructure programs, are typical of such blundering incompetence widespread among professionals today.

Economic science begins with the most elementary fact of human historical existence. "Primitive mankind," existing in the kinds of modes ethnologists have named "hunting and gathering," would require an average of approximately ten square kilometers of the Earth's land-area to sustain the average individual. The conditions of existence would be most precarious, mankind living in a most wretched state of existence, with life-expectancies significantly below twenty years of age.

Today, there are an estimated five billions persons; with full use of technologies already existing, this planet could sustain two or three times that number, at a standard of life comparable to conditions prevailing in advanced nations of western Europe and North America during the early 1970s. This thousand-fold increase in mankind's potential population-density, is entirely the result of a combination of interdependent cultural advances, whose most conspicuous feature is what we call "technological progress in an energy-intensive, capital-intensive mode."

Economic science is a branch of modern physical science, which determines what kinds of policies of nations will maintain and increase the potential population-density of mankind.

The foundation of economic science, is a branch of physical science which the eighteenth and early-nineteenth century economists named "physical economy," or, in French, "*polytechnique*." In economic science, matters of policies governing credit, indebtedness,

taxation, and banking, are treated as a subsidiary feature of "physical economy." The combination of physical economy with matters of policies governing credit, indebtedness, taxation, and banking, is called "political-economy."

European economic science began as a collaboration between the great Cosimo de Medici of Florence, and his advisor, George Gemistos (Plethon), during the middle of the fifteenth century. The elaboration of principles of technology, was founded chiefly by Leonardo da Vinci. Out of da Vinci's work, the study of political-economy was continued into the early nineteenth century under the title of "cameralism," signifying the arts and sciences of statecraft.

The transformation of cameralism into economic science, was accomplished by Gottfried Leibniz, in work to this effect over the period 1672–1716. Leibniz designed the "industrial revolution" (the development of heat-powered machinery to increase the productive power of labor), and was the first to supply a physical-science meaning for the term "technology."

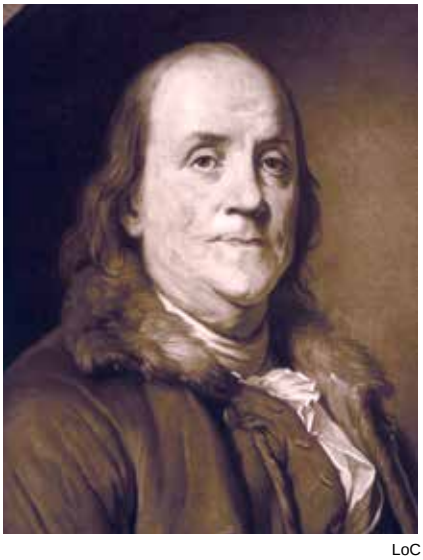
Patrick MacDowell, sculptor

Gottfried Leibniz was the first to supply a physical science meaning for the term "technology."

Leibniz was not only the leading scientist of the late seventeenth and early eighteenth century. During the last decades of his life, he was the central figure of an international conspiratorial network. This network was centered in Germany, France, and Italy, and extended into the opponents of Marlborough (Churchill) in Britain, and also into the English colonies in North America. Through these political connections to such allies as the Americans Cotton Mather and Benjamin Franklin, Leibniz's economic science became a central feature of what Treasury Secretary Alexander Hamilton was first to name "the American System of political-economy."

After the U.S.'s second defeat of Britain, in the war of 1812–1815, the work of French economists, such as [Jean] Chaptal [1756-1832], [François Louis Auguste] Ferrier [1777-1861], and [Charles] Dupin [1784-1873], was incorporated into the work of the leading American economists, then centered around Mathew Carey.

The crucial figures in this merger of the two branches of Leibnizian economic science were Gilbert Mar-



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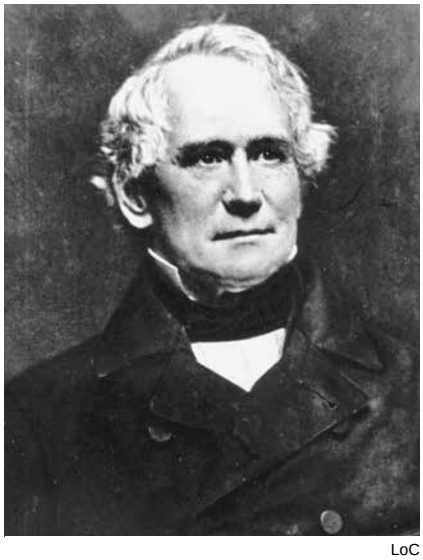

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Caroline Hövemeyer

Leibniz's work came into to the English colonies in America through the work of Benjamin Franklin (left) and Henry C. Carey (center). General Lafayette's protégé, the German economist Friedrich List, 1789-1846 (right), published the Outlines of American Political Economy *while in the United States and brought the Leibnizian-American economic science back to Germany.*

quis de Lafayette, and Lafayette's protégé, the German economist Friedrich List.

So, during the nineteenth century, the name by which economic science was best known internationally, was as "the American System of Hamilton, Carey, and List."

The faction in Britain, France, Switzerland, and Venice, which opposed the American Revolution, created an opposing doctrine of political-economy. The origin of this opposing doctrine was chiefly the noble, rentier-financier families of Venice and the Swiss banking interests centered upon Geneva and Lausanne. The Swiss banking circles introduced the Physiocratic dogmas to France. These same Swiss circles introduced the same anti-Leibniz dogmas to such leading employees of the British East India Company as David Hume and Adam Smith. Out of this emerged what became known as "British political-economy," radiating from the British East India Company's training-center at Haileybury. Adam Smith, Jeremy Bentham, Thomas Malthus, David Ricardo, James Mill, John Stuart Mill, [William Stanley] Jevons, and [Alfred] Marshall, are exemplary products of the British East India Company's Haileybury faction in political-economy.

With events of the 1870s, centered upon the 1878 Treaty of Berlin, a consortium of rentier-financier interests centered upon the Venetian, Swiss, and British financier cartels, established world domination of international monetary affairs. The pre-1919 British gold-standard system, the Versailles monetary order, and the Bretton Woods monetary system, are a continuation of this domination of world monetary affairs by rentier-financier cartels centered upon the Venice-Trieste and Swiss reinsurance cartels.

So, over the recent hundred years, those rentier-financier interests have dominated not only world finance and world trade, but have gained ideological control over leading elements of political parties, universities, and so forth. One result of this continuing arrangement, has been the expulsion of all references to internal features of economic science from the professions of accounting and economics.

Nearly all professional economics and accounting practice is based on certain axiomatic assumptions. In the case of the teaching of economics, such assumptions are explicit. In the practice of accounting, the same assumptions are less openly discussed, but are implicit, and efficiently so. These assumptions are based on assuming, as axiomatic, a continuation of the domination of international finance and trade by the "anti-American System" cartel of Venice-Switzerland-centered rentier-financier interests.

These axiomatic assumptions, reflect the presumption, that the national banking-systems of nations will be subordinated to private rentier-financier interests, and will be governed by such forms of international monetary and banking agreements as place the internal mechanisms of credit, debt, currency-issue, taxation, and banking, of individual nations, under regulations consistent with the special interests of the international rentier-financier cartels.

As a corollary, it is also assumed, that no revival of what are called "mercantilist" forms of nationalist monetary policies and banking, will be tolerated. It happens, that an economy can not function in the way economic science requires, unless the nation's policies of credit, debt, taxation, and banking are subordinated to the requirement, that "mercantilist" goals of technological progress are fostered.

Hence, as long as rentier, monetarist institutions dominate the processes of exchange within and among nations, sound economic policies are more or less prohibited in practice. Hence, to the professional economist or accountant, sound economic policies are a great inconvenience, not worth considering.

This arrangement is a highly impractical one. For what are called "developing economies," the arrangements set into motion internationally by the 1878 Treaty of Berlin, are intolerable to any patriot. They are often called "colonialism," or "neo-colonialism," or regarded, more simply, as more or less murderous policies of looting of the weaker by the stronger. For the stronger nations, they are a disaster, too; although this becomes clear only periodically, as new monetary break-down crises, like that of 1931–1932 or of the present period, demonstrate this consequence most unpleasantly.

The examination of international monetary policies since 1946, from the standpoint of economic science, enables one to foresee both the immiserating effects of Bretton Woods upon developing economies, and the ultimate eruption of a new breakdown in the international monetary order itself. From the standpoint of today's typical professional economist or accountant, the truth is not so easily foreseen. Such professionals "foresee" the inevitable failures of such monetary orders only at the point the breakdown is occurring. Since the collapse of such a monetary order occurs over the

span of only a generation or two, such professionals have approximately two generations during which to cultivate absolute confidence in the eternal verities of their rentier dogmas; at the point, they themselves are unemployed, they may begin to suspect some slight error in the monetarism they have admired so long.

There are, therefore, two questions which ought to discourage the professional from putting his pencil to paper, in estimating feasibility of a proposed infrastructure-program. He wishes to project financial results over the coming ten years: will the financial system on which his calculations are based, actually exist for as long as ten years ahead? He wishes to project the impact of the project on the nation involved: will that nation exist in its present form, as long as ten years ahead? The professional shakes away these disturbing questions. "I shall assume that the existing order will prevail for a more or less indefinite period to come," he says to himself, stubbornly, as he allows his pencil to move across the papers. His circles prefer not to consider the fact that the present international monetary system will probably collapse at some earlier or later point during the coming twelve months or so, in a crisis resembling that of 1931–1932, but much worse.

Such professionals are like the architect who constructs a building on the eve of a major earthquake, limiting his design to the assumption that no earthquakes will occur. The financial "earthquake" is imminent, at between 8 and 10 on the Richter scale. Professional feasibility estimates based on generally accepted professional assumptions of today, are not worth the effort to compose.

The fact, that the present international financial system is doomed to disappear during the short-term period ahead, ought to be the most fundamental fact considered in any feasibility study. Projects must be assessed for the impact upon the conditions generated by such a collapse of the existing financial order. The feasibility of a project is its value under the conditions the existing financial order has collapsed.

What are those conditions? All sorts of results are possible. However, we should limit our attention to those kinds of conditions which sane governments will create to defend their nations against the effects of a general monetary collapse. We must define those sane alternatives, and must judge the project as it might contribute to the success of such alternatives. Will the project be an important asset to the nation under those conditions? How significant a contribution will it make, under those conditions? No other sort of feasibility-estimate would be a sane one.

Over the recent forty years, and longer, it has always been the case, that economic policies of governments should have been governed by those principles of economic science associated with the work of Leibniz and the American System. Up to now, nations have paid a high price, in poorer economic performance, for neglecting those principles; however, despite the avoidance of those principles, most of those nations survived. Now, at the verge of a crisis worse than that of 1931–1932, nations must choose between absolute disaster and the guidance of American System principles. The essential difference between earlier parts of the past forty years, and today, is that the reality of past policy-errors has overtaken the world's economy.

Today, the only economic programs worth considering, are programs whose medium-term function will be, predominantly, rebuilding the shattered world and national economies, left in the wake of now-imminent collapse of the old monetary system. Any feasibility-study, which does not begin with, and continue from that standpoint of reference, is an utterly useless one, or even worse.

Conditions Determining Feasibility

The principal portion of international indebtedness today, is in the order of more than $10 trillions. Of this total, at least $3 trillions is in the form of "off-balance-sheet lending; since 1982, approximately $1.2 trillions of such off-balance-sheet lending has been accumulated within the U.S. banking-system. The banking system's nominal assets are being eroded through exposure to an intermingling of collapse of manufacturing, agriculture, and real-estate valuations. External indebtedness of developing nations, has been nonperforming in actuality since 1982, but IMF-specified measures have worsened the situation to the degree that dubious methods of refinancing unpaid balances can be continued no longer. For these and related reasons, the international financial system itself is bankrupt as a whole, to the degree that private financial institutions could not deal with the monetary collapse now looming.

The banks will have no option, but to place their destinies, their policies, at the mercies of governments. For the medium-term following the collapse, or perhaps longer, the time during which private financier interests could order the affairs of nations, has come to an end.

The only successful options available to governments, are American System ("mercantilist") options. The implicit powers of governments to create large volumes of credit, through issues of national treasury-notes as currency, is at the center of all feasible options. The only sound choice of mechanisms through which issue of such currency can be effected, is state ("Hamiltonian") national-banking: the loan of issues, at nominal borrowing charges, to selected categories of governmental and private investments, and for purposes of international "hard commodity" export-credit to domestic producers.

Governments and their national-banking channels, will be obliged to enforce stable values for currencies, by aid of measures of exchange-controls, capital-export-import controls, and tariffs in aid of stabilizing prices at "parity" levels, both domestically, and in world-trade.

These and related measures, will enslave monetary and related policies to the exigencies of physical economy. In such a circumstance, all significant values of economic activity will be values determined from the standpoint of physical economy, not the kinds of monetary equations which have prevailed during recent decades.

The initial emphasis, in governments' reconstruction policies, will be the mobilization of idled labor and capacities for priority forms of increased employment. Under those circumstances, presently conventional methods of national-income accounting (i.e., the GNP/GDP methods) must be discarded. Statistical measures of performance, will be based primarily upon physical output of goods per-capita for the population and labor-force as a whole. It is those kinds of statistical measures which must be employed now, for all studies of feasibility of infrastructural programs, and other categories of investments.

Statistical Standards of Performance

Under such circumstances, all raw statistics will be assembled in terms of two sets of simple yardsticks:

1. Per-capita market-baskets of output and consumption, of households' and producers' goods, principally physical goods, plus a restricted short list of special categories of services.

2. Demographics of employment, production, and consumption.

Demographics of statistical reporting, will define the family household, rather than the individual person, as the primary unit of accounting. Individuals are attributed to households, in terms of the internal demographics of different cohorts of households. The total labor-force is defined in terms of household-members eligible to be members of the labor-force, so defined by age-range, physical condition, educational qualifications, and essential functions performed within the household's economy.

Employment of the labor-force is classified in terms of sub-sectors of "productive" and overhead-expense employment, respectively, treating unemployment as part of overhead expense. The economy as a whole is viewed, for this purpose, as a consolidated agro-industrial enterprise, and the distinction between operatives and overhead-expense employment so viewed.

The principal sub-sectors of employment of operatives, are:

1. RURAL OPERATIVES
2. URBAN OPERATIVES
   a. Producers' Goods Production
   b. Basic Economic Infrastructure
   c. Households' Goods Production

The principal sub-sectors of employment in overhead expanse classifications, are:

1. MANAGEMENT & SERVICES OF PRODUCTION
   a. Production Supervision
   b. Science, Engineering, & Related
   c. Education
   d. Medical & Public Health
2. INSTITUTIONAL EXPENSE
   Expense incurred as necessary functions of business or government institutions, including selling expenses of firms.
3. WASTE EXPENSE.

Production is measured in terms of quantity of per-capita market-basket equivalents, for households' and producers' goods, respectively. Consumption is measured in terms of the relevant per-capita consumption by households and producers, respectively.

These measurements are correlated, first, with land-use statistics. The exemplary major classifications are:

1. WASTE & RESERVE LAND-AREA
2. AGRICULTURAL LAND-AREA
3. LAND CONSUMED FOR GENERAL TRANSPORTATION (excepting intra-urban land so used).
4. URBAN LAND USAGE:
   a. Manufacturing
   b. Residential

c. Commercial

d. Urban Transportation

e. Other

The measurements of market-basket, population, labor-force, and land-use data, are correlated with energy-data. Energy-consumption is measured, in first approximation, in terms of kilowatt-equivalents per-capita and also per-hectare (or square-kilometer) of land-use. The two measurements are then combined, as energy-consumption per per-capita unit of population-density.

The economic-science considerations applied to such statistics, include the following most prominently.

The general economic function to be examined statistically, is the functional correlation between an increase of potential population-density and technological progress, in an energy-intensive, capital-intensive mode of reinvestment of production-output and shifting composition of employment.

This requires us to estimate the correlation between certain relative levels of technological development and energy-throughput requirements, the latter in measured in terms of energy-throughput per per-capita unit of population-density.

There are six primary, interdependent constraints for such a function:

1. The per-capita level of quality and quantity of content of market-baskets, for both households' and producers' goods, must correlate with a level of technology, and must increase with advances in technology. (The variable educational requirements of society at various levels of technology, illustrates the point.)

2. With technological progress, the ratio of rural to urban employment of operatives must decline, subject to the condition that the output of agriculture must increase per-capita of the population as a whole. This is capital-intensity in the first approximation.

3. The ratio of employment of operatives in production of producers' goods, must increase relative to employment in production of households' goods, subject to the condition that the per-capita household market-basket is improved. This is capital-intensity in the second approximation.

4. The per-capita throughput of usable energy must increase. This is energy-intensity in the first approximation.

5. The average energy-density cross-section of energy-stocks must increase secularly. This is energy-intensity in the second approximation.

6. Technology must advance, in the sense Leibniz defines technology relative to his Principle of Least Action.

Profitability of the economy is measured in the following general way.

The market-basket costs associated with the employment of operatives for infrastructure, agriculture, and manufacturing, is the cost of output. Total output, less this cost, is the gross operating profit of the economy.

Overhead expense costs, similarly measured, are totalled, and this amount deducted from gross operating profit.

The remainder is the net operating profit of the economy.

The value of an investment, then, is the impact of that investment upon the profitability of the economy as a whole. The effect of not making the investment, is compared with the effect of making it, in these terms of reference.

The cost of not employing idled labor and capacity, is treated as part of such computations. The advantage of transferring employment from overhead-expense categories, to employment of operatives, is examined in the same way. The reduction of administrative and selling expenses, and also labor-intensive unskilled and semi-skilled services, is one of the great resources for productive labor: thus, reducing the parasitical component of overhead expense, while increasing the productive sector.

Comparisons of various economies in these terms of reference, are readily possible, using available statistics, today. There are great inaccuracies in available statistics, but the data is sufficient for constructing very useful generalizations. It is important to compare various classes of economies in terms of the six constraints. Despite the flaws in the data available, some very important indications are supplied for the work of policy-shapers. Over time, use of such data, will cause its collection to be much improved.

2. The Function of Infrastructure

"Basic Economic Infrastructure" includes two qualities of provisions: infrastructure whose efficient contribution lies in its nature as a physical product; services which directly foster the power to generate and assimilate technological progress within the labor-force, and the whole population more generally.

- Physical infrastructure includes, most prominently:

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EIRNS/Stuart Lewis

The value of basic economic infrastructure includes its efficient contribution as a physical product, and also its contribution to fostering the power to generate and assimilate technological progress within the labor force. Shown, clockwise from upper left: The Delta-Mendota Canal (left) alongside the California Aqueduct (right), high-voltage electric power transmission towers, a complex highway interchange, a laboratory bench scientist, and a high-school class in aerospace science.

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- General Transportation
- Water Management
- General Public Sanitary Functions, additionally.
- Production & Distribution of Primary Energy-Supplies
- General Communications
- Urban Physical Infrastructure.

Services essential to fostering and protecting the technological potentials of the labor-force and population, are, predominantly:

- Fundamental Scientific Research
- Engineering Services for Physical Infrastructure and General Production.
- Public Education & Classical Forms of Popular Culture.
- Medical & Public Health Services.

Certain other classes of services are part of the national infrastructure, but have only indirect bearing upon the productivity of labor. These are typified by the necessity for military and law-enforcement forces, to protect the preconditions for healthy functioning of the economy. Those social-services elements of infrastructure which bear upon the advancement of technology and of the productivity of labor, are classed under "Economic" functions of society's "overhead expense." Military and law-enforcement institutions are classified under "Institutional" functions of society's "overhead expense."

The significance of basic economic infrastructure, is illustrated by two sets of comparisons. In the first, we compare the most relevant statistics for Japan, the Federal Republic of Germany, and the United States. In the second, we compare the same features of various cohorts of developing economies. The comparison is made properly in terms of the six constraints we have identified. The most meaningful indications are already obtained by comparing only energy-densities with population-densities.

For the broadest generalizations, we may assume that, if we study averages over the period of the 1970s, the levels of technology of Japan, the Federal Republic of Germany, and of the U.S.A., were approximately comparable. This reasonably accurate, rough estimate, permits us to focus attention upon the way in which energy-density functions correlate with population-density functions.

We observe, first, that the energy-density per-capita decreases as a function of increased population-density. We also observe that energy-density per-hectare increases as a function of increased population-density. We also observe, that energy-density per per-capita unit of population-density, is approximately consistent among the three.

Looking at production, we find that per-capita and per-hectare yields in agricultural land-use, are functions of both population-density, energy-density, and capital-intensity. We find the same kind of correlations for industrial land-use.

Productivity, and levels of technology of particular industrial enterprises, are functions of energy-density and capital-intensity. This is to the effect, that industries of competitive qualities among the three OECD economies considered, have approximately identical functions for energy-density per per-capita unit of population-density of land-use classification.

Looking at agricultural and industrial production in this way, enables us to focus attention better upon the principal cause of variability of per-capita and per-hectare energy-densities among the three cases considered: basic economic infrastructure. The greater the population-density, the lower the energy-density per-capita required for a comparable level of technology and productivity. However, to achieve higher population-density, a greater investment in basic economic infrastructure per unit of land-area, is required. As the rough estimates of comparison illustrate, the relationship seems to be a "trade-off," until we examine the matter a bit more closely.

The physical components of basic economic infrastructure, are analogous to the foundation of a building. The degree of development of such infrastructure, determines the kind of production-development which can be erected on the basis of that foundation.

The amount of such infrastructure required per-capita unit of population-density, increases as a function of increase of both capital-intensity and energy-intensity. Since capital-intensity is dependent upon energy-intensity and technology, we can express the function approximately, in terms of energy-density functions.

Such approximations are better than convenient "rule of thumb" estimates. Since Leibniz's contributions to the founding of economic science, it has always been implicitly possible, to construct "purely thermodynamic" functions for economic processes. By expressing market-basket "inputs" in terms of the energy-consumption represented by the production of those market-baskets, we can measure labor and capital of production, in first-approximation, in terms of the energy costs of production of that labor and capital. If we redefine thermodynamics in terms of Riemannian physics' electrodynamics, we can also construct "non-linear" least-action functions which subsume the form in which technological progress is injected into the productive process. Hence, a generalized physical-economic function can be expressed comprehensively in terms of Riemannian electro(hydro)dynamics. Thus, an approximation of the measurement of infrastructure functions, in terms of energy-density constraints, is implicitly close to the mark.

Such approximations are unavoidable under today's conditions. The range of errors in data collected, permits no significant calculations beyond broad estimates, estimates which make no deductive assumptions affected by the margins of error in the data available.

As we have indicated, applying the six constraints we have indicated, to elaborate a generalized function for increase of potential population-density, we can construct a generalized mathematical form of ("non-linear") function for economic processes. (No such solution can be provided within the confines of linear systems analysis.) Having constructed such a generalized function, our concern is to adduce the proper values of coefficients and exponents for the terms of the function. If the data available were sufficiently precise, and accurately so, we could adduce very good estimates for the values of such coefficients and exponents. With less accurate data, we can make such estimates, but only within the limits of accuracy implicit in the quality of the data used.

Fortunately, we are not limited to statistical census data. Production-functions for particular modes of agricultural and industrial production, can be constructed, to isolate the variability of particular such enterprises within the terms of our general function. These more narrowly-focussed studies, combine: industrial-engineering methods of constructing producers' goods'

market-basket requirements for modes of production at various levels of technology; with, studies of the thermodynamics of the physical chemistry of the production transformations involved. With reference to good tables of physics and chemistry handbooks, or primary sources for compilation of such tables, we are able to estimate the impact of new technologies upon the increase of productivity, within the degree of accuracy of fractions of an order of magnitude of increase of productivity. Hence, we are able to project the increases of productivity which will occur over entire generations, or even large fractions of a generation's span, through such advances in technology, deployed according to the six constraints listed.

EIRNS/Stuart Lewis

Were the fares to be abolished in New York City's subway system, the City's population could have equal or better service, at half the cost to taxpayers.

For example, study of the internal history of iron and steel manufactures, and other metals industries, from this standpoint, is a good beginning in this finer-grained approach. The essential feature of progress in these branches of industry, is effective increase in the energy-density cross-section. Broadly, a function for this can be approximated, by applying elementary thermodynamics to data supplied by tables of chemistry and physics. Values of coefficients and exponents, for this particular class of production, can be estimated by aid of studies of both past histories of such production's evolution, and examining proven and semi-proven new advances in technology in that class. The transition to ceramics, is a leading bench-mark today. Advances in the direction of controlled-plasma modes of processing, up to and above the boiling-point of tungsten, indicate the longer-range perspectives.

Generally, as this illustration implies, we should focus upon the second degree of approximation for increase of energy-intensity, increase of the energy-density cross-section, and adduce the increase in raw energy-density per-capita, required by the increase of energy-density cross-section.

In a similar way, we can adduce the thermodynamic characteristics of particular classes of physical infrastructure.

The practical approach today, is to contrast the results of studies of particular classes of infrastructure and production, with the estimates afforded by general census statistics. We cross-check estimated coefficients and exponents for a function adduced on the basis of particular classes of activities, with the estimates adduced by reference to census statistics. The day-to-day work of economic-science research today, is located in the elaboration and cross-checking of these two approaches to investigation of exact values for the function.

Estimating 'Profitability' of Infrastructure

The income-benefit of infrastructural projects, is like the income from developing a construction-site. The income from developing a construction-site, is obtained from those activities, which would be impossible without developing the site. It is not obtained from the site itself.

Economists, accountants, and others, often allow themselves to be confused by the fact, that electricity is sold, that tolls are usually charged for passage through canals, that fares are usually charged to intra-urban rapid transit passengers, and that some nations permit tolls to be charged to users of bridges and public highways. These kinds of income paid directly to an infrastructural development, tend to re-enforce many people's belief in the delusion, that the direct income from operation of an infrastructural venture, determines the economic feasibility of the venture.

For example, some decades ago, a study was made of the feasibility of operating the New York City rapid-transit system without collection of fares from passengers. The crucial fact stressed in the study, was that the costs of collecting and administering fare-revenues, exceeded all other operating costs of the system. If the collection of fares were abolished, the City's population could have equal or better service, at half the cost to the taxpayers! This example illustrates a general principle.

In the study of feasibility of a rapid-transit system, such as the New York City system, no competent assessment can be reached without considering the costs of alternative modes of transport of passengers. Government must consider the increased cost of its total expenditure for highways, bridges, parking-facilities, and traffic management, were the rapid transit system not available, or less utilized. Government must also consider the impact of the lost time incurred by passengers, and the effect of this on business development generally. There are other considerations, but these two points of illustration are sufficient for our purposes here.

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In the case of Panama, a sea-level canal would transform the economy upwards in the most spectacular way, the greatest benefit going to the nations of the Americas, whose trade with one another, and with more distant areas, would be significantly stimulated. Shown: A container ship transiting the Gatun Locks of the Panama Canal, June 9, 2004.

In general transportation, we must consider two leading factors of feasibility:

1. Costs per ton-mile, or per passenger-mile.

2. The costs of slower modes of transportation, in delaying delivery of either passengers, or relatively high-value freight, to their destinations.

In terms of costs per passenger-mile, rapid transit is the lowest-cost mode of transport within, into, and out of high-density urban areas. The combined public and private costs incurred, per passenger, for alternative public or private modes of transportation, are significantly higher. In addition, if we increase the commuting-time of a passenger, from the range of a half-hour, to one hour, or an hour-and-half, or any comparable increase, we have lowered that passenger's standard of living significantly, and are worsening the functional qualities of the urban center as an employment market and business center.

There is no significant facet of the personal life and economic activity of an urban area, and its vicinity, which does not benefit significantly from the existence of a well-designed, efficiently functioning rapid-transit system in that area. In some instances, the benefit is directly incurred; in [other] instances the benefit is incurred only indirectly, it is usually not less significant than when incurred in a direct way.

To assess such an infrastructural development in terms of its direct-fare-revenue projections, is reckless incompetence.

Take the case of the sea-level canal proposed for the Thailand isthmus, or the new, sea-level Panama Canal, also proposed. Both canals will project toll-revenues. However, the toll-revenues will be the smallest portion of the revenue generated by the canal's construction. In the case of the Songkhla Canal through the Thailand isthmus, the major cut passes through a mineral-rich area, which makes the earth-moving operation actually an income-generating mining operation, rather than simply an earth-moving cost. In the case of both canals, the canal generates the basis for an industrial development zone at both of its extremities. The canal, by attracting the flow of freight to those vicinities, creates a juxtaposition of various parts of a wide spectrum of freight, a confluence not brought about in any other way. The canal's development becomes the infrastructural basis for a highly profitable array of industries in that vicinity.

Both canals attract much of the total freight passing through from very long distances: from Europe, from the Americas, from India, from Japan. Much of this portion of the freight is a mixture of bulk, semi-finished, and finished products. Much of this portion of the freight must be transported a significant distance

further, once passing through the canal. Here, a very interesting economic factor comes into prominence.

In economic studies, we must consider not only transport costs per ton-mile; we must consider the costs of transport as a percentile of the total cost of inbound freight of the product carried. If we can transport a ton of high-value freight, rather than a ton of lower-value freight, an economic gain is obtained. In other words, if there is a sound basis for processing of the material transported, at something logically akin to the mid-point of a long journey, a significant economic gain results, in reducing the percentile of total cost attributable to transport-costs.

The mid-journey point at which such upgrading of the product could occur, must be a point with certain special qualifications. Nearly all of the elements required for processing of one of them, must be easily available at that point. Maintenance of processing plants at that location, must be made economical by aid of such things as the presence of machine shops, and so forth. A major canal, capable of handling large bulk-cargo carriers, and well as other classes of carriers, is the ideal point.

For example, such a canal must have ship-repair facilities. This means a proliferation of machine-shop skills within the local labor-force, skills easily diversified to supply related qualities of services to local industries. Such a canal requires major local power-sources; one need merely expand these in scale, to produce the energy-infrastructure for general development of industries. Industry requires relative low costs of inbound freight, and efficient, low-cost handling of such freight, to and from port facilities. And so on and so forth.

So, in the cases of both Thailand and Panama, we are considering a canal which is much more than just a canal. Such canals are major stimulants to the entire economy of both nations, and also a major stimulant to economic progress in neighboring nations.

In the case of Panama, the canal would transform the economy upwards, in the most spectacular way. The greatest quantity of benefit would be to the nations of the Americas, whose trade with one another, and with more distant areas, would be significantly stimulated.

In the case of the Thailand canal, the industrial zones athwart the canal itself would stimulate the development of a deep-sea port within Thailand, across the Gulf, a deep-sea port which would become key to a belt-way of concentric circles of economic development, centered on the port, up into the northeast region abutting the Mekong River. It would also stimulate the development of a regional maritime commerce, of great benefit to Indonesia, most emphatically, and also to Malaysia and the Philippines.

An infrastructure program's economic feasibility, must address the economic, chain-reaction impact of the program, upon the economy of the nation and its neighbors.

Urban Development

In developing nations, most emphatically, the pattern of growth of large urban centers has become predominantly a "cancerous" one. This is a combined heritage of several factors: pre-colonialist cultural factors, the impact of colonialism, and post-1946 monetary and economic trends. Most of these centers are greatly overgrown, and with internal structures which prevent efficiency of movement of persons and goods within the center.

Three general measures must be taken:

1. The functional economic relationship between urban centers and countryside must be greatly improved, to make urban industrial-educational centers the motor-force for fostering technological progress in the productivity of the countryside.

2. Stopping the population-growth in such centers, and transferring large segments of the population in those centers to new cities.

3. The development of an efficient urban infrastructure in both new and old cities.

Throughout the developing nations, and also among most OECD nations, there are urgently required major infrastructure-building programs: most emphatically so in developing nations. These programs define suitable new centers for urban sites, both in terms of economic geography, and in respect to the fact that infrastructure-development projects attract labor-force to these locations, thus establishing the foundations for organic development of such new urban centers.

The requirements are, chiefly, that a new city must be associated with:

1. A junction-point of major flows of transportation of freight and passengers.

2. A center of large-scale water-management.

3. A center for generation and distribution of primary energy-supplies.

4. Economically situated in respect to sources of supplies and in respect to impact on the positive devel-

opment on the economy of the surrounding area.

Since developing economies are characterized by limitations of social capital, a variety of leading problems are posed in contemplating the proper development of such new urban centers.

Very few economists today consider seriously the net economic impact of slum-area development within urban centers.

The nature of the problem has been studied rather well among some of Egypt's policy-shapers. The same portion of national wealth, which has very little beneficial impact, when spent in attempted amelioration of conditions in large regions of Cairo and Alexandria, has a very positive impact on the same number of persons and households, if allotted to the development of irrigated urban-agricultural "new city" zones. It is cheaper to provide the population with quality new housing, in modern urban zones of new cities, than to attempt to ameliorate, unsuccessfully, degraded conditions in decayed and obsolete sectors of existing cities.

Department of Atomic Energy, India

LaRouche wrote that the future of India's economy depends upon a nationwide water-management program, a major modernization of rail, and a large-scale nuclear-energy program. Shown: the Kakrapar Atomic Power Station.

The benefits pertain not only to better conditions of life for the citizens, providing the cheapest and best quality available per unit-amount spent. The impact upon the potential productivity of the labor force, is a significant one. New cities are efficient, whereas old cities are economically inefficient in general structure. Dispersion of the urban centers in a rational way, improves greatly the functional interrelationship between urban and rural areas of land-use, and also contributes to significantly greater political and economic stability within the nation as a whole.

Whenever we implement a major infrastructural program, we bring together at those sites, a large concentration of technologically advanced engineering capabilities. The incremental costs, of adding urban development of selected sites to the project, is significantly less than attempting site development in other ways. In the instance of developing industrial-urban sites athwart the Thailand or Panama sea-level canals, the canal's construction itself brings together all of the most essential capabilities of site-development; also, the canal's construction is cheaper, if the development of the sites is integrated with the construction.

With a large-scale engineering approach to site-development, implicit in developing of sites as an adjunct feature of large-scale infrastructural programs, we can accomplish modern site development at a lower unit-cost per-capita, than by a lower-grade urban development undertaken by other means. It is a useful image of the matter, to say, that much of the cost of site-development falls between the cracks of the costs of developing the infrastructure project. At least, that advantage exists to be exploited by those who plan shrewdly enough.

We should knock in the head, the argument, that poorer nations can not afford modern urban development.

For example, poorer nations' populations can not afford the general use of the automobile common to Europe and North America. Few can afford to purchase and maintain private vehicles; communities can not afford the kinds of highway systems and traffic management systems needed to permit efficient use of high rates of per-capita dependency upon private vehicles. Rapid transit is much cheaper than any other option, and is, generally speaking, the only economical option

available. So, it is absurd to argue that the major urban centers of developing nations "can not afford" modern rapid-transit systems.

For example, in India today, it would be insane to develop the kind of highway systems common in Western Europe or North America. Too much precious land would be wasted, for one thing. For related reasons, reliance upon air-travel for rapid interurban transport, is contra-indicated. Efficient, modern interurban rail-transport for freight and passengers, is India's only option. Ultra-high-speed interurban rail transport is more urgent than in the OECD nations. Urban rapid-transit systems are also urgently needed. The future of India's economy depends upon three leading infrastructural programs:

1. A nation-wide water-management program.
2. A large-scale nuclear-energy program.
3. A major modernization of rail transport, and development of intra-urban rapid-transit.

These three measures are the leading preconditions for development of the agricultural and industrial potential, and for facilitating a rational shift of composition of population from rural to urban residence, partly into new cities.

The U.S. is not an exception to this general pattern.

During the present century, virtually no new city has been developed inside the U.S. The future of the internal economic geography of the U.S., depends upon the development of a vast water-management system, centered in the states to the west of the Mississippi River, but including a more rational management of the water-systems to the east, as extensions of a network based upon the Great Lakes. U.S. cities are obsolete and decayed, to the point that they must be either virtually abandoned or rebuilt substantially from the ground up. The development of new cities in what are presently the arid regions of the western states, is a key feature of the future economic geography of the nation.

The development of such new cities, should occur as a key feature of a combined agricultural-urban development of western states, associated with implementation of the large-scale NAWAPA [North American Water and Power Alliance] water-management program. This project, overall, would be the work of a generation; a span of about a generation would be needed, to develop the land-areas, and to promote the beginnings of forestation in key areas.

3. Feasibility of Infrastructure

The economic feasibility of infrastructural projects rests principally on two considerations:

1. The direct impact of the program in terms of improving some among those preconditions associated with the six listed primary constraints.

2. The productive investments made possible by the program, which would not be available, either at all, or simply at the same cost, without the program.

Often, both considerations are the most prominent ones in a proper estimate of feasibility. In the final analysis, the two considerations converge to become the same point. The first consideration emphasizes the more general form of the benefit, the second emphasizes particular benefits. In the first sort of consideration, we present the benefit in terms of an improvement in the general economic-development potential of the economy. In the second, we stress the benefit of some of the particular investments made possible by the program.

Accountants and finance ministries greatly admire exact figures. The costs of a project can, and should be projected with the generally accepted standards of accuracy. In the case of an agricultural or manufacturing investment, we can ordinarily project probable levels of operating revenues within a reasonable margin for error. In the case of a large infrastructural project, we must not attempt to estimate the feasibility of the investment by the standard of forecast probable levels of operating revenues. We have already identified the principled reasons this distinction must be made between infrastructure programs, and ordinary investments in agricultural, manufacturing, or commercial enterprises.

This does not mean that estimates of feasibility ought to be nebulous ones. A national economy's infrastructure-program budgets can be, and should be, estimated to a degree consistent with accounting-accuracy. The point we are stressing, is that no competent estimate of feasibility can be constructed using today's generally accepted standards of accounting practice. For this reason, we must introduce the correct methods by a pedagogical approach to the matter, as we are doing here.

A consortium of prospective investors delivers the plans for development of a new manufacturing or commercial facility to a consulting organization spe-

cializing in providing independent assessments of the financial feasibility of the proposed venture. The type of result expected is understood very well by both experienced investors and such consultants. We would ordinarily recommend such a practice ourselves, and would apply the same standards of consulting practice, if we were retained for such work. The point is, that to use the same approach for estimating feasibility of an infrastructural program, is intrinsically incompetence.

This does not mean that such consulting practices do not have limited uses in connection with infrastructural programs. We explain.

In any infrastructural program, we have two general classes of things to consider in judging the program's economic merit. We must, of course, project the economic benefits, and must put an estimated price on those benefits. We must also make another set of calculations. This latter projects the sources and applications of funds. The applications are: initial construction, operating costs, and debt-service. In the case that the project will obtain direct revenues from part of its total operations, these revenues can be projected by aid of conventional accounting methods, and these sums constitute a part of the sources of funds. For the projection of sources and applications of funds, conventional accounting practices are quite suitable. For calculation of the benefits generated by the program, conventional accounting methods must not be introduced. For this latter, methods of economic science must be used, instead.

An illustration helps to make the point clearer.

The most precise correlation to be found in the history of the post-war U.S. economy, is the correlation between increased investment in basic economic infrastructure and increase of productivity of operatives. These two curves correlate precisely, by a lag-factor of twelve-to-eighteen months.

The key parameter for measuring the benefit of infrastructural programs, is their impact upon the average productivity of the national or regional economy. Any other approach to determining economic feasibility, is fundamentally in error.

The first step toward constructing estimates of feasibility for infrastructural programs, is to construct an economic model for the national economy as a whole (or, in the case of a program with multinational impact, an economic model of the region). An infrastructural program is treated as a change in the structure of that economic model; the impact upon the economy as a whole, is the basis for estimating the measurable factors of feasibility.

The economic model to be used, is that consistent with the six constraints we have identified here. The economic models constructed according to "The LaRouche-Riemann Method," are indicated.

Conceptually, this "model" is a "non-linear function." The difficulty is that digital computer-systems are axiomatically incapable of explicit representations of a non-linear function. Therefore, in practice, we use the tricks of "curve-fitting," to program computer-systems to simulate a sequence of linear approximations of our function. As long as we are aware of the nature of the error introduced by such methods of approximation, the results are useful, and have the advantage of being far more accurate than linear models constructed from a different standpoint.

So, the first steps in conducting feasibility studies of infrastructural programs, are, to load up a large-memory computer system with all the essential data on the national economy, and to program the operations according to the sequence of linear approximations simulating our non-linear function.

In approaching the matter of feasibility of an infrastructural program, we concentrate on three features of the economic process: infrastructure, agriculture, and manufacturing. Our approach, broadly, is that implicit in our earlier discussion of the comparison of the U.S.A., the Federal Republic of Germany, and Japan.

We have indicated that certain levels of values for the first five of our six constraints, correspond to the required potentiality for any given level of technological development. We have also indicated that the level of technological development correlates with the level of productivity of operatives. So, to achieve a potential level of productivity, we must achieve a level of technology, and must also develop the values for the first five constraints consistent with that level of technology. We have indicated how a general sub-function for infrastructural development, is subsumed within those five constraints.

To situate the problem of estimating feasibility of a particular infrastructural program, we must understand the interrelationship of the various aspects of physical basic infrastructure. What is the balance of the various kinds of such infrastructure, which corresponds to an efficiently balanced combination for the level of technology considered?

Naturally, most infrastructural programs, especially

major ones, are a mixture of classes of physical infrastructure. For example, a major water-management program usually includes elements of generation and distribution of power, elements of general transportation, and so forth. What we require, is not a collection of individual projects, considered apart from the economy as a whole; we require an infrastructural program, or coordinated set of such programs, each including a number of component "projects." This combined program must balance the incremental development of national infrastructural development as a whole.

Feasibility is determined primarily for the total infrastructural program. Feasibility of individual projects, included within the program, is determined by the incremental effect of the project in respect to the requirements of the program as a whole.

It should be obvious, on the basis of considerations presented up to this point, that the success of infrastructural programs depends upon the existence of an efficient national consensus on goals of development of the private sector, especially agriculture and manufacturing. The principal portion of benefits of infrastructural development, will occur as the beneficial impact of that development upon agriculture and manufacturing. This impact will be transmitted chiefly through new agricultural and manufacturing investments; obviously, these new investments must occur synchronously with the development and operation of the infrastructural program.

For this reason, an infrastructural program implies that the government and business community have reached a working consensus on the integration of the infrastructural program into national economic development. This assumes, usually, that combined governmental and business agencies will mobilize supplies of credit for the agricultural and manufacturing investments, as well as the projects themselves.

By this route, with assistance of the economic model, the exact impact of the infrastructural program on the national economy (or, regional economies) can be projected with a relatively high degree of accuracy. We can, for example, estimate the numbers of households, in which regions, by which categories of land-usage, will experience varying degrees of impact of the program. We can project the shifts in productivity resulting. We can also estimate the total impact of the program, in terms of the six constraints, and in terms of increase of national productivity.