

of Venezuela, but the current study is its first large-scale practical application. Although most relationships embodied in the model have been validated in their original form, there has never been a full validation of the complete ANCOR model with a comprehensive empirical data base. To the extent that reliable and disaggregate construction and operating-cost data can be obtained for the rail or highway modes in Costa Rica, this presents a valuable opportunity to evaluate comprehensively the strengths and weaknesses of the current model and to suggest directions for possible improvements.

In addition to the ANCOR model used in this research, two other corridor cost models have been developed: ANCOR-AGUA, which performs cost and resource use analysis for water transportation systems, and ANCOR-AIR, which analyzes air transportation technology alternatives. It would be of interest to utilize these models to explore non-land-transportation options in suitable settings.

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## Research on Appropriate Planning Methodology in Developing Countries

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#### ABSTRACT

Developing countries have generally adopted the planning methodology conventionally practiced by developed countries. The results have not been encouraging. There is a dire need to evolve inexpensive appropriate methodology especially applicable to developing countries, which will help policymakers reduce the inefficiencies in transport, correct misguided priorities, promote equity, and enhance the quality of life. The following topics connected with appropriate planning methodology are examined in this paper: development and diffusion of planning methods, basic problems of land use and transportation planning, the meaning of need as compared with demand, distributional effects of current planning methods, appropriate planning methodology, and the ethics of methodology assessment. The issues concerning appropriate planning methodology are clarified and areas where further research is needed to improve the planning process are identified. An agenda for action is included.

Recent interest in appropriate planning methods stems from the general dissatisfaction with the planning and development process expressed by the public in developing countries. Planners dealing with the planning process in these countries have also expressed frustration with applying the conventional sophisticated planning methods. The objective of this paper is to clarify the issues concerning appropriate planning methodology applicable to developing countries and to identify areas where further research is needed to improve policymaking in the choice of methodology. Although the focus of this paper is directed toward land use and transportation planning, the ideas expressed can be extended for general application to the planning of the urban and rural infrastructure. The organization of this paper hinges around seven tasks: (a) to understand the development and diffusion of planning methods, (b) to identify the problems of land use and transportation planning in developing countries, (c) to differentiate between need and demand, (d) to understand the distributional effects of current planning methods, (e) to investigate appropriate planning methodologies, (f) to examine the place of an ethics of methodology assessment, and (g) to describe research issues applicable to developing countries. This speculative paper is an attempt to seek answers to the topics listed and to question some of the conventional answers that are generally taken for granted within the profession.

A word needs to be said about form in presenting this paper. The subject discussed here lies in the realm of metamethodology, which means methods of selecting methods: a progression from theoretical enquiries toward practical solutions.

#### SOME DEFINITIONS AND DESCRIPTIONS

In most of the discussion in this paper the terms "methodology," "technique," and "technology" are used interchangeably. Gendron's definition of technology captures the meaning of the other terms (1):

A technology is any systematized practical knowledge, based on experimentation and/or scientific theory, which is embodied in productive skills, organization, or machinery.

Also, because this paper is essentially concerned with the assessment of planning methodology appropriate for developing countries, Coates' definition of technology assessment is applicable (2):

Technology assessment is a class of policy studies which systematically examines the effects on society that may occur when a technology is introduced, extended, or modified. It emphasizes those consequences that are unintended, indirect, or delayed.

Technology and society are tightly intertwined by complex mutual causal relationships. Hence assessment may take on a normative or planning character by establishing a technological path from the present to a future state, where goals reflecting the social values of society can be achieved (3).

Although the terms "appropriate" and "intermediate" have been used in connection with planning and technology since 1973, no formal definition of the terms has been put forth so far. Darrow and Pam's description of appropriate technology covers the key elements. They stated (4):

"Appropriate technology" is a term that represents a particular view of society and

technology. It suggests that technology is neither neutral nor does it evolve along a single path. It recognizes that different cultural and geographical groups will have different technologies that are appropriate to their circumstances; that technological self-determination is essential to cultural identity (and political independence). It suspects that the only wise technologies are those which seek to accommodate themselves to the biological environment within which they are used. It assumes that the purpose of economically productive activity is to produce what is determined by need, in an enjoyable, creative process; not what is determined by endless greed, in an alienating, repetitive production process. It stresses that every society has a technological tradition and that new technologies must grow out of this tradition. And it presumes that the only development that makes sense is development of the people and their skills, by the people and for the people.

The implications of appropriate planning methodology are taken up in a later section of this paper.

#### PLANNING METHODOLOGY: DEVELOPMENT AND DIFFUSION

Model building and methodology are fundamental to policy analysis. Orderliness, predictability, controllability, and reduction of and allowance for error are some of the hallmarks of methodology. Because methods are the outcome of complex social demands, it is obvious that one can predict what will happen to methods if one can predict what will happen to society. There is yet a deeper aspect to method. A knowledge of method shapes the perception and ultimately the organization of the world by those who possess it. In this sense, method becomes the organizing basis for a world view (5).

Methods originate, modify, and change over time because of the environment in which they are applied. Figure 1 shows the four phases of the development of methodology: definition, formalization, maturity (and diffusion), and decline (5). Methodological development is naturally a dynamic process with a feedback element.

Figure 2 shows how a method is under constant revision as the needs of society warrant change. For example, with the decline of innovative method I, another appropriate method II will take over, and so on.

#### PROBLEMS OF LAND USE AND TRANSPORT PLANNING IN DEVELOPING COUNTRIES

Although modern urban planning techniques have been used in developing countries for a couple of decades, surprisingly little is known about the outcome of short-term and long-term strategies and investments used in these countries (3). Comparative studies of the factors influencing the development and quality of transport systems are now gaining some recognition.

Almost every transportation-related decision is really a public issue. The transport system impinges on those who use it and also on those who do not. "If there is one inescapable conclusion from a study of the world's major cities, it is that people everywhere are dissatisfied, often to the point of public protest with their transport, with the way it is developing and the effects it is having on their cities" (6). The problems are all the more intense

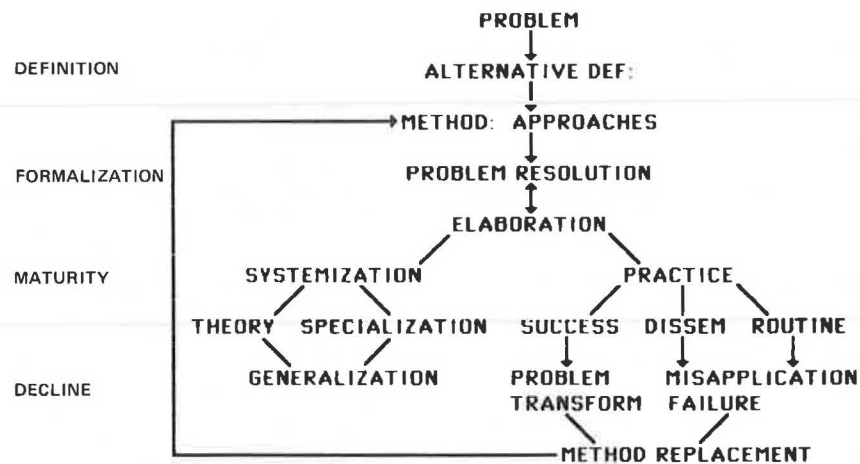


FIGURE 1 Elements in methodological development (5).

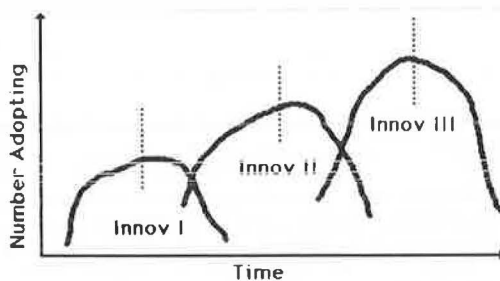


FIGURE 2 The effect of discrete innovation in reproducing change.

in developing countries. The need for transportation arises because of the existence of time and space, and the cost of transportation determines the current transportation technology, the size of cities, and hence the human opportunities for work and leisure, for the choice of jobs, and the quality of life in general (7).

Transportation is only one of the many necessities required to accelerate the pace of economic progress, but in many situations it plays a key role, and in all cases it sets the limits of improvements. Inadequate supply of transportation services for both goods and people has plagued the developing countries. The high influx of rural migrants usually seeking employment in urban areas is straining the already overutilized infrastructure. For instance, in India during the decade 1961 to 1971 the urban population has increased by about 20 percent (8).

There is a wide divergence of opinion on how to solve urban and rural transportation problems, but the common aim is to search for the best solution given the resources available. Land use and transportation planning studies have been conducted according to more or less standard procedures and methodology in most major cities of the developed world since the 1950s. This remarkably uniform methodology, consisting of the five-step sequential models of land use, trip generation, trip distribution, modal split, and traffic assignment, has been referred to as the conventional urban transportation planning process. Because of the necessity of considering many land use and transportation alternatives, efforts have been made in the last decade to evolve simplified urban travel demand models, chiefly to reduce the cost, time, and complexity of analyzing options (9).

The current situation of urban and rural planning in developing countries is alarming. Further deterioration is in prospect if present trends are allowed to continue unchecked (10). In the last decade many developing countries used travel models similar to the ones used in the United States and other developed countries. These procedures, methods, and models are highly sophisticated, very data hungry, and extremely costly and require specialized trained personnel to run them. Some work has also been done to adapt these sophisticated models to suit the requirement of developing countries, but still the cost of running these sophisticated models is horrendous. Unfortunately, all this work and expense, although intrinsically valuable, has not helped the developing countries and the results have been disappointing. The reasons for this disappointment are not difficult to comprehend, and some of the glaring ones are noted as follows (11,12):

1. The planning objectives and policy variables formulated for developing countries have usually been those meant for advanced societies of the world, instead of being related to the social needs and the economic status of developing countries. Similarly, the constraints encountered in developing countries are much more severe than those in developed countries. Some of the chief planning constraints are limitations on capital and resources; the capacity to pay for travel; limitation on available expertise to plan, implement, and maintain the transport system; the problem of benefitting the maximum number of people; and the conservation and use of scarce resources, such as energy.

2. Cities in developing countries have grown enormously. Some cities have grown by 300 percent within 30 years. Such growth has brought with it immense problems for public authorities who have to eventually provide the life-support system essential for the survival of these cities.

3. Heroic responses by public authorities to cope with rapid urban growth have often been really ad hoc reactions. There has thus been no time to adapt and evolve as cities have grown in size. Diffusion of innovation, the pace of technical change, and the rate of income growth are all out of balance. Also, economic, social, and political institutions have not kept pace in regulating patterns of growth.

4. The analysis of cities is highly complex in developing countries because of the coexistence of the different kinds and levels of technology. Electric trains run side by side with hand-pulled carts,

bicycles, cars, and pedestrians. Moreover, there is a marked lack of research into the growth and structure of cities in these countries. Naturally, the transferability to developing countries of sophisticated transportation and land use planning methodology as practiced in the United States is, to say the least, highly questionable. There is currently a lack of suitable tools for analyzing and understanding urban structure in cities of developing countries.

5. The lack of data to fuel any kind of urban activity-transportation model is one of the main bottlenecks. With over 30 years of experience, transportation planners have realized that the quality of results expected from sophisticated models is chiefly dependent on good, sound, reliable data. Developing countries are unable to collect the large amount of data to fuel sophisticated models, mainly because of financial constraints. The prime concerns of transportation planners operating in developing countries are how to collect data for input into land use and transport models as cheaply as possible and in the shortest time, how to transfer effectively the sophisticated methods currently being used by developed countries, and what the possibilities are of applying modified, simple methods capable of providing answers suitable for developing countries.

6. Because of the rapid and uncertain rate of urbanization, planners have usually concentrated on short-term plans. In most cases this has been a disaster because by the time the plans are completed, they are already obsolete.

The experiences of the past 30 years in planning methodology applied in developed countries have taught policymakers and planners several lessons. One of the main ones has been to recognize the limitations of methodology--that methods must be tailored to fit the task and the budget. This experience leads to the following suggested rules (3,12):

1. Initial application of planning methods should start with sketch planning, which is generally small-scale, quick, and manageable;
2. Methods should generally have a fast turn-around time to make the results responsive to policy needs and issues;
3. Detailed information on operating and fixed costs of transportation modes should be collected;
4. The patterns of human activity and their clustering characteristics should be known to discover clues to the reasons for agglomeration; and
5. The dilemmas of growth, control, and distribution as observed in developing countries should be analyzed.

#### NEED VERSUS DEMAND

As pointed out earlier, the constraints on planning are much more severe for developing countries than for developed countries. In an economy faced with scarcity, the priorities and the provision of transport supply have to be carefully estimated. The general run of transportation models provides answers that depend on the concept of demand for travel. The concept is founded on traditional economic theory. Demand for travel is based on the willingness-to-pay concept. Those with low incomes and no automobiles are less likely to demand travel.

In contrast, the social concept of need is not clearly defined (13):

Travel needs may be considered as fixed amounts of travel that are deemed necessary

to provide an adequate standard of living. This quantity is not affected by the price of travel. That is, a person may have a need to travel independent of the ability or willingness to pay. In this context, need is an equity criterion, indicating that a deviation from an established norm should be corrected.

The assessment of needs is a crucial part of the planning process.

Burkhardt (14), in describing a case study of transportation needs, provided a procedure for estimating trips needed by households in five rural areas. In his conclusion he suggested that future research should focus on a concept of need that refers to transport services that would be used, instead of those that should be used. Need must therefore be based on actual behavior (or estimates of actual behavior), not on some idea of what people ought to do. Bradshaw (15) has expressed similar ideas by classifying need into four categories: expressed, felt, comparative, and normative. Expressed need is what people think they want and is the most obvious measure of need, whereas normative need postulates a standard below which one is not expected to fall. According to Burkhardt (14), "it is thus an objective measure based on a subjectively-determined norm." A method of assessing need for travel in developing countries is sorely lacking.

#### DISTRIBUTIONAL EFFECTS OF CURRENT PLANNING TECHNIQUES

In the Western world public decisions for public projects most frequently use the benefit-cost model for evaluation. The model rests on the assumption that in any public-decision problem an attempt must be made to maximize the net benefit to society (16). This traditional process has been used by planners working on projects in developing countries. It is a consensus-seeking process because it assumes that a system can be constructed that will produce an aggregated net social benefit conceptualized in terms of the public interest. The general logic of benefit-cost analysis is well documented and so are its shortfalls (17-19). In this context Bolan's observations are most appropriate. He says (20):

Our concepts for optimality, our focus on an abstract welfare function, and our concern for an illusory greater good (or public interest) is brought into serious question . . . . Planning is being challenged more and more, not on its service to an overall public, but rather on the differential and distributional aspects of its results affecting particular publics.

These observations are particularly apropos to the problems of equity and distribution one constantly encounters in less-developed countries.

Benefit-cost analysis is grounded in the 19th-century social philosophy of Jeremy Bentham concerning the need for pursuing a course of action that would provide the greatest happiness for the greatest number in any public decision. Bentham's model, like cost-benefit analysis, was consensus seeking and thus ignored distributional issues by concentrating on net aggregate benefits. Cost-benefit analysis, when used for assessing net aggregate benefits for purposes of evaluating alternative courses of action, makes use of the Pareto optimality condition, which states that if one person gains and nobody else loses, there is a net gain in welfare. If some gain while others lose, however, the



method can provide little guidance, although the Kaldor-Hicks criterion states that an allocation of resources is warranted if those that gain could in theory compensate those that may lose. In actual practice, this does not require that compensations be paid nor does it imply that gainers and losers be identified (21). The implications of the Kaldor-Hicks criterion for potential Pareto improvements is highly questionable and is of special importance when the socioeconomic standards of the community are so distinct that transportation improvements frequently benefit particular groups of society systematically at the expense of others (22).

In comparison with Bentham's theory of utilitarianism, which aimed at the greatest happiness of the greatest number, Gandhi and Bhave went a step further in an attempt to establish a new social and economic order based on human values--a decentralized, self-governing, nonexploitative, cooperative society. Gandhi gave that society the name "sarvodaya," meaning the uplift of all, that is, a society in which the good of all is achieved (23).

The concept of sarvodaya is the most original contemporary contribution to political thought. It postulates that development of self-governing village communities, decision of local issues by near unanimity, limitation of needs, and the development of the capacity to manage affairs with minimum governmental control and assistance will lead to the welfare of all. Bhave's cogent example of a mother distributing food to her children, not on the basis of mathematical equality, but taking hunger and digestive capability into account, drives home the point on the exercise of discriminative equality (24).

As much as sarvodaya is attractive there are questions that must be resolved. First, does the sarvodaya theory postulate a condition? In other words, does sarvodaya call upon the human race to grow towards sarvodaya, which sarvodaya alone can create? Second, in the face of growing complexity of modern life can one apply the principle that government is best that governs least? And third, how can the winds of change blowing from the developed world be prevented from adversely affecting the people of developing countries (24)?

#### APPROPRIATE PLANNING METHODOLOGY

The term "appropriate" is itself one of the general terms that has come from the literature on planning, technology, and development. Most authors agree that the fundamental requirement of appropriate technology is that it make optimum use of the available resources in a given economic environment (3). Schumacher, the originator of the idea and philosophy of appropriate technology, illustrates the value dependence of economics by comparing two economic systems embodying entirely different values and goals. In one system the quality of life is measured by the amount of annual consumption. In the other system, the aim is to achieve a maximum of human well-being with the minimum of consumption (25).

Leopold Kohr has answered several questions raised in connection with the meaning of the term "appropriate," which implies the existence of limits. Beyond certain limits technology not only ceases to be a solution but is actually the most intractable obstacle to it. Planning and technology are most efficient when they provide humanity with the cultural, political, economic, and convivial ingredients that make up the good life. The question of size is also important. Explaining the meaning of limited size, Kohr says (26),

Today, improvements in transportation and communication have made it possible to extend city size limits to perhaps 12 or 15 million. But beyond this, no further technological improvement can match the geometrically multiplying problems of scale setting in. They now turn into diseconomies of scale.

Planning and technology are described by their input requirements--labor, capital, and materials--along with the expertise required to plan. The answer obviously lies in reducing and/or in balancing the input requirements to dimensions where "appropriate" tools for human improvements can be furnished through simpler, cheaper, and transparent methods.

Modern methods of planning and the application of the latest technology as used in the developed industrial world have traditionally been recognized by developing countries as the driving force behind the apparent growth and prosperity of the Western world. This prosperity and growth is reflected in the quality of life and again the apparent well-being of the people inhabiting the developed industrial world.

The general problems and specific failures of modern planning methodologies and the application of technology in developing countries prompted Schumacher to advocate appropriate technology as a means of improving the condition of the nonindustrialized world.

There is naturally a lot of controversy regarding appropriate planning and technology. The advocates of current planning and technology believe strongly that greater economic growth through capital-intensive and energy-intensive plans is the way to go, whereas proponents of appropriate technology claim that current planning and technology have resulted in negative impacts to the environment and the quality of life. Indeed, it is claimed that in countries where high technology is practiced, a point of diminishing and even negative returns to scale has been reached, as shown in Figure 3 (27).

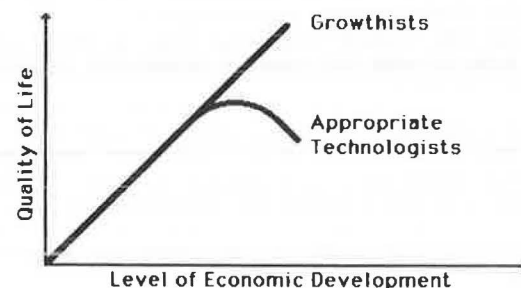


FIGURE 3 Growthist and appropriate-technologist perspectives (27).

Equity, as pointed out earlier, is another important factor affecting developing countries using traditional planning and technology borrowed from the West. Environmental factors, including a focus on energy use, is yet another problem in these countries.

The choice and application of appropriate planning methods in developing countries is one of the most important collective decisions confronting any country. It is a choice that determines, among other things, how, when, and where improvements should be made to the infrastructure in keeping with community goals and objectives, and this decision in turn affects the whole quality of peoples' lives (28).

Very little systematic research has been con-

ducted into appropriate planning methodologies applicable to developing countries. The reasons for this situation are not difficult to find. First, innovation in planning is almost always induced as a response to a perceived need. Second, there appear to be economies of scale in the research and development field for evolving such techniques. Third, the existing examples of planning adaptations of Western techniques in developing countries have been erratic. Little is known about their success. It could be generally concluded that major planning adaptations falling in the category of appropriate planning will not be forthcoming if research and development is left solely to private researchers (11).

#### ETHICS OF METHODOLOGY ASSESSMENT

The importance of the ethical dimension in assessing the short-term and long-term effects of methodology has been recognized from the earliest stages of technology assessment. Unintended consequences are likely to result from implemented methodologies and policies if rigorous assessment is not conducted. The question before planners and policymakers as they seek to improve anticipatory methods research is how the assessment itself can be used to promote gains in the quality of life. The task becomes one of ascertaining the limits of methodology and the limits of being able to assess that methodology vis-à-vis the value system of individuals who make up society as a whole, and the possible linkages between the region and the communities at the local level (29).

Jessen says (29):

Technology assessment and social impact assessment lie at the crossroads of tension between the value free (properly translating a modern problem in technological and human terms) and the value laden (implementation consequences: bridging the gap between findings, policy recommendations and political actions to carry out the policies).

Jessen's statement is appropriate. He says,

We professionals who use only the narrow, specialist training of sterile quantitative methods, without taking into consideration the qualitative aspects and the broader understandings and insights of citizens regarding their world view in their own situational complexes, cannot adequately define the problem and therefore cannot adequately provide prognosis to accompany our diagnosis.

In summary, it is maintained that the application of some kind of ethics of assessment is necessary in order to maximize positive results in the predictive enterprise of methodology assessment.

#### RESEARCH ISSUES

Because the concept of appropriate planning methodology in developing countries is quite new, there are barely any results of such research available. Although there has been much advocacy and theory, there has been little scientific examination of the dimensions of appropriate planning methodology.

Any innovation in developing and applying appropriate planning methodologies would necessarily have to go through several stages (11):

1. Evolution of new methodologies particularly meant for application in developing countries or the

modification of existing know-how based on proven cases;

2. Organization of possible innovations for ready application in test cases for the most part and in actual application in some cases where the method appears to have a fair chance to succeed;

3. Development of the methodology for regular use, in the form of "canned" or packaged programs based on the success observed in test cases;

4. Evaluation of proven methods for their appropriateness--cost, stability, applicability, robustness, and so on; and

5. Diffusion of appropriate planning methods, so that indigenous planners in developing countries are familiar with their use, limitation, and strengths.

Because very little systematic documentation is available regarding appropriate planning adaptation in developing countries, a high priority should be placed on recording how innovative appropriate methods of planning were introduced, by whom, at what cost, and where, together with information regarding the ambient political and social conditions prevailing at the time of application and adaptation.

Records must also be maintained on the diffusion of appropriate planning methods. Instances have come to light from several countries that indicate that the diffusion process invariably neglected the important issue of assimilation capability, which depends in most cases on the level of technological development of the transferee.

In preceding sections of this paper several questions have already been posed in the hope that a cutting edge will be available to researchers to begin a systematic examination of appropriate methods. In addition the following questions emerge:

1. Given the limitation on the cost and availability of data, what performance criteria might be realistically adopted for the evaluation of appropriate methodologies?

2. Is enough known about cities in developing countries? Is enough known about changes in travel behavior over time in developing countries to take them into account in the planning process?

3. How can the planning process be made truly sensitive to the needs of the community?

4. What means should be used in developing countries, under different systems and styles of political systems, to promote an appropriate interface between planning and the political process?

#### AN AGENDA FOR ACTION

Where does the foregoing leave those concerned with evolving appropriate planning capability for developing countries? An agenda for developing that capability is outlined as follows:

1. The first task should be development of a clearinghouse of information regarding land use and transportation methodologies used by planners. Preliminary work of this nature has begun in the shape of newsletters from the Subcommittee on Transportation and Land Use Planning in Developing Countries of TRB. Similar endeavors of the Institute of Transportation Engineers are emerging.

2. The second task should be to inventory existing and emerging land use and transportation planning methods currently used in developing countries in the form of a sourcebook. Details provided would include such topics as data base used, time line, costs, manpower needs, results of application, and special problems. The scale and level of detail could follow the matrix indicated in Table 1.

TABLE 1 Methodology Scale Matrix

Methodology Application	Scale				
	Rural	Urban Microscopic	Urban Metropolitan	Inter-urban	Regional
Data needs and collection	X	X	X	X	X
Socioeconomic forecasts	X	X	X	X	X
Land use planning	X	X	X		
Alternative scenarios	X	X	X	X	X
Travel characteristics analysis	X	X	X	X	X
Quick-response and sketch planning	X	X	X	X	X
Operations planning	X	X			
Strategic planning	X	X	X	X	X
Long-range planning	X	X	X	X	X
Short-range planning	X	X	X	X	X
Intermodal planning	X	X	X	X	X
Goods movement planning	X	X	X	X	X
Investment analysis	X	X	X	X	X
Technology transfer	X	X	X	X	X
Policy planning	X	X	X	X	X
Impact assessment	X	X	X	X	X

3. The third task, which is an offshoot of Task 2, should be to inventory existing and emerging methods currently being practiced in the United States (and other developed countries) that have been proven to work, either as is or with modifications, in developing countries. A range of proven methods would naturally emerge from this exercise, possibly fitting the matrix in Table 1. Although the foregoing agenda is not exhaustive or revolutionary, it does recognize that any headway in methodological innovation will have to be incremental in nature.

4. The fourth task should be to seek out methodologies developed in one country that can be transferred to and adopted for use in another country.

As a closing comment, it should be recognized that the evaluation of planning methods and their practical applications in the developed countries of the world has spanned a period of over 25 years. Therefore, it should not come as a surprise if the process of seeking appropriate methods, identifying gaps between theory and practice, developing research to fill the gaps, and documenting the results takes considerable time and effort.

#### CONCLUSIONS

It is apparent that there are no easy answers to issues concerning appropriate planning methodology development and adoption. Criteria for identifying appropriate methods are needed. It is also apparent that planning cannot be done by central office bureaucrats who are not familiar with the culture and microscopic details of the country where appropriate planning application is proposed. Planning cannot be from the top down and cannot stifle the originality, energy, intelligence, and innovative drive of a country's existing organization. It must incorporate these qualities and blend them into what is appropriate.

Finally, it is critical to obtain a greater factual base of methodology that is currently being used in developing countries, to monitor the results, and to build on such methods in the light of the best knowledge available.

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## Business Plan for Engineering Districts: The Pennsylvania Experience

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### ABSTRACT

During 1984 the Pennsylvania Department of Transportation embarked on a key initiative designed to improve the overall planning process. To facilitate a businesslike approach to operating Pennsylvania's 11 engineering districts, individual 4-year business plans were developed. Although Pennsylvania's capital improvement projects are coordinated through a 12-year transportation improvement program that is reviewed, revised, and adjusted every 2 years and maintenance projects are developed for each county through an annual work plan, the 4-year business plans for the first time combine these two program elements into a multiyear strategic management document. The 4-year business plans are intended to assist the district engineers in working toward the common objectives of the department. Business plans encompass manpower needs, physical plant, equipment, and materials requirements associated with district and county activities. The business planning process also provides each county manager with the opportunity to examine the anticipated multiprogram effects on the transportation system.

The Pennsylvania Department of Transportation (PennDOT) is "big business." It is expected that the total revenues in 1984-1985 will be around \$2.0 billion. This will include \$1.4 billion from Pennsylvania's Motor License Fund and \$550.5 million from federal sources; \$870.7 million in Motor License Fund monies will support departmental highway and bridge programs; the balance, \$534.1 million, will be used to fund local government transportation programs and debt services. This magnitude of revenue places PennDOT among the top 250 corporations in America.

The department's responsibilities are very diverse. It serves all motorists with a variety of driver and vehicle transactions, 25 million each year. The department spent \$460 million underwriting local transportation systems in FY 1982-1983. This included over \$180 million in municipal assistance

and over \$144 million for public transit operating assistance. PennDOT maintains almost 45,000 mi of roadways, more than the combined state highway mileage in the six New England states plus New York and New Jersey. Percentagewise, PennDOT controls 40 percent of all roadway miles in the commonwealth, compared with an average of 20 percent in other states.

The network of roads and bridges in Pennsylvania today is the fourth largest in the nation and represents an investment by taxpayers of more than \$50 billion.

Not only is the department big business, but the environment in which the department operates is becoming more and more complex and demanding. The areas of uncertainty are increasing, and change is all around; it appears, in fact, that the rate of change is accelerating.

What does this mean for management? It means that