CHAPTER 9

SUB-SYSTEM STUDIES: SOCIO-ECONOMIC FACTORS

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9.1 INTRODUCTION

This chapter provides background information and an introduction to study methods relating to socio-economic factors. In many cases, particularly in urban areas, the social and economic impacts of a proposed project are extremely important, even to the point that favourable social and econmic impacts may win approval for a project that has significant adverse effects on "the environment". Alternatively, the identification of adverse social and economic impacts may help when field naturalists and other concerned parties seek to preserve woodlots, ravine lands, wetlands and wildlife habitats threatened by project proposals in urban areas. The interrelationships between subsystems are incorporated in Environmental Impact Assessment requirements in Canada, and these, almost universally, recognize that an attempt should be made to predict all significant impacts of a proposed project, including social and economic effects.

This chapter presents a non-technical overview of the principal issues and concepts involved in dealing with socio-economic factors for the purposes of:

1. better understanding the important interdependencies which exist within and between the component systems in urban areas;

2. providing a better understanding of the socio-economic factors themselves;

3. being better equipped to criticize an existing environmental impact statement (EIS) or planning document, as well as documents which support or are critical of its methods or conclusions.

This chapter is not designed to be a "how to do it guide", but it may be useful to a citizens' group preparing to review a published EIS, land-use plan or similar document. The reader interested in following up on the issues raised here is directed to the bibliography at the end of this chapter.

9.2 THE PROBLEM

The problem is essentially to *predict* the significant effects of a project and various alternatives on key social and economic variables to indicate how society will *evaluate* these effects. The evaluation is then integrated with that of other effects so an overall recommendation may be made about the best course of action. Chapter 6 describes how these two problems - prediction and evaluation - are handled in situations where EIA's are required.

The prediction phase requires a selection of key attributes or variables which are to serve as indicators of change. Table 9-1 provides the reader with an idea of the range of variables which might be short-listed. The table is first organized by class or type of impact (demography, local economy, etc.) and then into a set of key variables or indices which are usually particularly important. Finally, some other variables pertaining to the class have been listed.

To predict the effects of a project we need to have: (a) suitable baseline data on all variables of interest; (b) a prediction of changes in these variables with the project; and (c) a prediction of the changes in these variables without the project. In the physical and biological sciences the selection of variables and the prediction of their changes in response to some other change may be estimated from *theory*. Unfortunately there is very little good theory in the social sciences. Indeed this is a principal reason for the difficulty of socio-economic impact assessment and why so little agreement exists as to what variables should be included and how they should be predicted and evaluated.

Table 9-1. Socio-economic impacts: classes, indices and other variables

Class	Indices	Other variables where appropriate, measured as changes
A. DEMOGRAPHY		
1. Population	-Rate of population increase	-Birth rate -Percentage of population under 16 years -Percentage of population over 65 years
2. Migration	-Rate of immigration -Number of immigrants	-Average age of immigrants -Socio-economic status of immigrants -Ethnicity of immigrants
B. LOCAL ECONOMY		
1. Public fiscal balance	-Net change in government fiscal flow (revenues less expenditures and annualized capital expenditures)	-Total operating expenditures -Local tax rates -User charge revenues
2. Employment	-Change in numbers and percent employed, unemployed, under-employed, by skill level	-Labour force participation rates by age, sex -Number of households with both parents working
	-Number of new long-term and short-term jobs provided	-Percentage of new jobs going to "locals" -Average wage rates of new jobs
3. Wealth	-Change in land values	
C. PUBLIC AND PRIVATE SERVICES		
1. Drinking water	-Change in frequency, duration and severity of water shortage incidents, and number of people affected	-Change in likelihood of increased water shortages, and number of people likely to be affected
	-Change in salinity, and other indices of drinking water quality and safety, and number of people affected	-Changes in effluents or purification processing likely to affect taste or other qualities of drinking water
2. Hospital care	-Change in number of citizens beyond x minutes travel time from emergency health care	-Average travel time to nearest hospital -Maximum travel time to nearest hospital -Number of ambulances per capita
	-Change in average number of days of waiting time for hospital admittance for elective surgery	-Average waiting time for emergency treatment -Number of doctors per capita in market area
3. Crime control	-Change in the rate of crime in existing community	-Expert rating of change in crime hazard -Number of particular crimes -Number of policemen per capita

Table 9-1 Continue

Class
3. Crime control (continued)
4. Fire protectio
5. Recreation
6. Education
7. Local transportati

Table 9-1 Continued

Class	Indices	Other variables where appropriate, measured as changes
3. Crime control (continued)	-Change in percent of people feeling a lack of security from crime	-Personal expenditures for protection
4. Fire protection	-Change in fire incidence, property loss and casualty rates	-Expert rating of change in likelihood of fires, fire spread, rescue hazards -Number of major fires -Number of firemen per capita -Fire insurance rates
5. Recreation	-Change in number and percent of households satisfied with public recreation opportunities	-Comparative rating of this area *versus* others
	-Change in number or percent of households using facilities, (viewed relative to nominal capacity), by facility	-Average participation rates -Frequency of visits, length of stay
	-Change in number and percent of households with access to various types of recreation facilities within x minutes of travel, by type of facility and mode of travel	-Average travel time to facilities by type -Maximum travel time to facilities by type
6. Education	-Change in number and percent of students within x minutes, by type of school and travel mode	-Average travel time, maximum travel time -Average number of major streets crossed in walking to school
	Number and percent of students having to switch schools or busing status (from walking to busing or *vice versa*)	-Number of students affected by altered school regions -Change in location of schools, and physical conditions around schools or along routes to school that are likely to affect satisfaction with accessibility
	-Change in school crowdedness indicators e.g. student-teacher ratios, number of shifts	-Number of programs added or deleted -Number of students not accommodated in first choice programs -Number of major discipline occasions -Changes in standard test score averages
7. Local transportation	-Change in vehicular travel times between selected origins and destinations, by time of day and day of week	-Public transit and pedestrian average travel times between selected origins and destinations
	-Change in duration and severity of congestion by mode	-Number of bottleneck intersections

Table 9-1 Continued

Class	Indices	Other variables where appropriate, measured as changes
7. Local transportation (continued)	-Change in average time needed to find acceptable parking space within x metres of residence (or desired destinations) in neighbourhood, by time of day and day of week	-Demand for parking spaces -Supply of parking spaces
	-Change in numbers and percent of residents with access to public transit within x metres of their residence; and numbers and percent of employees who can get within x metres distance of work location by public transport	-Rate of transit ridership -Number of transit riders -Probability of obtaining a seat in rush-hour
	-Change in the rate of traffic accidents	-Expert rating of change in hazard -Number of serious personal injury accidents
	-Change in number and percent of households satisfied with traffic safety, and with walking conditions and opportunities in their neighbourhood	-Change in physical conditions (sidewalks, noise, etc.) affecting current satisfaction or dissatisfaction with traffic safety or walking conditions, and number of households likely to be affected
8. Shopping	-Change in number and percent of households within x minutes travel time to shopping, by type of store and mode of travel	-Average distance to nearest grocery store -Average distance to nearest drug store -Average number of parking spaces per store
	-Change in number and percent of households satisfied with local shopping opportunities	-Average number of family shopping trips outside local area -Number of retail establishments changing function
D. HOUSING AND SOCIAL CONDITIONS		
1. Housing adequacy	-Change in number and percent of housing units that are substandard and the number and percent of people living in them	-Average number of rooms per person -Average number of persons per toilet

Table 9-1 Continue

Class
1. Housing adequacy (continued)
2. People displacement
3. Population mix
4. Crowdedness
5. Sociability-friendliness
6. Privacy
E. AESTHETICS AN
1. Attractivenes
2. View opportunitie

Table 9-1 Continued

Class	Indices	Other variables where appropriate, measured as changes
1. Housing adequacy (continued)	-Change in number and percent of housing units relative to need by type of housing (price, owner/rental, number of bedrooms, style, etc.)	-Number, rate of demolition and new construction -Number of rooming houses -Average amount of private green space per housing unit
2. People displacement	-Number of residents or workers, displaced by development and whether they are satisfied with having to move	-Percentage of displaced residents able to find similar, or suitable housing -History of turnover in displaced units
3. Population mix	-Change in population distribution by age, income, religion, racial or ethnic group, occupational class, and household type	-An index of spatial segregation of various types of groups
4. Crowdedness	-Change in percent of people who perceive their neighbourhood as too crowded	-Residential density -Average number of persons per household
5. Sociability-friendliness	-Change in social interaction patterns (e.g. frequency of neighbourhood visits, community activities)	-Average number of acquaintances in neighbourhood -Number of sidewalk conversations
	-Change in percent of people perceiving the neighbourhood as friendly	-Number, frequency and size of neighbourhood social events -Participation rates in local social groups
6. Privacy	-Change in number and percent of households satisfied with privacy in and around their homes	-Change in sightlines, pedestrian volumes, or other conditions likely to affect satisfaction, and number of households potentially affected
E. AESTHETICS AND CULTURAL VALUES		
1. Attractiveness	-Change in number and percent of citizens who are satisfied with neighbourhood appearance	-Disturbance of physical conditions currently considered attractive; removal/improvement of conditions currently rated unattractive
2. View opportunities	-Change in number and percent of citizens satisfied with views from their homes (or businesses)	-Number of households (or businesses) whose views are blocked, degraded or improved

Table 9-1 Continued

Class	Indices	Other variables where appropriate, measured as changes
3. Landmarks	-Rarity of landmark and distance to nearest similar examples of land-marks to be lost or made more accessible	-Number of formal and informal visitors annually -Average frequency of visits by local residents
F. OVERALL CONTENTMENT		
1. Overall contentment with neighbourhood	-Change in percent of people who perceive their community as a good place to live	-Difference in average length of time it takes to list 5 good, and 5 bad things about neighbourhood -Percent of household heads who report they would move out of neighbourhood if given $10,000.00.
2. Fairness to all groups	-The above indices should be considered with respect to specific clientele groups or population segments that are affected to reflect the quality of fairness in new developments	-Percentage of citizens who think that the net effects of the project will not be fairly distributed -Number of man-hours expended in demonstrations

Table adapted from Schaenman and Muller (1974) and Schaenman (1976)
The last column and several other items are original to the present authors.

The problem of obtaining quantitative measures of variables is particularly acute when it comes to socio-economic variables. For example, even if it were possible to define clearly what is meant by "community cohesion", it is next to impossible to measure this attribute meaningfully or validly at a high level. An example of "a high level of measurement" would be a measure of government fiscal revenues in dollars - i.e. something concrete to which we could add meaningful decimals and the value 8 is known to be twice as large as 4. This high level of measurement is referred to as an interval or ratio scale. There are two lower levels of measurement: the ordinal - in which we can simply "rank order" values but we cannot say how much higher one value is than another; and the nominal - in which we can only put things in categories, such as (male, female) or (house, condominium, apartment). In socio-economic analysis often we can only attain these lower measurement levels. This poses significant problems for comparisons, for adding up, and for assessment of change over time. It is not meaningful, for example, to add ranks nor to find the average rank, whereas these are entirely valid ways of dealing with high level measurements. The final chapter about how to write up a report focusses on the presentation of high level measurements. Simple statistics, described in Chapter 10, such as the mean and the standard deviation, cannot be used in conjunction with many socio-economic variables because of their low level measurement. Without a guiding theory, the variables selected, the way in which they are measured, and the forecasting of changes in them should be based on clear, intuitive reasoning and common sense. For example, it would be unwise to add up all local crimes (theft, break-ins, murders, etc.) as an index of neighbourhood security.

The evaluation phase, as was pointed out in Chapter 6, is also extremely problematical. We must be able to say how people value less traffic congestion, more crowded schools, more accidents, a more aesthetically pleasing environment, and so on. In fact, not only must we deal with the social evaluation of direct social and economic effects but we must also deal with the *social* evaluation of effects which are not directly social or economic - for example, decreased variety

of birds, animals and trees. There must be a very strong value judgement made in order to say that society would favour a situation in which 5 minutes is saved on the average intra-urban trip but that there are 4 more traffic deaths annually and one less ravine, or a situation in which a hectare of semi-natural ravine land is destroyed for the construction of an apartment building accommodating 400 persons. If an EIA statement or planning document makes any *recommendations* at all, then a strong judgement about what people prefer and how different people's preferences are to be weighted must have been made. Unfortunately, the norms which are used are typically hidden and not made explicit. Existing welfare theory does not provide a basis for the value-laden judgement that society prefers the saving of 5 travel minutes per capita to 4 lives. Indeed, the whole problem of "evaluation" is exacerbated by the likelihood that any particular project, including doing nothing, will make some group(s) in society better off but make some other group(s) in society worse off. As there are no right answers to these value-based questions in the paradigm of science, such decisions are, and should be, left to the realm of politics. The planning process should be as objective as possible in its predictions of effects or changes. But, to the extent that evaluation is performed, there must be a clear explanation and justification for the subjective value judgements which *must have been included*. The problem of judgements often appears to be solved by surveying the public and/or holding a public hearing.

In the discussion which follows the prediction and evaluation of socio-economic effects are dealt with separately. The discussion of approaches to prediction distinguishes between variables that are capable of high levels of measurement and those that are only capable of low levels of measurement. The discussion with respect to evaluation focusses on two particular commonly used approaches - cost-benefit analysis and social impact assessment. An exemplary problem is outlined first, however, and is used throughout to illustrate the discussion of both prediction and evaluation.

AN EXEMPLARY PROBLEM

It will be useful for what follows to have an illustrative reference problem. The following entirely hypothetical problem embraces a wide variety of issues to which we can subsequently refer.

Imagine that a private land development firm has proposed building an apartment complex on land which it owns. The land is in an accessible part of a major ravine bordering on a middle-income residential neighbourhood. The site is forested, of mixed relief, subject to occasional flooding, the habitat for many species of wildlife not usually found in urban areas. The land has a walking and bicycling path through it and is used by the public for passive recreational purposes and by the Society for Crippled Children as its site for a summer day camp. The proposed apartment complex is to be largely subsidized low income housing for inner city residents.

Before proceeding, it is useful to point out the difficulty faced by the assessors in selecting alternative projects. Of course, leaving the land as it is - the "no-go" alternative - must be included. There are two different bases for selecting other alternatives. The first, and most obvious, is other uses for this parcel of land. For example, the apartments could be for non-subsidized households; there could be single family housing; there could be a formal park; or a permanent camp site; etc. In order to bound the tremendous variety of alternatives, assessors usually only consider those which have been seriously suggested by community groups, politicians, etc., and which are deemed to be technically feasible and do not contravene zoning by-laws or official plans. The second, and less obvious type of alternative, is based on recognition that the project addresses the need for low income housing and that an alternative way of meeting this need would be: (a) to construct a similar project on another available (and perhaps more suitable) site; (b) to subsidize the needy directly in various ways so that they could participate in the normal "housing market". Again, alternatives are typically restricted by a survey of those which have been suggested. Groups who are fundamentally opposed to such development of urban "natural areas" must develop compelling counter-proposals (in both senses noted above) very early in the planning process. The alternatives

which should be included, according to welfare theory, are those which are suspected of better meeting the objectives of the project, (or more generally, the goals of society), than the proposed project itself. Great care must be given to the process of defining the objectives of the project, so that meaningful and feasible alternative ways of meeting the objectives can be invented and evaluated.

9.3 PROFILING AND PREDICTION OF SOCIO-ECONOMIC VARIABLES

In order to evaluate change, we must be able to predict change. In particular, we must determine the current levels of key variables, and we must predict the future levels of key variables with the project, without the project, and with other judiciously selected alternatives. All variables likely to be affected by the project or alternatives constitute key variables. The problems of variable selection is addressed in section 9.4 as well.

Prediction is one of the principal goals of science. The first step towards prediction is to find, or formulate, relevant theory. Theory is especially required in situations in which there is great complexity and a high level of interdependency and interaction among the variables of interest.

The list of indices and variables in Table 9-1 highlights that the socio-economic system in an urban area is exceedingly complex and highly interrelated. Predicting the change in one variable is not possible without taking account of the causal and derivative changes in other variables. Compared with theories in the physical and biological sciences, those in the social sciences are scarce and weak. The models which tend to be used are highly simplified conceptions of real world socio-economic systems. The approaches to predicting economic and high level of measurement social variables on the one hand, and other less "quantifiable" variables on the other, are taken up separately in the discussion which follows.

HIGH LEVEL OF MEASUREMENT VARIABLES AND THEIR PREDICTION

In this section we will discuss four exemplary approaches to predicting economic and high level of measurement social variables (e.g. indices A1, B1 and B2 in Table 9-1). The first, "input-output analysis", serves to illustrate how interdependent economic systems are often modelled. The second, cohort survival models, illustrates how population change is usually predicted. Regression analysis is the third: it is used to illustrate how statistical analysis can be used in forecasting. The fourth, "analogy" acknowledges the possibility of making tentative predictions with very little theory indeed. A secondary purpose of this section is to present a few examples of important urban socio-economic processes which must be addressed, in one way or another, in any urban impact assessment.

Input-output analysis

Input-output analysis has been widely used to model national economies. Recently, however, the technique has been adapted to, and used successfully on, urban economies. See, for example, Morrison and Smith (1977). Imagine that we have been able to divide the local economy into a set of useful sectors, or groups of industries, for example: construction, manufacturing, retailing, private services, public services, education, etc., and finally households. Each industry buys goods and/or services, from, and sells them to other industries. For example, households purchase goods and services, consume education, and supply labour. We now set up a table, or matrix, with each of these industries as both rows and columns. Data are then found on the dollar value of transactions between each industry and all others in the existing economy. This table is then subject to minor manipulation to produce a matrix of input-output coefficients which show the breakdown of one dollar's worth of output into fractions of one dollar's worth of various inputs. It is this table which captures the interdependencies in the economy. Further straightforward manipulation yields a set of equations in which we have the level of output of each industry as a function of the level of "final demand" for each industry's product.

These equations are typically used in the following way. Most projects will change one or more levels of final demand. For example, our project will certainly

increase the demand for construction, the demand for services, for education, etc. in fairly predictable ways. The new values of demand are then "plugged in" to see how the output of each industry will (must) change if the final demand is to be satisfied. Monetary values must then be placed on the increase in the outputs which constitute the "impacts" (valued effects) of the project. The reader may well reason that such a model is entirely unnecessary. The increase in construction jobs can be valued as the increased wage bill, the increase in retail purchases can be directly valued, and so on. But this is not so. New construction jobs give rise to increased retail purchases, increased service need, increased need for class-room space, etc. Increased retail purchases require a larger number of retail clerks, increased manufacturing and manufacturing jobs, and so on. The lesson here is that for every change in final demand in the economy, there will be a long series of reverberations throughout the economy, not only in the sector of direct impact but in all (or most) others, too. The input-output model captures all of these reverberations in a theoretically rigorous way. It is normally assumed that the system returns to "equilibrium" fairly quickly; it is not capable of directly dealing with other changes from outside - for example, new government budgets, etc.

Thus input-output analysis is capable of fairly accurately predicting the total economic effects of a change in demand by accounting for all of the indirect and induced effects. There are two interesting problems - bounding the study area, and obtaining or estimating the transaction table. If the study area is taken only as the local community, it is clear that many of the indirect effects (often benefits) will occur outside this area. For example, the increased spending by construction workers will largely take place where they live. There is an important lesson here: there is no reason, save convenience, for considering only costs and benefits at the local community or immediate impact area. After all, we should be addressing the issue of welfare to all of society. It is possible to structure input-output models so that they deal with more than one region; thus we can obtain estimates for local effects and effects on the rest of the urban area. The real difficulty in using input-output analysis at small scales is obtaining the relevant data. Surveys are expensive and many of the procedures which have been developed for adjusting national and provincial input-output tables for use at the local level are theoretically weak.

Cohort survival methods

Cohort survival models are designed to forecast future population distributions by age (cohort) group, sex, and in some cases, other variables. Like input-output models, they work with flows between cells of a matrix. Imagine that by studying census data we are able to determine the percentage of individuals in each 5-year cohort (e.g. aged 6-10 years) who survive to the next 5-year cohort group (here 11-15 years) at the end of 5 years. We can also easily discover the number of births and the birth rate by age of mother. In the absence of migration in or out of a region, and assuming nothing significant happens in the way of epidemics or medical breakthroughs, we can use the birth rates and survival ratios to forecast the population size, by cohort, 15, 30, or 50 years hence. This simple cohort survival model can be made much more elaborate.

In particular, in forecasting population change in small areas, we must take migration into account. At the simplest level, we would deal with net in-migration; at more sophisticated levels, we can have a full multiregional model. In our case study, we would have to forecast normal population change under the no-go alternative and for this we would probably be satisfied with an estimate of migration based on the most recent migration data. To see the direct population implications of the project we would have to estimate the age, sex, and period of arrival of the new residents and enter this systematically into the model. If the birth rates and survival attributes of the new group are significantly different from the existing group, we would want to take this into account. Also, the new, low-income arrivals may have an effect on the rate of out-migration and we would want to estimate this indirect effect.

These cohort survival-type models are a well-developed and powerful set of tools for coping directly with fairly well-understood processes of population dynamics. See Glenn (1977) for a more elaborate description of these models. If the models themselves are not used, then the ideas contained in them should be drawn upon. The weak links will be obtaining detailed and up-to-date population data which pertain to the area of interest and in forecasting future migration. Indeed,

there is a separate body of literature and set of models which address the problem of migration but they are usually not well adapted to small area problems precisely because individual household movement decisions are not well understood.

Regression analysis

The input-output model is entirely deterministic - that is, probability and statistics are not involved. Cohort survival models are slightly probabilistic in that we normally speak of the probabilities of surviving from one cohort to the next. However, for both, the processes are reasonably well understood and set out in theory. For many socio-economic variables, for example, crime rates, number of fires, passive recreation participation rates, for which there is no well developed theory, one way of proceeding is to first develop a simple form of (statistical) empiricism and then use this to forecast future levels. The statistical technique known as regression analysis is ideally suited to the task when suitable data can be found or collected. In fact, suitable "regression equations" for prediction may already be available in the literature or from public agencies (fire and police departments, hospitals). To illustrate the idea of regression we will deal with the case of predicting recreational use of the ravine land adjacent to the proposed development.

We will start with the simplest possible model. It is intuitively clear that the number of people who live within easy walking distance of the ravine will very likely vary directly with the number of people who live within easy walking distance of the ravine; we will use 500 m for convenience. In order to use regression, data are required on two types of variables - the variable to be predicted and the variable which will serve as the predictor. In the present case, the former is the number of ravine users on an average day and the latter is the number of people living within 500 m of the ravine. The next step would be to select a sample of 10 or so ravine sites around the urban area which are similar (in the sense of type of setting and available facilities) to our area of interest. For each sample area, data must then be collected. Data on number of ravine users, U, per day would require a field survey, whereas the population in the area, P, can be estimated by counting houses on a large scale map and multiplying by the average number of people per house (from the census). Standard statistical manipulation will allow the formation of the following linear equation which indicates the number of ravine users per day as a function of the total accessible population.

$$U = a + bP$$

a and b are the intercept and slope of the "regression line" respectively. A "b" value of 0.08 would indicate that for every increase in population by 100, the number of users would increase by 8. Note that in order to develop such an equation one must have enough data to be able reliably to estimate the parameters - the a and b values. In order to predict the presumably larger number of ravine users we would simply have to plug into the equation the new value of P (accessible population) after the project has been built. Regression equations like this are only helpful in prediction if the following three conditions are met. First, there must be a strong relationship between the two variables (here U and P) and this may be easily assessed using statistical theory. Second, it must be argued that the processes at work in structuring the data we collected (say, for last year) will be the same processes at work next year or 5 years hence. (However, if there are temporal trends in passive ravine use, we can restructure the regression equation to deal with these.) Finally, and most obviously, the variable, here P, we are using to predict the U must be much more reliably predicted than the U itself; otherwise we will be no further ahead as the value of P would then have to be predicted in the same way using another variable.

Typically, socio-economic variables cannot be "explained" by relating them to only one other variable. For example, land values cannot be explained with one variable. We must use several variables and multiple regression analysis of the form: $U = a + b_1P + b_2X + b_3Y + b_4Z$, etc., where X,Y and Z are other variables which we believe will help explain and predict U. In the present case, for the number of ravine users, the following additional variables could be considered. The proportion of the accessible population which are children may help, because children may be

heavy users. The average amount of yard space per capita may help because participation rates would tend to increase in areas of apartments and small back-yards. The number of alternative reasonably accessible parks, ravines, etc. (intervening opportunities) would help because use of one location would tend to decrease as the number of alternative locations increases. Note that none of these variables relates to the attributes of the ravine. If we are interested in predicting the effects on users of changing the attributes of the ravine (cycling path, walking trail, etc.) then we should include as predictors, variables which represent these dimensions of the problem. The best predictor variables are those which are directly affected by the project.

Regression analysis is a tool which has been very commonly used in the social sciences. Not only is there a well-developed body of statistical theory under-pinning regression but computer programs for doing all the work are almost universially available. The interested reader is referred to Blalock (1979) for a discussion of the uses and statistical basis of regression analysis, and to the SPSS computer package developed by Nie *et al.* (1975) which represents the most generally available set of computer programs for regression analysis. There are two commonly cited reasons why regression analysis has not been as widely used in impact assessment as it should be. Often it is claimed that insufficient data were available. Most of the time this is simply not true; if assessors expect all data to be provided in suitable form without searching and field work, etc., then there is little sense in doing impact assessments. The excuse for insufficient time, budget and/or expertise is also a common one. All studies have such constraints. The decision not to make a serious attempt to predict an important socio-economic variable should usually be simply taken as evidence that a value judgement has been made to use limited research resources in other ways. A very damaging criticism of any impact assessment is the demonstration that a relatively simple and inexpensive predictive model could have been used. It is especially damaging to implement such a model and to show that its results do not substantiate a guess based on *ad hoc* methods.

The use of analogous situations

All three methods of prediction noted above are formalized quantitative techniques. For a variety of valid reasons (including a genuine lack of data, an inability to measure all the required variables at a high level, etc.) it may not be possible to use these methods of prediction for particular variables. One of the most straightforward ways of proceeding under these conditions is to find and make use of the impacts attributable to a similar project and situation elsewhere. The goal is to find a project which is as similar as possible to the present proposal and which was actually implemented in the recent past. Ideally the time of implementation would be far enough in the past that most of the impacts would have worked themselves out by now, but not so far in the past, or so far removed spatially from the proposed project, that the criticism could be made that what happened then and there has no connection with the present project. For example, for our case problem, we would search for a low income apartment which was constructed say 3 to 5 years before on the edge of a ravine in a middle class residential district. If it is not possible to find a "low income" apartment, we can still get a reasonable idea of many of the expected impacts by studying the impacts of a regular apartment. The ravine site would, however, be less dispensible.

The objective of finding such an analogous situation is first to discover the impacts of that project and second to justify the reasoning that those same impacts are likely to be forthcoming with the proposed project. The theory is simply that the processes at work, including peoples behaviour, etc., do not change dramatically over time or through space - so that what happened before will happen again. Note that in studying the analogous project we are still faced with the problem of determining which changes in socio-economic variables are attributable to the project and which are due to other causes. A good way of doing this is to match the analogous project with a benchmark ravine area which was not developed. Unlike the other prediction methods discussed above, analogy may be used to suggest changes in variables which are not easily measurable at a high level - for example, "neighbourhood cohesion", "neighbourhood aesthetics", etc.

It should be clear that if a good analogy can be found, then a good deal of insight may be gained. However, it is equally clear that basing predictions on analogy, particularly tenuous ones, can be soundly criticized. Nevertheless, it is likely that the credibility of predictions based on good analogies is much higher than the subjective judgements of assessors using *ad hoc* approaches. It is surprising, therefore, how seldom analogies are used in comparison with *ad hoc* approaches.

LOW LEVEL OF MEASUREMENT VARIABLES AND THEIR PREDICTION

Stress has been placed in the discussion above on the prediction of changes in variables which are measurable at a high level and for which it may be reasonable to asign monetary values to evaluate the predicted changes. The variables with these attributes tend to be those which are appropriately called economic or demographic. Many social and cultural variables, if measurable at all, are only measurable at a low level. A way must be found of dealing with these variables.

It is helpful, at the outset, to provide a rough idea of the kinds of "social" impacts that would normally be treated. The different subject matters and perspectives of at least four different social science disciplines should ideally be embraced: sociology; social psychology; anthropology; and political science. Thus, one would expect to see discussion of effects on individuals, families, groups and organizations, neighbourhoods, the community, various institutions, culture and politics. The questions asked should, therefore, range over, but not be restricted to, the following. How will individuals perceive and react to the changes brought about? Will they have an enlarged or a reduced choice of activities, more or less free time? Will they feel more involved in decisions and in the community generally? Will they feel better or worse off? Will the institution of the family be affected and, if so, how? Will the size, composition, objectives and actions of community groups, organizations and clubs be changed and, if so, how? Will some organizations die and others be formed? Will participation in organized religion be influenced? Will there be reduced polarization between opposing interest groups? Will the ethnic character and culture of the community become more, or less, homogeneous? Will neighbourhood or community identity, spirit, and cohesiveness be diluted or reinforced? Will community leadership be affected? Will political institutions be altered? Will political participation be increased? more focussed on fewer issues? more polarized? It is clear that these and similar questions must be both asked and answered from the point of view from those people, groups, and neighbourhoods most affected by the project.

In Table 9-1 we have provided an exemplary list of the classes of socio-economic impacts that are normally examined in the socio-economic chapters of EIA reports and similar planning documents. Many of the questions set out above are not represented. For example, whereas under D and E the issues of sociability, friendliness, privacy, ethnicity, crowdedness and attractiveness of community are addressed, there are no variables representing impacts on community groups and institutions, nor interactions between these and other variables. Indeed, it is very unusual to see any impact assessments deal as they should with the whole range of questions posed above. Of course, in any particular project, especially a fairly small one, it should not be necessary to deal with all these areas. Unfortunately, however, there has been a bias toward including in the study only those variables which are easily measured at a fairly high level; for example, most of the ones included in Table 9-1 are of this type.

It should be noted that, whereas the largest economic and demographic effects tend to be direct ones (for example, directly due to the project, to the people who move in, etc.), the largest and most important social and cultural impacts are more likely to be indirect effects. For example, one of the impacts of the case project noted above may be increased pressure by local service organizations on local politicians to make ravine lands freely available to summer day camps like that of the Society for Crippled Children. Another may be a larger juvenile division in the local police force, at the expense of other important divisions. It also could be remarked that most social effects will be concentrated in a smaller area than most economic costs and benefits, although exceptions may certainly be found.

Predicting most social impacts is more of an art than a science. As has been noted, the problem really boils down to a lack of theory. The task is made a little less problematic if agreement is first reached on a set of *meaningful social indices* of the type listed in Table 9-1. Clear definitions (in the form of proxies or indicators) of what is being predicted saves a great deal of time and anguish. A wide range of prediction methods have been discussed in the literature. (see, for example, Miller 1977; Hausmann 1979). In the following rather superficial overview only four exemplary approaches to the prediction of low level measurement (social) variables will be discussed. Two approaches, regression analysis and the use of analogous situations are dealt with together. In the experience of the present authors, the methods wich have been used most frequently are *ad hoc* non-methods of sheer guesswork analysis. Nothing can be said about these, except that they provide excellent grist for the critics mill.

Regression analysis and the use of analogous situations

The methods of regression and analogy, noted previously, may be used to forecast changes in social variables and are particularly suitable for those cases in which it is possible to use a high level social indicator. However, both methods depend on having data relating to the impacts of other similar projects. Unfortunately, these data are seldom directly available and are very difficult to collect *ex post*.

Expert judgements

One common approach to forecasting in situations of little or no theory, great complexity, and uncertainty is to ask "experts". The first task is to assemble a group of experts who are familiar, or who are made familiar, with the project and the society it is likely to impact. They may include sociologists, social psychologists, anthropologists, political scientists, and others. They are asked to predict certain social effects of the project - be they direct or indirect. If the experts do not agree, then one of two courses of action commonly is pursued. The first is to take the average or median prediction. The second it to try to secure greater agreement (ideally unanimity) by implementing what is called the Delphi method. In this method, the group is shown the average response (and perhaps the range in responses) to the questions at issue and each participant is asked to consider revising his or her predictions in light of what others have predicted. This can be done in a meeting or via a questionnaire. It can involve discussion before revisions are asked for, or no discussion. Experience has demonstrated that on many types of issues and questions, a substantial convergence of opinion (prediction) can be achieved. The final prediction is usually taken as the median view.

Judgements of community members

Other social impact assessment researchers feel that for many social variables - especially those which call for a judgement about how the community feels or will evaluate the change - "community leaders" should be interviewed or asked to participate in a Delphi-type exercise. A single group of community leaders could be used for a wide range of variables or several group leaders could be selected especially for each key variable. They could comprise political leaders, business leaders, union leaders, presidents of organizations and service clubs, directors of political bureaux, leaders of local interest groups and/or simply prominent citizens. One way of selecting these "community leaders" is to conduct a sample survey of local residents (which is often undertaken for other reasons - more below) and simply ask them to list five or so community leaders; the most frequently listed names would then be invited to participate. Research has demonstrated that if community leaders have been judiciously selected, their views about what the impacts will be are a fairly accurate picture of what the average members of the community at large think they will be.

Finally, it may be argued that the best people to ask would be a random sample of community members likely to be impacted. This could be done by questionnaire, telephone interview, or face-to-face interview. This view is difficult to sustain if the variables to be predicted are highly technical or complex ones. A better case can be made for involving the public directly when the variables at issue are highly subjective and intuitive; for example, the effects on community culture, friendliness, and so on. In such cases the public should normally be asked to both predict and evaluate the effects.

9.4 EVALUATION OF SOCIO-ECONOMIC VARIABLES

In environmental impact assessment, many of the variables of interest are not value-laden *a priori*. For example, we may *predict* that the long run population change will be am increase of 1,000 residents, or a loss of 1,000 seagulls. The social *evaluation* of these changes may range from highly desirable to disastrous, depending on who is asked. When social variables are at issue it is very often difficult to distinguish between prediction and evaluation. This is partly due to intrinsic properties of such variables but also partly because of the way the variables are labelled. For example, friendliness, attractiveness, neighbourhood cohesion are clearly such that all reasonable people would evaluate a positive change in these as desirable changes. To some extent, then, prediction of the effects of the project on such variables is an evaluation.

However, it is always wise to bear in mind that the real objective of most EIA's is to *predict the community's evaluation* of predicted effects. Thus, for example, we want to know not only that, say, 60% of the community think that community "attractiveness" or "cohesion" will be adversely affected, but also whether society (the community) thinks these are critical, important or unimportant changes. Two approaches to evaluation will be reviewed here. The first, cost-benefit analysis, henceforth CBA, copes with the issue of value, or relative importance, by reducing all variables to a common unit of value - dollars. Most people think that it is infeasible and/or unwise to reduce all social-type impacts to this unit of value. This criticism has provided a major stimulus for the development of social impact assessment, henceforth SIA, the second approach that will be reviewed here. In cases where this approach is used and evaluation is required (and it usually is), the SIA analyst is put in the unenviable position of having to discover the appropriate "weights" to attach to the different dimensions of the social realm - a task normally considered to be reserved for duly elected politicians.

COST-BENEFIT ANALYSIS

By far the most common approach to evaluating the socio-economic impacts of proposed projects has been cost-benefit analysis. This is the only approach that is based on a well-articulated theory - in particular, the welfare economic theory. A description of the key features, and problems of CBA is a direct way of getting at some of the essential components of a good evaluation of socio-economic impacts. Although conceptually very simple, CBA is a very powerful and sophisticated tool with many tricks and subtleties to lead the unwary astray. Only a few of these will be discussed here. The interested reader will find a number of helpful references at the end of the chapter - especially the manual put out by the Canadian Treausry Board in 1976. It should also be noted at the outset that CBA has come under considerable attack in recent years for a variety of good, and misguided, reasons. One valid criticism is the inability of the approach to deal effectively with variables which are not measurable at a high level and easily expressed in monetary units. Whereas most "economic variables" have tended to be fairly easily measured and monetarized, most "social variables" are not. The CBA's then tend to deal with these latter variables in a non-systematic or contentious manner, or to omit them entirely. Thus, the present discussion will lead quite nicely into a discussion of ways that social variables can be integrated or treated differently.

The conceptual framework

In making investment decisions, for example a new plant, private firms estimate the construction costs and operating costs and then forecast the revenues (benefits) they will derive from selling the product. Because one dollar in costs or revenues in the future is considered to be worth less than one dollar today, all future costs and revenues are "discounted" at the prevailing interest rate, to "present value" terms. (This process of discounting is the exact converse of computing the future value of a dollar invested today using the formula for compound interest.) Future costs and benefits are discounted so they are in commensurate units (present dollars) in order that they may be compared. In particular, the firm would seek that investment which maximizes its net worth. Note that in considering costs and benefits, the firm would only consider those costs and benefits which pertain to it directly. For example, it would not include the costs imposed on others by smoke from its chimneys, or the secondary impacts on the community of increased employment.

Cost-benefit analysis is based on the same principle of comparing the present values of costs and benefits. The difference is that *all costs and benefits to society as a whole now and in the future should be included and handled in the same way*. Normally with projects, most of the costs are incurred early in the project, whereas most of the benefits are spread over many years. Also, the major direct costs are relatively easily expressed in dollar terms whereas the dollar value of many benefits must be estimated indirectly. Economic theory is used to impute the values of costs and benefits which are not directly available in dollar terms. For example, the benefits derived by walkers and cyclists in the "no-go" alternative, in the exemplary problem outlined earlier, would have to be estimated from some inferences drawn about their "willingness to pay" for their recreational use of the land. Some imputations are often very tricky and are, of necessity, based on simplifying assumptions which may be quite unrealistic.

It should be stressed that CBA is an *evaluation method* based on reducing effects to a common unit - current dollars. The method does not address the issue of how to forecast the effects or the changes in key variables in the first place. (Indeed, all environmental impacts assessment "methods" are evaluation methods; none of them address the problem of prediction.) The approaches to prediction which are commonly relied upon were reviewed earlier in this chapter, and these must be used to forecast the effects or changes in key variables. The CBA has been criticized because it uses dollars to measure all costs and benefits. On the other hand, this can be viewed as a forte. If the goal is to arrive at some fairly objective bottom line summary figure on which to base action, *some common unit of value must be used*. Standard loaves of bread, human lives, ergs of energy, or some other invariant unit could be used. However, dollars are much more commonly used and understood. There is also a well-developed body of theory in economics on which we can draw in assigning dollar values to a wide variety of variables, including many which might be considered to be more social than economic.

The selection of variables and assigning of monetary values

The rule used to select the variables to be included in the study is very simple: include all variables which are affected by the project or alternatives. In practice, the number of variables to be examined is reduced substantially by considering only those for which there will be a "significant change" and only those affected differentially by the alternatives under study. Because it is not feasible to predict the change in every conceivable variable in order to discover those which had a significant change, the wisdom of the assessors is applied in creating a "short list". The adjective "significant" should be taken in the sense of social significance. It is possible that a large change in a variable might have little social significance. For example, in our sample problem, the number of people using the local buses may increase dramatically - but this is not very significant if the bus system has considerable excess capacity. On the other hand, a small change in a variable might have great social significance. For example, among the trees to be cut down (a small percentage of the total forest), there may be several 300 year-old oaks and mature walnut trees which have been local landmarks for years.

Any thoughtful reader of most CBA's and impact assessments should be able to find key variables that have been left out of the study.

The simplest variables to value are goods and services provided through competitive market processes. The value is deemed to be equal to the price and total value is price times quantity sold. This is only really valid when the change in supply is relatively small (marginal) and there is no element of monopoly or externalities. If either of the latter is present, one should modify the market prices. If there is a significant change in supply, the notion of "consumer surplus" should be used to assign values. The logic of this concept is quite simple. The surplus associated with each unit of a good or service is the difference between the price that is in fact paid and the price that a person would be willing to pay (which is typically greater than the price actually paid). In order to do this, one needs to estimate individual "demand curves". For many goods and services, especially those not provided through market process, this is often a difficult task.

Those costs and benefits related to the project which are not directly tied to market processes must be "imputed". Benefits are monetized by trying to answer the question - what would the beneficiaries be willing to pay (if it were possible to charge them)? For example, in our hypothetical case study, it would be necessary to monetarize the benefits of those using the land parcel for passive recreation. Usually, this estimation is carried out by examining the accessible alternatives available for each activity (e.g. cycling in the woods) and trying to determine the additional costs that individuals would bear to use these alternatives. This additional cost is often imputed to be the extra time to get there (valued at the hourly wage rate). It is clear that many assumptions must be made in order to proceed. Often values are determined by examining the prices that similar goods and services sell for in the market place. For example, in valuing the benefits to the crippled children's camp, from free use of the site, one approach would be to use the rent paid by similar camps in other portions of the ravine system (perhaps even in another city). The value of the housing to the low income families should be valued at more than the subsidized rent levels; rather we would use the market price (rent) of similar-sized units in the area. Prices which are used to estimate the true value of certain goods and services are generally called "shadow prices". There are some very powerful methods for estimating these shadow prices but they require considerable data and analytical expertise to operationalize.

Although the proponent of the project clearly incurs more of the cost, there are often many "external costs" borne by members of the community which must be estimated. The costs of increased vandalism in the community (if any) could be valued at the repair and replacement costs of property vandalized. However, the social cost of the loss of the mature oak and walnut trees would be much more difficult and would have to be based on the value placed on similar trees elsewhere in the city or on an estimate of the community's willingness to pay for the right to have these trees preserved.

The estimation of the monetary values is one of the trickiest parts of a CBA. Usually a careful reading of a CBA will reveal a number of rather peculiar and far-fetched assumptions or procedures. One of the most common flaws of hastily prepared CBA's is the double counting of costs or benefits; this can severely distort the results. For example, let us assume that we have been able to estimate the costs due to increased vandalism and crime in the neighbourhood and the social costs of loss of forest and the reduction in land values around the project. It would not be legitimate to simply add these up as components of total costs. This is because land values are predicted to fall in part *because* of these other increased social costs. Social costs and benefits are capitalized into land values - but seldom perfectly. Land value change should either be omitted from consideration or else a case should be made that land value change alone gives a good indication of net social benefit. Another common fault is including costs or benefits which are costs to one group and benefits to another. For example, it is common to see it argued that increased sales by local retailers are a benefit of the project. However, if the families have moved here from downtown, presumably the merchants there lost the business gained here. It is clear that if the impact area is defined to be very small that distortions of this kind will be much more common. It should be remarked that defining the impact area as a very small area is an error which tends to increase the benefits artificially of all land development projects.

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The discount rate and decision rules

It has been noted that, for most projects, the stream of benefits continues much longer than the bulk of the costs. This means that if future costs and benefits are discounted at a very high discount rate, this will significantly reduce the present value of benefits vis-à-vis costs. On the other hand, if a low rate is used, the present value of benefits will be substantially increased. The choice of the discount rate is, therefore, very important. Related to the issue of discount rate is the "life of the project" which is typically set between 20 and 40 years. No costs or benefits beyond this are considered. Small variations in project life are irrelevant if a high rate of discount is used, because the value of a dollar 20 years from now would be practically zero.

There are a number of conflicting schools of thought regarding the appropriate discount rate for public projects; two will be noted. Low interest rates are often justified by using the rate of interest on ostensibly "risk free" long-term government securities. It is argued that this interest rate should be low because society, via government, is more concerned about the more distant future than are individuals or firms. Higher interest rates are justified by arguing that if the money was not used by government, it could be invested by private firms at the prevailing market interest rate. Thus, the "social opportunity cost" rate is taken as equal to the private rate. Wise analysts undertake computations with several different rates to see how the conclusions of the CBA may change. If this has not been done, the conclusion of a report can be made to appear very suspect by demonstrating that a small change in the interest rate changes present values dramatically and alters the ultimate conclusion.

Assume now that we have been able to work out the present value of costs and benefits for each of the alternatives: which is the best alternative? This simple question is not as easily answered as one might think. Clearly any alternative which has benefits greater than costs is socially desirable in net. Why not simply recommend the alternative which has the largest net benefit? That an alternative with smaller net benefit may be a superior project (more socially profitable) can be simply illustrated. In our case study, the costs and benefits of the proposed project may both be in the range of a hundred million dollars, so the difference between them - the net benefit - may be $5 million dollars. On the other hand, the costs and benefits of leaving the land as it is may both be rather small in comparison so the net benefit may be only $1 million dollars. However, the *rate of return* on investment (actual outlay) may be substantially higher in the second case - making it the more cost-effective alternative. The appropriate rule, in most cases, is to select that alternative which has the largest benefit-cost ratio. However, even this ostensibly objective rule can be compromised by analysts who have a vested interest in a particular conclusion. It is easy to demonstrate that the rank ordering of B-C ratios can be altered by appropriate redefinition of components. If the analyst likes the project, then treating a number of key costs as "disbenefits" (substraction from benefits) will usually succeed in markedly increasing the B-C ratio. Reports should be carefully scrutinized for evidence of such "fiddling".

Risk, sensitivity and equity

Among the difficult variables to deal with in any formal analysis are those which represent increased or reduced risks to society or individuals, and one should seek to uncover the strong value judgements which have been made. In our example, the proposed project may increase the risk of flooding in the ravine. In order to estimate the value of damages one must estimate the increased number and severity of floods. Past statistics, expert opinion and use of analogous situations elsewhere are typically used. However, in order to place a value on the risk, an assumption must be made about the population's degree of risk aversion. If people are highly risk averse, a strong case can be made for valuing the expected damages at more than the cost of repairing and replacing damaged property, etc.

The problem of uncertainty associated with forecasts of effects is much more pervasive than that of risk. Analysists can never be too confident about the predictions of future floods, future vandalism, future gas prices, future trip making

behaviour, etc. Such predictions should be based on common sense approaches. However, one should be very skeptical of predictions, not based on strong theory, for which no attempt has been made to indicate the degree of uncertainty or the range in possible future values. Sensitivity analysis is a name given to the process of systematic exploration of the sensitivity of conclusions to changed assumptions or values of predicted variables. Sensitivity analysis is particularly important when "guesstimates" must be made about the values of variables which are likely to be strongly affected by an alternative. The analysts owe it to the readers and decision-makers to indicate how the conclusions (the total costs and benefits) are altered if alternative plausible values are given to key variables.

Cost-benefit analysis is based on the assumption that the best alternative is the one which has the greatest social return on investment. It is fundamentally concerned with efficiency, i.e. the size of the pie which is to be divided among members of society. It is not particularly concerned with which particular individuals or groups in society win or lose. However, as was noted near the outset, it is impossible to reach any conclusion about what is good for society without using some (strong) value judgement about equity - that is, how the welfare of certain groups should be "traded-off". Almost all CBA's proceed on the (usually implicit) assumption that a dollar's worth of cost or benefit is worth one dollar, no matter who is affected. Individuals are thus weighted equally. (Some weights must be assessed in order to be able to add up the costs and the benefits.) It should be noted that equal weights are *not required* of the analysis; it is just the simplest and most common way of proceeding and tends to give the impression of being relatively "value-free". In fact, there is a built-in status quo bias in CBA which favours the existing distribution of real income and power in society. This "equal weight assumption" also has a tendency to favour urban development *versus* no-go alternatives. Although it is widely believed in our society (but cannot be proven) that the value placed on a dollar by the poor is more than that by the rich, most CBA's do not consider this belief. According to the conventional CBA calculus, a project which benefits the rich by $2 million dollars and costs the poor $1 million dollars may be the most cost-effective alternative. One way around this conclusion, which would be perverse to most people, would be to provide different weights for the rich and the poor. This has very rarely been done because the analyst would then be faced directly with the problem of providing the weights. It is so much easier simply to assume the weights are all equal.

The lack of concern for equity in formal CBA calculations is a principal reason why no one has ever recommended that CBA results be the only input into a public decision. With the criticism of the CBA in recent years, and the knowledge that principal winning and losing groups are usually not the same, it is now almost universally recommended that CBA documents have an obligation to point out exactly who (which individuals and socially relevant groups) pays - and how much - and who benefits and how much. The problems involved in pointing out the implications of alternatives for the (re)distribution of income are, in context, no larger than the other problems of estimation and evaluation which must be solved. It is rather easy to discredit, at least partially, a CBA which has not included such a discussion by arguing that the reason why it was omitted was that it would cast important doubts on the main conclusion of the CBA.

The discussion of CBA has, of necessity, been rather superficial and has sought to clarify some of the principles and problems involved. Although the theory underlying the method is the best that social science has to offer, there are many unresolved theoretical issues (e.g. the discount rate) and even more practical problems of obtaining data, forecasting the future, imputing monetary values, etc. The conclusion is that *any CBA* may be intelligently criticized on many grounds and that any criticism of a CBA may also be criticized. Any group which wishes to review a CBA should convene a committee of members who have studied economics, or else retain an economist.

SOCIAL IMPACT ASSESSMENT

The literature which calls itself social impact assessment goes back only less than a decade although, being essentially applied social science, its roots can be traced back much farther. Useful overviews of the relatively small literature are provided in the volume edited by Finsterbusch and Wolf (1977). Christensen (1976) provides a useful short discussion. The beliefs which seem common to this literature are remarkably few. There is a shared conception of the problem that SIA addresses; namely, to select the key social dimensions or social variables likely to be affected by a project, to predict how the project will change the baseline attributes, and to provide a social evaluation of these changes. It is thus the same problem addressed by EIA except over a range of variables considered to be social ones. There is also agreement that social impacts are likely to be very important ones, and there is little or no good theory upon which to draw for selection, prediction, or evaluation, and that all three phases will be exceedingly difficult. (Because of the dearth of theory, it is unlikely that this picture will improve significantly in the foreseeable future.) Nevertheless, there is also general agreement that a sincere attempt to deal with social impacts and to take them into account in decision-making is better than simply leaving them out on the grounds that nothing rigorous or general can be said. The dilemma is obvious.

Major viewpoints

The approaches to SIA advocated or used in the literature can be divided into two camps based on their views of how evaluation should be treated and than again into two camps based on their views of the desirability of "measurement".

The first view is that the assessment process is obliged to "evaluate" change. Proponents of this view argue that it is not really possible to remain objective in the sense of being value free and, usually, that this would not be desirable even if possible. This camp can usually be partitioned into those who would like to see evaluation reduced to a process of adding up changes, measured in commensurate units; and those who believe that, because adding up is so troublesome, it is sufficient to evaluate dimensions or variables separately. The former group would essentially like to see an attempt made to treat social variables as economic ones and to see cost-benefit analysis as the integrating framework. They argue that imputing prices and values, or some other common unit to such things as community spirit and an aesthetically pleasing environment makes overall evaluation much easier and is, in fact, no more problematic than creating *any meaningful index* which purports to evaluate. The latter group, while agreeing that measurement is generally desirable, would argue that if the assessment is able to provide indices of evaluation for each key variable separately, then political decision-makers should be left with the task of trading these off and effectively adding them up.

The second major view is that the evaluation process should be left to decision-makers because the assessor's task of predicting significant change is difficult enough without having to guess at the values and weights of society. It should be noted at once that this view is often at odds with the real terms of reference of EIA and SIA which requires "evaluation". Again, it is useful to divide this view into two camps. The first would argue that every attempt should be made to measure every variable at the highest possible level and to provide quantitative predictions. The second would argue that because there are a number of variables which cannot be measured, and because the process of measurement itself tends both to distort the true story and context of the problem and to give a false sense of security and accuracy, measurement is not desirable. This latter group then believe that the best picture that can be set before decision-makers is a narrative and qualitative one based largely on intuitive and unavoidably subjective reasoning. Little can be said in general about the way research should proceed with this latter view except that it should involve trained social observers who have become thoroughly familiar with the project and the society it is expected to affect.

The use of social indicators

Some researchers in all but the latter camp often have developed and used social indicators of various kinds in the process of conducting a SIA. The present authors believe that, although such indicators do have their disadvantages, they represent about the best device available for dealing with many social and related impacts. In our view, first clearly defining and then measuring as many social impacts as possible at a high level, even if it means selecting a few proxy or surrogate variables, is a distinct advantage. At least it is clear what precisely is being predicted and evaluated. We would not claim, however, that all social effects can be dealt with meaningfully in this way. In the remainder of this section we will discuss social indicators as useful indices.

Social indicators have a fairly large literature of their own and are usually considered to be part of the attempt in the last 15 years to construct quality of life indices. These latter have been proposed as replacements for GNP (gross national product) as a measure of social welfare or the human condition, and are argued to be a more broadly based single index. Such an index (or indices) could be used to compare countries or regions, or the same nation or region over time (for example, before and after a project or major policy change).

An idea of common types of social (and economic) indicators is provided in the second column of Table 9-1. This table is part of one given in Schaenman and Muller (1974), a report on a method of impact assessment for urban land development. Several other reports in the same series, by Muller (1975) and Christensen (1976) provide more detailed advice on how to handle specific types of social and economic indicators. The summary report of this series, Schaenman (1976) is an excellent overview. In addition, a rather complete list of social indicators is provided by Olsen and Merwin (1977). It is sufficient for present purposes to give a few examples of social indicators.

Health care

The impacts on the physical health of the community are often divided into two groups - those pertaining to the incidence of illness and death due to various diseases, and those pertaining to accessibility to health care. The former can normally be measured at a high level (as rates) whereas the latter usually cannot be. Two indicators of the latter are shown in Table 9-1 under C2. Physical access is often measured by the percentage of the population which is beyond a certain travel time or distance from the nearest hospital. (Note the same reasoning is used for schools, fire stations, and the like.) The reasoning is that social welfare is reduced as this percentage increases. The second indicator is the waiting time for hospital admittance for elective surgery. If the facilities are overburdened (congested), then elective surgery is the first to be deferred and the length of the queue grows. There is no pretence that these two indicators are the only two aspects of hospital access that people care about. Rather it is reasoned that these are particularly important, and likely to be *representative of a host of other measures which could be used.* Other obvious indices are average distance or travel time to nearest hospital, average waiting time for emergency treatment, and number of ambulances per capita.

Recreation

The impacts on recreational opportunities and their quality are often among the most important ones for urban projects requiring impact assessments or planning permission. The most common indicators used are those shown under C5 in Table 9-1. The first measures the overall level of satisfaction with public recreation opportunities. The second is a set of indices which attempt to measure the number of users or use occasions and the quality of the experience. For example, crowdedness is usually an important determinant of quality. Schools can be similarly treated, as can be seen under C6. The third, like the hospital care above, is the percentage of people who are within a certain travel time or distance from their closest facility.

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Transportation

Most projects affect local transportation directly or indirectly. Included in transportation would be private vehicular transportation, public transportation, pedestrians, cyclists, etc. A number of useful indicators are listed under C7 in Table 9-1. The best single index is the average travel time or cost in going between selected common origins and destinations. For example, a new bridge would tend to decrease this index, whereas a new apartment - generating additional traffic - will tend to increase this index. In addition, access to public transportation (e.g. bus stops) and accident rates are usually considered to be very important.

Some others

Several indicators for crowdedness, sociability and friendliness are listed in Table 9-1 under D4 and D5. It is clear that these attributes of a neighbourhood or comminity are even harder to measure at a high level than those noted above. Two of the three indices use a very common way of dealing with perceptions of the neighbourhood. The goal is to assess the change in the percentage of the community which perceives the neighbourhood as "too crowded" or "very friendly". This can be determined through a survey. Note that a high level of measurement has been achieved. It is also very important to note that what is important here is not a measure of crowdedness or friendliness, but rather a measure of the *perceptions* of the changes which will take place in these.

Aesthetics

The indicators listed in Table 9-1 under E1 abd E2 for aesthetics and cultural values also rely on this approach. However, this may be one attribute which it may be impossible to measure at a high level even in proxy form. A major problem with attractiveness and view opportunities is to determine what exactly is being evaluated. The context of interaction between man and milieu depends on many highly variable factors, such as the viewer's purpose, familiarity, mood and circumstance; the weather, light, time of day and season; whether the views are taken from on foot or in a vehicle, and whether they are deliberately chosen or accidentally come upon. Even if these unknowns are resolved by the analyst, he or she must then resolve another fundamental problem - how should landscape be evaluated? The need to address this question arises from the presence of variability whenever human values are involved. Replicating the average value and using this for evaluation and decision-making in this instance will systematically reduce the variety of landscapes present in the environment. It is obvious that such an approach serves few people (including the "popular" majority) particularly well, and that what are needed are evaluations (and decisions) which are sensitive to the variety of interests and values present in society.

Values, social evaluation and decision-making

Many social impact assessments very cleverly try to avoid the issue of evaluation by attempting to present a dispassionate view of change. Most, in fact, end up evaluating change without ever facing up to the problem of whose values are being used (or should be used) and why. Very profound criticism can be levelled at such assessments - first by pointing out that the value basis is not stated and second by suggesting or demonstrating that, in some sense, the wrong values were used.

The answer to the question of whose values should be used is, in our view, rather subtle and two-pronged. First, assessors should evaluate the predicted change in the variables (good, bad, how much so) from the point of view of the society directly affected - usually the community or neighbourhood. Secondly, an attempt should be made to *evaluate the evaluations* of those in the neighbourhood *from the point of view of a broader society* - say the metropolitan area, the province, or even the country. The differences can be illustrated with respect to our exemplary project. It is very likely that the evaluation of the social effects of the low income apartment project by the directly affected local community will be

negative and perhaps quite strongly so. Nevertheless, it still may be that, in net, the project is socially desirable because of the positive social and other effects to a broader society which, for example, may place greater value on housing the poor than the social disruptions the poor may stimulate in this small middle class area. Dealing with this second level, broader societal evaluation is precisely the same problem as deciding on weights to place on individuals (or groups) in cost-benefit analysis, except that it is even more difficult because the things which require weighting are often poorly defined and not even measured. Perhaps the best thing which can be said about the evaluation process is that a good job should be done on the question of how the affected community evaluates the change and decision-makers should be left with the task of placing these in broader perspective.

The community's evaluation of change may be estimated in a number of ways. The same reasoning applies here as was used in the discussion of prediction earlier. First, experts can be asked to predict people's evaluation of change. The case can be made, however, that whereas experts have special training which allows them to predict effect, they have no special attributes allowing them to deal with social evaluation in its deep sense. This may not be true of certain social psychological effects. One of the most expedient ways of dealing with evaluation is to ask community leaders. It could be argued that, in principle, community leaders are particularly well situated to be able to provide representative evaluations on behalf of the community. The task would then boil down to presenting a balanced picture of the different evaluations likely to be provided by different interest group leaders. For example, the president of the local "neighbourhood preservation association" and the president of the local business organization (largely shop-keepers) will likely have different views of the case project noted above. One way of dealing with divergent evaluations is to report the numbers of persons likely to share positive and negative evaluations - preferably by strength of preference.

Public participation and sample surveys

One of the most common methods for dealing with evaluation is the direct involvement of the public. This may be done by open meetings, through some form of written questionnaire, telephone survey, personal interview, or some combination of these. A great deal has been written about suitable public participation processes because it now seems to be generally believed that the public should be directly involved in one form or another. Very little will be said about the various issues involved here.

While meetings may be appropriate for finding out the issues of most interest to community groups early in the study, they are not well suited for accurately determining either the range in preferences or evaluations, or their relative strength. Surveys of representative citizens are much better suited to the evaluation task. Ideally, the sample should be taken in such a way that every view is represented and undue weight is not given to any particular group. The best sampling strategy under these conditions is a stratified sample. This is a sample in which key groups, likely to hold different views, are identified and a particular quota of individuals or households in each group is then surveyed. The basis for selection within each stratum or group should have a strong element of randomness in order to avoid bias. While aspatial sampling designs are often suitable, the best approach in most situations would be to select spatially defined regions as the strata. Because the impact of most projects is expected to vary with distance from the project, the best spatial strata in most cases are, in fact, roughly concentric zones centred on the project site. As a good rule of thumb, which incidentally makes subsequent generalization easier, it is best if the number of persons/households sampled within each stratum (zone) is roughly proportional to the number of people in the stratum. For an excellent discussion of geographic sampling methods, the interested reader is referred to Dixon and Leach (1977a).

Questionnaire and/or interview design is a very important factor underpinning the accuracy of the results. In addition, qualifications must be commonly placed on results because people do not always say what they believe and because people in such cases are inclined to overstate their preferences or values to affect the conclusion.

An examination of many questionnaires used in impact assessments will reveal that many questions have been asked in the wrong way or in the wrong order and some are phrased in such a way as to suggest that there is a right answer. (e.g. "Most citizens believe that the project is aesthetically pleasing, do you agree?") Because social impact assessments often rely heavily on the results of surveys, a critic's time is very well rewarded by careful scrutiny of the questions asked, their order, the instructions given, and so on. Dixon and Leach (1977b) provide an excellent introduction to questionnaires and interviews.

If the purpose of the questionnaire is to obtain both predictions and evaluations this should be made clear in the questionnaire. Questions relating to predictions should be asked before those relating to evaluation; often side by side in a table format is the best. If the purpose is to obtain evaluations alone, it is important that some idea of the *predicted effects* be provided first. For example, people should be told that "experts" (police officials/sociologists) expect that the rate of vandalism will increase by 20% to five incidents per week on average, before citizens are asked to evaluate the effects. In fact, this is not done in many cases so that it is difficult to know what the responses mean. There are a number of ways of obtaining evaluations in questionnaires and interviews. Asking people to describe their evaluation in their own words is not very helpful as there is then the problem of summarizing the results. The simplest, and perhaps the best way, is to provide a set of rank ordered boxes, as below, and ask people to check one.

very bad	bad	no strong feelings	good	very good
☐	☐	☐	☐	☐

Five and seven point scales seem to be the best. Alternatively, people could be asked to place a mark anywhere on a line representing a continuum between, say zero to ten. In the former case, results can be summarized by reporting the frequencies of different responses. In the latter case, the actual mean or median position on the line can be reported, but it should not be treated as a high level measurement in any subsequent analysis.

Whether or not an attempt should be made to provide a synthesis of the results of any exercise designed to elicit evaluations or weights depends on what is required. Most researchers would prefer not to attempt to add up the evaluations of different effects. When such an adding up process has been undertaken, it can always be criticized in some way.

9.5 CONCLUSIONS

The socio-economic subsystem of the environment is one which is affected by all kinds of projects. It is clear that socio-economic processes are among the most complex and least understood of all those to be considered prior to the allocation of resources by society. There is simply very little good theory. Exacerbating this fundamental dificiency is that the socio-economic subsystem will certainly be the one with the largest proportion of relevant variables which are not measurable at a high level. Indeed, for many of the relevant variables, such as aesthetics, it is not meaningful to "measure" them at all.

Nevertheless, planners and impact assessors are obliged to consider the direct and indirect impacts of proposal developments on society and the economy since the welfare of people in society is the raison d'être for all forms of planning. We have sought in this chapter to describe what theory and high level measures are available for this task. We have also stressed that any planning document or impact assessment must deal with establishing a baseline body of data, predicting how the important baseline variables will be changed for each alternative, and finally evaluating the significance of these changes from the point of view of social welfare. For the socio-economic dimension of the assessment problem, it is particularly critical to distinguish between the prediction and evaluation steps. Many analyses appear to side-step the fundamental problem of *social evaluation*; we have strongly argued that this is simply not possible.

Consequently, the task of socio-economic assessment is really almost an impossible one; there is no such thing as a perfect set of social values and, therefore, no possibility that perfect or "correct" assessments can be carried out. It follows, therefore, that much more attention must be given to providing decision-makers with high quality (measured) data bases and prediction. Even in the case of assessments that are well done, the critic's job is probably the easiest of all.

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