

ORIENTATION AND RESEARCH METHODS
- A Book of Readings

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19 TECHNIQUES FOR MEASURING THE BENEFITS OF POLICY-ORIENTED SOCIAL SCIENCE RESEARCH

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INTRODUCTION

Research is a search for knowledge for the solution of specific problems. Nnamdi Asika (1991:2) defines it as any organised enquiry that aims at solving identified problems. Briefly, research is a systematic enquiry into a subject in order to create new knowledge, facts and theories or revise existing ones. Research is often carried out in different fields of study—natural and applied sciences, engineering sciences, behavioural and social sciences, medical sciences etc. But, whatever the discipline, research is knowledge building and it takes a scientific approach especially when it follows the steps of scientific enquiry involving the identification, definition, delimitation and analysis of identified problems. It involves deductions, and recommendations based on the analysis of the problem (Asika, 1991:2). Thus, in the social sciences and other disciplines, research is seen as an organized enquiry aimed at providing information for the solution of identified problems.

The social sciences are believed to have had their origins in moral and political philosophy characterized with speculative ideology and to have attained their present state as empirically grounded observational and experimental sciences. They have not only tended to lose some of these speculative features but have added some costs associated with systematic collection of data

(Riecken, 1972:486). In this respect, the social sciences have come to share some of the financial problems which the natural and applied sciences face in the process of scientific enquiry. But unlike the physical and biological sciences, social sciences do not require the use of extensive and expensive equipment. Rather, as Riecken (1972) observes, the cost of social science research consists primarily of payments for skilled (and often professional) labour of interviewers, observers, experimenters, coders, data analysts and those who develop questionnaires and perform various kinds of tests. The introduction of high-speed electronic computers into the social science research process in modern times and the professional and technical manpower costs associated with their use have also raised the costs of social science research.

In this essay, we define social sciences to include anthropology, economics, geography, political science and sociology. This definition is based on the notion that these disciplines deal with the social world with the relation between people in the societies in which they live. Social science research is concerned with the discovery of laws and principles which can improve the people's welfare. Since research is a quest for information, the purpose of a social science research depends on how the information sought is to be used. Sometimes, the purpose may be to seek solution to a specific problem or it may be to add to man's stores of knowledge. Margaret Early (1977:182) has argued that the search for information may take the researcher to libraries "to find out what is already known and perhaps forgotten." More importantly, however, social science research is an important guide for the determination of social policy.

The concept, "policy", has many connotations. Here we define it as "a purposeful course of action chosen from a variety of alternatives for the purpose of guiding and determining both present and future decisions, definite course of action selected from among alternatives, and in light of given conditions to guide and determine the present and future decisions." As a plan of action, policy is indispensable in the decision-making process and the major tool for policy determination is research. The theoretical and historical foundations of empirical research date back to the days of Francis Bacon in the 1600s. In about 1820, the philosophical foundation of

research was developed by Hegel whose thesis of "Historical Determination" constituted the basis for:

- (i) the Marxist anti-capitalist philosophy; and
- (ii) the German school of thought which laid the foundation for institutionalism.

The latter school was led by Gustav Schmoller and Adolph Wagner. This school saw no usefulness in economics as it then existed. Rather, they suggested the accumulation of historical data as the basis for determining the cause-effect relations among social phenomena. As Chryst and Back (1966:10) pointed out, from the beginning, the main interest was to contribute to the evolution of social policy. From this standpoint, in their view, "the orientation was normative, social in a broad sense (encompassing what we now class as social sciences), and empirical."

Empiricism, as a philosophy and method of science, has the basic tenets that:

- (i) knowledge begins with one's sense impressions which involves perception of fact; and
- (ii) scientific enquiry then proceeds through (a) classification of facts, (b) induction to "middle axioms", and (c) induction of laws (Chryst and Back, 1966:10).

One logic which underpins research as a decision-making process is that good methods can teach researchers "to develop and use to their better purpose the faculties with which nature has endowed" them, while poor methods can prevent them from turning those endowments into good account. According to this logic, "a genius of inventiveness, so precious to the sciences, may be diminished or even smothered by a poor method, while a good method can increase and develop it" (Bernard, 1927). From the theoretical point of view, research, as a decision-making process, enables scientists to raise questions and decide upon the answers. The techniques employed here are tools in the process of answering the questions (rather than raising issues) and these tools must "be selected on the basis of what, philosophically, constitutes acceptable answers" (Gibson, Jr. et al, 1966:x).

The analysis that follow looks at research as a necessary tool for policy decisions. The remaining sections of the paper are consecutively arranged as follows: review of related studies, link

between Research and Social Science policy, historical evidence of the benefits of policy-oriented social science research, relevance of social science research in policy formulation, techniques for measuring the benefits of policy-oriented social science research, analysis of techniques for policy decisions and recommendations and conclusion.

2.0 REVIEW OF RELATED STUDIES

Research is a form of investment, and right from the classical era, it was generally assumed that people "make investments because they expect to earn profits on them" (Higgins, 1959:91). High profits were believed to attract large amounts of investment resources. Summers (1991:8) has added that investing in public goods and getting the highest returns possible for the investment is the most traditional role of government. According to Summers, the World Bank was created to assist governments make necessary and appropriate infrastructure investment.

Scholars have developed different techniques for measuring returns to investment. One of such tools is the benefit-cost data as "benefits minus costs, benefits divided by costs, and benefits divided by investments." But he points out that choosing among the three from the same basic data can lead to a different ranking among alternatives. He also argues that if the information collected for a benefit-cost analysis is meaningful, the same information may be used in a criterion function by means of which (i) the decision variables relating to a specific project may be optimized through programming analysis, and (ii) a limited development budget may be allocated among alternative projects around the nation.

In the same vein, Prest and Turvey (1974:145) see benefit-cost analysis as a practical way of assessing the desirability of projects where it is important to take a long view (in the sense of looking at the effects in the near and distant future) and a wide view (by allowing for side effects of many kinds on many persons, institutions, regions, etc.). In other words, benefit-cost analysis implies the enumeration and evaluation of all relevant costs and benefits. According to them, this involves drawing on a variety of traditional areas of economics (welfare economics, public finance, resource economics, etc.) and trying to weld these components into a

coherent whole. Prest and Turvey gave some justifications for the growth of interest in benefit-cost analysis. One reason is that it is a "technique which is explicitly concerned with the wide consequences of investment decisions." Another reason has been the growth of large investment projects which have absorbed large amounts of resources with repercussions over long periods of time. But they hasten to point out two main limitations of the technique. In the first place, benefit-cost analysis is only a technique for taking decisions within a framework which has to be decided upon in advance and which involves a wide range of considerations many of which are of political or social character. Their second concern is that the technique is least relevant and serviceable for large-size investment decisions. They caution that the technique can be used appropriately or inappropriately.

Other scholars who have dealt at length with benefit-cost analysis include Howe (1971), Kalter and Stevens (1971), Current, Lutz Scherr (1995) and Lutz, Pagiola and Reiche (1994). The study by Lutz, Pagiola and Reiche (1994) for example, uses the benefit-cost analysis to investigate the nature and severity of the soil degradation problem and to assess the cost-effectiveness of proposed solutions. This study examines the problem of soil degradation and conservation from the perspective of the society as a whole and from that of the individual farmers. From the society's standpoint, all costs and benefits of a given activity must be considered, including "the true opportunity cost of the resources used in and obtained from policy interventions or market failures. But from the farmers' point of view, only the costs and benefits that actually accrue to them from their decisions on the use of their resources are considered. According to the authors, "cost-benefit analysis techniques provide a coherent framework for integrating information on the biophysical and economic environments faced by farmers." Other simple techniques, such as calculating the value of lost nutrients can only roughly indicate the severity of the problem but cannot provide the guidance in selecting the best response (Lutz, Pagiola and Reiche, 1994:278). But benefit-cost analysis is not the only model used to capture the benefits of research. Some variants of the Operations Research model have been widely in use. The Linear Programming (LP) is one such variant. Iniodu (1981:9-10, 81) sees LP as a

mathematical technique which seeks to maximize or minimize linear objective constraints. In this view, the LP techniques is effective in handling complex problems involving a large number of planning constraints. It is superior to alternative models in its valuation of fixed resources. According to him, in its search for optimal solution (maximum benefits), the technique examines total rather than partial effects.

Clark Edwards (1966:173) has argued that the LP technique is necessary in order to enable one to write down a measurable objective function for which policy makers can agree that "more is better than less." According to him, when benefits are measured in terms of value of sales from a region and cost in terms of costs of production, the criterion becomes one of maximizing net revenue. He cites an example of "programming a small agricultural region as if it were a single, profit-maximizing unit." He also makes reference to the feasibility of quantifying relevant variable such as placing values on human life when some account of such value is deemed necessary in reaching a policy decision. He further states that LP can handle measures of an index of several factors which have market prices.

However, Pitt, Rosenzweig and Gibbons (1993:319) have used the Regression Analysis to discover the relationship between the presence of grade and middle schools in villages and the school attendance rate of teenagers with consequent welfare implications. They argued that developing countries invest heavily in a wide variety of social sector programmes with health, fertility control and schooling being central among them. They concluded that some of the improvements in the human resource outcomes may reflect economic growth which the data do not measure.

In the same way, Martin and Warr (1993) have used the dual approach with the translog functional form to assess the relative importance of the causes of decline in the agricultural sector of Indonesia. They identify the causes of decline to include declining relative prices of agricultural products, differential rates of technical change and changes in relative factor endowments. The dual approach is said to have been widely used to analyze resource allocation in agriculture, but, according to them, this study and their previous one in 1992 are the only known studies in which the

approach has been used to analyze the behaviour of the agricultural sector as a whole. Their findings, which have important implications for policy in the country under study, suggest that further accumulation of capital in relation to labour will have significant effects on agriculture's share of the gross domestic product (GDP), creating new opportunities outside agriculture. The World Bank (1990) sees this trend as "likely to be accompanied by continued reduction in poverty", especially in rural areas. The declining trend in the agricultural sector, according to Martin and Warr (1993:398-399), would not indicate the failure of the nation's agriculture and its agricultural policy. Rather, it would be the natural consequence of the success of the nation's overall economic development strategy.

In Nigeria, social scientists have been intensively involved in researches which have employed different quantitative techniques, the result of which have demonstrated the benefits derived from such researches. Among these scholars are; Olajide and Essang (1975), Onimode (1975), Ekpo (1991), Umoh (1991), Oladeji and Ogunrinola (1992), Adubi and Atobatele (1992) and Ogunwunike (1991).

From the above studies and many others, serious efforts have so far been made to quantify the benefits of social science research.

3.0 RELEVANCE OF SOCIAL SCIENCE RESEARCH IN POLICY FORMULATION

Okpala (1981) has argued that "...good research on information in the social sciences should be an aid to sound policy making in the given subject and that such policy-making should be responsive to social science research..." Considering the relationship between the intelligentsia, especially social scientists, on the one hand, and public decision making process, on the other, with reference to the United States of America, Mills (1959:183) raised the following questions:

Where is the intelligentsia that is carrying on the big discourse of the Western world and whose work as intellectuals is influential among parties and publics and relevant to the greatest decisions of our time...? Why is the free intellect so divorced from decisions of power? Why

does there now prevail among men of power, such a higher and irresponsible ignorance?

The main concern of Mills was the failure of American social scientists and social science practitioners to rise up for truth, reason and justice, by which they would be able to mobilize the populace towards ensuring that societal values are respected by the political actors in the governance of the United States. He considered this as a deplorable situation in which "research is used and social scientists are used for bureaucratic and ideological purposes" and where social scientists had the political meaning of their work modified and its use not determined by themselves "as matter of their own policy" but by the carriers of the prevailing orthodoxy and in furtherance of the interest which that orthodoxy represents and protects (Mills, 1959:177).

Thus, Mills expects social scientists to play a more independent and more decisive role in public decision-making processes (Akeredolu - Ale, 1995: 1-2). In the words of Mills (1959:179):

If human reason is to play a larger and more explicit role in the making of history, social scientist must surely be among its major carriers. For in their work they represent the use of reason in the understanding of human affairs; that is what they are about. If they wish to work and thus to act in a consciously chosen way, they must first locate themselves within the intellectual life and the socio-historical structure of their times. Within the social domains of intelligence, they must locate themselves; and they must relate these domains, in turn, to the structure of historical society.

Now, regarding the ways and means by which the social scientist may advance to actualize his historical mission in the proper perspective, Mills presented the educational and the political role of social science in democracy, by stating that:

It is the politic task of the social scientist... continually to translate personal troubles into public issues, and public

issues into the terms of their human meaning for a variety of individuals. It is his task to display in his work - and as an educator, in his life as well - this kind of social imagination. And it is his purpose to calculate such habits of mind among the men and women who are publicly exposed to him (Mills, 1959:187-188)

Undoubtedly however, the presentation of Mills represents a revolutionary and perhaps also controversial concept of the political role, social responsibility and practical relevance of social science and social scientists in a democracy, as well as how social scientists may properly proceed to actualize that role, that responsibility, and that relevance (Akeredolu - Ale, 1995:2).

From the foregoing, the relevance of social science research and social scientists in policy formulation lies in the extent to which the revolutionary role is being performed since social scientists are immensely instrumental to the attainment of the crucial goals of sustainable economic growth, human welfare and development, and social justice, all achievable through a deterministic economic, political and social transformation. Therefore, in a situation where the existing public policies are grossly inconsistent with fundamental societal goals such as efficiency in the allocation and distribution of economic resources and benefits as well as social justice and security, the need for the services of committed social scientists to conduct researches for the all important purpose of determining where the lapses lie becomes urgently imperative. This may facilitate the determination of ways and manners (politics) by which the political actors can deal decisively with the prevailing societal problem.

Writing on why policies fail or succeed in Nigeria, Egonmwam (1991) said that another reason of the inability of policy makers to identify accurately, causes of social problems is their failure to adopt better use of scientific and technical means of information gathering and analysis as a means of improving the causal theory upon which policy is based. He continued that, in policy making, if the information on which basis a policy is formulated is not derived from analytical foundation, and is wrong or inadequate, the resulting policy is not likely to attain the intended result. This means that for a policy to be effective, and to achieve its

intended goal, it must derive its source from scientific investigation. Also according to William and Paul (1952:41) on the usefulness of social science research to the American society, "the changing position of the discipline has not, however, been restricted to academic centres, for today the techniques of social research are employed in the forefront of programmes aimed at slum clearance, the improvement of institutional management, the decrease of racial tensions, and the planning of long-range civic improvement and in industrial relations."

Furthermore, the necessity of carrying out social analysis for policies that affect people generally and also carrying out technical, economic and financial feasibilities of such policies or projects has been recognized by the World Bank. This was reflected in the comments of Warren and Stokes (1985:473) who state in a research conducted for World Bank development policies, that the purpose of social analysis is to consider the suitability of the proposed design to the project population, to suggest ways to improve the "fit" between the two, and to fashion strategies for project implementation that can be expected both to win and hold people's support and to achieve project goals by stimulating changes in social attitudes and behaviour. In summary, social research and policy formulation cannot be separated because social research helps to identify the societal problem (where it lies) and proceeds to collect the necessary information, after which the analytical tools are applied to analyze the information. Inference may then be drawn from the results to form the basis for policy formulation.

One should not be surprised at the extension of social science research to the health sector. However, the realization of the importance of sociology as a field to the formulation of health policy has brought about a subject in the field of medical/health sciences called "medical sociology." This is very important because it helps to identify people and the type of health problems associated with or prevalent among them and to probe into their causes. The knowledge acquired from here helps in tackling the problem by administering treatment to the affected people. It also helps in preventing the spread of the disease to other people or areas. Besides, the contribution of the field of economics to the dissemination of medical/health services has equally brought

another field in medical/health sciences called "Health Economics." In the words of Lambo (1993), "in the last decade there has been considerable impact of health economics on health policy, especially at macro level." Health economics is concerned with the health of man, and all the inputs that are necessary for its procurement in terms of medical care which depends on the availability of drugs and other equipment. It also concerns all those other factors that are detrimental to health, such as drug abuse and general unhygienic way of living. The work of Chaloupka (1975) on "Public Policies and Private Anti-Health Behaviour" which focused on the effects of public policies on three unhealthy behaviours (cigarette smoking, drinking and alcohol abuse, and illicit drug use) stated that given the well-documented health and other consequences of the use of these substances, policies lowering use, particularly by youths, are likely to lead to substantial long-run improvements in health. This stresses the point that a very impressive benefit awaits a serious research conducted on the economics of health matters.

The works of Anderson (1984:9) which commented on the relevance of political scientists to policy analysis points out that scientists are necessary and useful to guide policy analysis, as they help to clarify and suggest possible explanation for policy action. As a result of this, most theoretical results become tools for empirical analysis.

The above discussion has succinctly demonstrated the relevance of social science research as an effective instrument of policy formulation. It should be recalled that social science research is concerned with change and development. Many of the failures of social policies are due to their lack of empirical contents. Social science research and the related analysis must be backed by adequate data so as to make the empirical results authentic.

4.0 TECHNIQUES FOR MEASURING THE BENEFITS OF POLICY-ORIENTED SOCIAL SCIENCE RESEARCH

Measuring the benefits of policy-oriented social science research really transcends the fundamental work of determining the costs and benefits of a particular project, or that of adopting or rejecting the policies emanating from a particular research work. Such measurement involves an assessment of the extent to which an

enacted policy on a particular research work, has been able to ameliorate or utterly solve the contending social problem that warranted the conduct of the research, in the first place. This implies that the benefits arising from a particular research work can only be measured by exploring the impact of the ensuing policies on the problems at stake. That is the only way by which the resources plunged into the execution of the research can be adjudged worthwhile or not. This position was equally presented by Grossman (1994) who deduced from his work that if policy-makers are to make the most effective use of limited resources to advance social goals, they need to be able to know whether or not social programmes have been able to produce the desired effect, such as, improving the life of individuals and communities and the extent of the improvement, as this would help in determining the justification of the programme's cost. He argued that in developing countries, in particular, governments and development institutions cannot afford to waste scarce resources on programmes that do not achieve goals. As a result, he stressed that ineffective programmes should be modified to make them work or be cancelled altogether *when there seems to be nothing else that could be done to make them work* (italics ours).

Therefore, following from the above, it becomes imperative to discuss the techniques necessary for the evaluation of social policies in order to determine whether or not the investment in a programme is justifiable. Evaluation will equally allow policy-makers to know whether or not any aspect of the programme requires modification to enhance the quality of programme execution. For instance, during a particular deep and long recession, the U.S. Government often provides unemployed workers with extra unemployment compensation (Grossman, 1994). An evaluation of such an emergency programme in the late 1970s (Brewster et al, 1978) revealed that workers did not actually receive much of the money until after the economy began to recover. This made the government to change the rules of distributing such money when a similar scheme became necessary following the recession of the early 1980s. Thus, an evaluation of the modified programme indicated that the new rules allow policy-makers to deliver aid more precisely when it was most needed (Grossman, 1994).

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 Evaluation techniques may be either quantitative or qualitative, with choice depending mainly on the researcher. However, various research works have shown that quantitative models in drawing intelligent conclusion from policy analysis have been stressed by Klein (1981). His work shows that it is not adequate to argue for or against the justification of policies on purely qualitative grounds. This implies that quantitative techniques constitute a more appropriate approach to policy analysis. This position was supported by Fraker and Maynard (1984) in their seminal paper which used data from a major random assignment demonstration programme conducted on the National Supported Work (NSW) demonstration in the United States. They constructed comparison groups, using various matching strategies including those employed in the comprehensive Employment and Training Act (CETA) evaluations by which they calculated what the impact estimates would have been had the outcomes for the NSW treatment group been compared with the outcomes for the matched comparison groups, instead of with those for the randomly selected NSW control group. They found that the estimates based on comparison groups (qualitative technique) did not come close to the actual impacts estimated using the randomized control group (quantitative technique). Also, Lalonde (1986) further weakened the case for comparison groups when he showed that the various sophisticated econometric techniques developed to solve self-selection problems did not improve the estimates presented by Fraker and Maynard, using the quasi-experimental technique. Their findings which were summarized in Lalonde and Maynard (1987) showed that the statistical inference based on a comparison group methodology was incorrect in 40 per cent of the cases. Hence they concluded thus:

Non-experimental procedures may not accurately estimate the true program impacts. In particular, there does not appear to be any formula (using non-experimental methods) that researchers can confidently use to replicate the experimental results of the supported Work Program. In addition, the studies suggest that recently developed methods for constructing comparison groups are no more

likely (and arguably less likely) than the econometric procedures to replicate the experimental estimates of the impact of training... These findings are further evidence that the current scepticism surrounding the results of non-experimental evaluations is justified (Fraker and Maynard, 1984:226).

From another research work by Westat, Inc. (1984) on the Manpower Development and Training Act (MDTA) which compared the earnings of participants with those of non-participants, using the non-random methodology, the estimated effect showed that the programme decreased trainees' income, even when the researchers controlled for differences in the two groups. In order to find out the authenticity of this result, the work of Director (1974) examining the earnings of participants and comparison group individuals before the programme, discovered that participants had earned less than the comparison group members, even before the programme. This rendered the estimate derived by Westat likely incorrect. The result here further strengthens the argument for the weakness of qualitative methods of policy analysis. The qualitative techniques highlighted above are discussed in the sections that follow:

4.1 Qualitative Techniques

By qualitative method of analysis, problems are evaluated on the basis of approaches other than those employing statistical tools for analysis. It may also be referred to as survey designs (Asika, 1991:229) in which the researcher merely observes what is happening to sample subjects, without making any effort to manipulate or control them. His report only reflects what he has seen and how he feels about it, from his own judgemental perspective. A survey design can be either a cross-sectional or longitudinal research design. When the researcher picks a particular time period for investigation, he is engaged in a cross-sectional analysis. On the other hand, he is engaged in a longitudinal analysis when he chooses to carry out his observation or observations at different time periods. However, the general and the most important aspect of this method of analysis remains that no statistical or mathematical analysis is involved.

Programmes or policies could be analyzed from this viewpoint, using the "matched comparison" method. By this, researchers identify a group of individuals whom they judge to be comparable to the participant group in important dimensions but who do not receive programme services. This means that to evaluate a particular programme or policy, the researcher has to select individuals who will benefit by participating in the programme and those who will not because they did not participate in the programme. The comparability of the individuals to be assessed requires that they must possess the same characteristics affecting the outcomes of interest. This means that if the programme concerns agriculture, for instance, farmers growing the same type of crop should be selected for comparison. We may assume the existence of a programme by the government to improve the output of a crop like maize by distributing a certain grade of fertilizer to some farmers. The effectiveness of that programme can be measured by comparing the output of the group which utilized the fertilizer to that of the group that did not. But if for any reason, the researcher decides to compare the output of cocoa farmers, for instance, to that of maize farmers, the effectiveness of the policy would not be determined since the two crops have different characteristics.

A good example of programme analysis using matched comparison has been the evaluation of the California Conservation Corps (CCC), a training programme for out-of-school youth (Wolf, Liederman, and Voith, 1987). The study matched the selected participants who enrolled in the programme during a twelve - month period with those participants who went to the CCC's single largest referral agency as comparison group members. They were matched by using the following factors: age, race, gender, marital and family status, how receptive they were to moving away from home, how much they enjoyed working outdoors, and how much they enjoyed physical work. These were all important factors to guide the corps members to decide whether or not to join the programme which would affect the key outcomes of the study and their welfare in terms of self esteem, environmental awareness, and earnings.

4.2 Quantitative Techniques

These involve the application of both mathematical and statistical tools in evaluating social programmes or policy. Some of the relevant models are econometric models, accounting models, mathematical programming (including linear and goal programming) models, and systems dynamic models. Econometric models, for instance, which involve the application of both statistical and mathematical tools in addressing economic problems, make use of regression analysis for both policy formulation and evaluation. Regression analysis is concerned with the study of the dependence of one variable (the dependent variable) on another (the explanatory variable), with a view to estimating and predicting the (population) mean or average value of the former in terms of the known or fixed values of the latter (Gujarati, 1979:14). The model can be extended easily to address problems in any other field in the social sciences.

Econometrics involve the estimation of the parameters of a model in order to obtain the numerical estimates of the structural coefficients, using available sample data and appropriate statistical technique. The estimators are mainly of two classes; the least square Estimators, and Maximum likelihood estimators.

Least square estimators are employed to obtain estimates of parameters by minimizing the sum of squared residuals, the various types being the Ordinary Least Squares (OLS), the Two - Stage Least Squares (2SLS), and the Three - Stage Least Squares (3SLS). The OLS is used to estimate the parameters of a single equation model while the 2SLS is used to estimate the structural coefficients of a simultaneous equation model. On the other hand, the 3SLS estimates all the structural equations simultaneously with the complete specification of the model taken into account explicitly. The maximum likelihood estimators are basically simultaneous equation estimators. It is made up of two parts namely: Limited Information Maximum likelihood (LIML), and the Full Information Maximum Likelihood (FIML). The LIML is an equation - by - equation method which estimates each of the equations in a simultaneous equation model independently. On the other hand, the FIML takes the complete specification of the model into account explicitly by estimating the equations in the model simultaneously. This enables it to improve on the efficiency of the LIML estimator.

In a situation where the programme involves the maximization of an objective function (as stated earlier in this paper) subject to certain constraints, mathematical programming models (comprising "linear" and Goal" programming models, among others) become the most relevant and applicable tool. According to Kroeber and Laforge (1987:6) linear programming is a method of analysis that has found many useful applications in business. They further stated that a linear programming consists essentially of expressing the problem situation as a series of simple mathematical equations or inequalities and finding the solution that best achieves some stated objectives in production scheduling. According to them, the problem may consist of finding a combination of products to process in some planning periods so that total contribution to profit is maximized while at the same time the availability of man and/or machine hour is not exceeded. This implies that if a policy or programme is geared towards the maximization of something like profit, or minimization of something like cost in a manufacturing concern, the impact of the policy can be easily estimated, using mathematical programming.

Dynamic models are very useful when a decision-maker is faced with a multistage decision in which case decision making requires several interrelated choices (Roger, 1976:576). These decisions are conceptualized as consisting of policy choices, stages, states and objectives as thus explained:

Policy Choice: This concept signifies a choice (decision) that is made at some point in a multi-state decision for which a policy is typically required for each stage.

Stage: This is a collection or set of feasible choices that appear at some point in a multi-stage decision.

State: State connotes the condition that influences a policy choice at a stage of decision.

Objective: A goal to be achieved by the policy choices specified for each stage of the multi-stage decision constitutes the objective.

This model, like the mathematical programming model, is equally useful when the policy or programme to be evaluated has the basic goal of optimization. The only difference is that this model recognizes policy choices made in stages, as in production stages.

Generally, quantitative techniques are categorized as experimental designs. This is because they allow researchers, with

the application of statistical and mathematical tools, to evaluate the situation before and after the programme or policy in order to determine the efficiency of the programme or policy in addressing the prevailing problem. By this, policy-makers are able to decide as to whether the desired goals have been met or not.

5.0 HISTORICAL EVIDENCE OF THE BENEFITS OF POLICY-ORIENTED SOCIAL SCIENCE RESEARCH

From a research by Oyegun (1995:10-11) on "The elegance of Geographic Research in Environmental Policy Process in Nigeria," it was discovered that eighty per cent of the respondents agreed that geographic research is useful for environmental policy formulation. It was on this basis that it was recommended that for policy proposal to receive the expected support, it must be tailored to fit into the perception of the major policy actors.

Another work by Abalu (1985), looking at the yield performance of major crops at three levels of technology under sole cropping in Nigeria showed an improvement under improved technology (see Table 1). Results from the table show that if improved technology is adopted, it will lead to increase in output which will, in turn, increase returns. From this kind of result it becomes easier to justify the application of the improved technology since analysis has shown that it yields better results which could help in attaining self-sufficiency in food production.

From researches done on population growth, recent findings of the Demographic and Health Surveys (DHS) showed age at marriage to be closely linked with fertility rates in Bolivia, Guatemala, the Dominican Republic and Mali, Morocco, and Burundi (Arnold and Blanc, 1990). The implication here is that the earlier the age at which women marry, the higher the fertility, and the later the age of marriage, the lower the fertility. Also, a survey in Nigeria has found a strong negative correlation ($r = -0.7104$) between the age at first marriage and completed fertility, in Ugep (Obono, 1995). This has the same interpretation with the findings by Arnold and Blanc stated earlier.

TABLE 1

Yield Performance of Major Food Crops at
Three Levels of Technology Under Sole Cropping

Crop	Traditional Technology (Yield) kg/ha	Improved Technology (Yield) kg/ha	Percentage Increase(a)	Improved Technology (Yield) kg/ha	Percentage Increase(a)
Sorghum	785	1680	114	3920	399
Millet	740	1344	82	2800	278
Maize	1046	3000	187	7840	650
Rice	940	1445	54	3360 ^b	257
Wheat	1750	n.a. ^c	n.a. ^c	4500 ^d	147
Cassava	5570	11263	102	22580	305
Yams	6272	9004	94	20070	220
Groundnuts	586	1120	91	2240	282

Notes:

- (a) Percentage increase above traditional technology yield.
 (b) Refers to upland rice. Best swamp yields of 4800 kg/ha and irrigated yield of 5600kg/ha have been recorded.
 (c) Not available.
 (d) Irrigated wheat.

To further buttress this point, according to Adlakha et al (1991), available reports revealed that rising age at marriage is strongly associated with falling fertility rates. The evidence from these findings should basically inform policy-makers in any part of the world that in order to reduce fertility, the marriage age must rise. For instance, in Nigeria, the marriage age of 18 years could be raised to 22 years or above to check population growth. Further, there are many studies which prove that policy oriented social science research is beneficial. This is done by assessing the extent to which the resulting policies have been able to attain their intended goals. For instance, Chaloupka and Saffer (1992) were able to examine the effect of smoking restrictions on cigarette demand and found that the most restrictive laws, those limiting smoking in private work sites, had been enacted in places where antismoking sentiment was high and demand was low. However, after controlling for this endogeneity, it

was discovered that relatively strong restrictions on public smoking significantly reduced demand, while more stringent restriction had no additional impact. Also a recent work by Chaloupka and Wechster (1994) which looked at the impact of prices of all major tobacco control policies on cigarette smoking among college students revealed that the decision to smoke and cigarette consumption by smokers are very sensitive to price. They estimated the price elasticity of demand by college students to be - 1.42, which is over three times the consensus estimate for adults. The implication here is that tax increase would reduce smoking significantly in younger populations which would in turn lead to a very substantial long-run improvements in health. They also found that relatively strong restrictions on public smoking would significantly reduce the smoking rates, while any other restrictions would reduce average consumption among smokers.

On the examination of the impact of alcohol control policies on drinking and driving, Saffer, Grossman and Chaloupka (1993) completed the first comprehensive examination, using state motor vehicle accident fatality rates for 1982 through 1988, considering the effect of beer taxes, drinking ages, and all major policies to deter drunken drivers. They found that a policy indexing beer taxes to the inflation rate since 1951 would have saved approximately 5,000 lives per year during the period covered by their sample, with about 1700 of those saved falling between the ages of 18 and 20 years. On the other hand, they equally discovered that moving from a uniform drinking age of 18 years to 21 years would have saved no fewer than 700 lives annually, mostly in the 18-20 age group. Also they found that swift and severe penalties for drunken driving, such as one year administrative suspension, effectively deter people from drinking and driving.

Generally, the evidences presented so far, are substantial enough to prove the benefits of social science research to policy formulation.

6.0 POLICY IMPLICATIONS AND CONCLUSION

Policy decisions have increasingly assumed empirical contents in recent years. Various quantitative techniques have been constructed and used as analytical tools for policy-oriented social

science research. Many of these techniques have proved useful in measuring the benefits of research efforts. But, as noted earlier, the usefulness of a model is influenced by the objective, scope and nature of the study and by the level of participation of the local people, the "researched." In order to ensure that appropriate quantitative techniques are employed in measuring the benefits of any policy-oriented social science research, some policy suggestions are desirable.

First, simple models which are less costly and less time consuming should be preferred to complicated ones, provided they are able to account for all the measurable benefits of the research. But care must be taken not to sacrifice efficiency for simplicity. Where it is necessary, an all embracing model that caters for externalities, intangibles and other non-pecuniary influences may be desirable.

Second (and closely related to the first suggestion), popular participation research approach which requires the involvement of the people, "closest to reality", should be taken into consideration in selecting and adopting any analytical model. Wide participation is essential not only at the initial stage of the research process, but also during all its phases. To make any meaningful contribution, the research project must be enriched, at all levels of its formulation, with "information provided, discussed and analyzed by the citizens themselves" (United Nations, 1995:7). The policy issue here is that the research process should be based on a system of discussion, investigation, evaluation, and analysis in which the local people are as much a part of the process as the researcher himself. Thus, as much as it is feasible, the technique should be tailored to accommodate this requirement.

Third, the social science researcher should not be contented with mere knowledge of economic theory and statistical analysis. He must be able to apply the theory, define the problem analytically and decide on the minimum of statistical and other information needed for use. Besides, he should know where and when to gather information, be able to sort, collate and process the data, be able to interpret the results obtained from the analysis and arrive at action-oriented conclusions. To equip the social scientist with these requirements, appropriate training policy must be evolved.

Fourth, since the ultimate goal of research is to improve the base of knowledge that supports policy decisions, wide publicity and dissemination of research results should be accorded a priority status. The practice of stacking research reports away in bookshelves and not making them available to those who should apply them is counter-productive and must be discouraged. It is believed that the more widely research reports are disseminated, the more they are likely to be applied to practical situations, and the greater the chances of increased benefits to a wide audience. Thus, research output must not be seen just as an input for further research. It has some effects on other knowledge-based activities, including education, health, and welfare of the wide community.

Finally, social science research is concerned with human welfare and how people and groups understand, order, and value their social relationships and systems of their social organizations. The main inputs of such research are human and financial resources. It is therefore, imperative that social science research be designed to ensure that these resources actually produce maximum benefits to the intended clientele and maximum welfare to the society.

In conclusion, it is pertinent to reiterate that research expenditure is investment in knowledge building or knowledge discovery. Research, itself, has been seen as a powerful tool for policy-decision. Consequently, as Summers (1991) opines, future research agenda should address the "pivotal issue of helping governments identify and perform the central functions that only they can do." This requires the development of analytical techniques that go beyond the traditional benefit-cost analysis which has limited application. Such techniques must be able to account for the externalities that arise from the research project. Also it must be able to analyze the aftermath of the adopted policies. New and modern techniques which are able to identify national aspirations using the participatory approach, constitute an innovation in development management. Their application should be encouraged if the true benefits of research are to be fully measured.

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