



CONTEMPORARY ISSUES IN SOCIAL SCIENCE RESEARCH

# RESEARCH METHODOLOGY FOR SOCIAL SCIENCES

Edited by  
**RAJAT ACHARYYA AND  
NANDAN BHATTACHARYA**



# RESEARCH METHODOLOGY FOR SOCIAL SCIENCES

*Research Methodology for Social Sciences* provides guidelines for designing and conducting evidence-based research in social sciences and interdisciplinary studies using both qualitative and quantitative data. Blending the particularity of different sub-disciplines and interdisciplinary nature of social sciences, this volume:

- Provides insights on epistemological issues and deliberates on debates over qualitative research methods;
- Covers different aspects of qualitative research techniques and evidence-based research techniques, including survey design, choice of sample, construction of indices, statistical inferences and data analysis;
- Discusses concepts, techniques and tools at different stages of research, beginning with the design of field surveys to collect raw data and then analyse it using statistical and econometric methods.

With illustrations, examples and a reader-friendly approach, this volume will serve as a key reference material for compulsory research methodology courses at doctoral levels across different disciplines, such as economics, sociology, women's studies, education, anthropology, political science, international relations, philosophy, history and business management. This volume will also be indispensable for postgraduate courses dealing with quantitative techniques and data analysis.

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# RESEARCH METHODOLOGY FOR SOCIAL SCIENCES

*Edited by Rajat Acharyya  
and Nandan Bhattacharya*

First published 2020  
by Routledge  
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge  
52 Vanderbilt Avenue, New York, NY 10017

*Routledge is an imprint of the Taylor & Francis Group, an informa business*

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Development Centre, Jadavpur University; individual chapters, the  
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*British Library Cataloguing-in-Publication Data*

A catalogue record for this book is available from the British Library

*Library of Congress Cataloging-in-Publication Data*

A catalog record has been requested for this book

ISBN: 978-1-138-39051-5 (hbk)

ISBN: 978-0-367-40984-5 (pbk)

ISBN: 978-0-367-81034-4 (ebk)

Typeset in Bembo

by Apex CoVantage, LLC

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# FOREWORD

I congratulate Prof. Rajat Acharyya and his colleague Dr. Nandan Bhattacharya at the UGC-Human Resource Development Centre of our University for initiating a series on *Contemporary Issues in Social Science Research* based on lectures delivered by experts in teacher-training programmes, such as orientation courses, refresher courses and short-term courses. The present volume is the first in the series. It addresses the crucial issue of research methodology for social sciences.

Social science by its nature is subjective; any problematic in this discipline can be viewed differently, and the more scholarly debates there are, the more enriched the discipline becomes. But such debating exercises need to be undertaken on the basis of scientific research methods. This entails constant refinement of research methodologies in social sciences, and the present collection gains a particular significance in this perspective. At the same time, increasing adoptions of interdisciplinary approaches in social science research are making irrelevant the research methods and tools of analysis defined by traditional rigid confinements of particular subjects, such as economics, political science, sociology or history. But in the name of interdisciplinarity the specific flavour of a particular branch of social science need not be undermined. In terms of social science research methodology what is perhaps thus required is a fine blending of the particularity of a subject and interdisciplinarity of the discipline. I hope in this context, too, this volume will break new ground.

I understand that selections on *Peace and Conflict Studies: Theory and Practice*, *History and Philosophy of Science*, *Gender Studies* and *Disaster Management* have been planned under the present series. We eagerly look forward to their publications. On my own behalf and on behalf of the university I also sincerely thank Routledge India for collaborating with the UGC-HRDC unit of Jadavpur University to publish this collection, which should benefit both the reading public in general and social scientists in particular.

– Suranjan Das,  
Vice-Chancellor, Jadavpur University

# EDITORS' NOTE

A wide variety of methods and techniques are applied in social sciences to analyse social and economic phenomena. Such methods range from census survey data to the analysis of a single agent's social behaviour, from documentation of stylized facts and case studies to rigorous statistical and empirical analyses and from collecting data from the field to analyses of secondary data.

This volume on *Research Methodology for Social Sciences* takes researchers and market analysts through concepts, techniques and tools at different stages of research. With epistemological issues, debates over qualitative versus evidence-based quantitative research, survey design, choice of sample, methods of data collection, construction of indices, statistical inferences and quantitative analyses of both qualitative and quantitative data put together, the volume provides a useful guide for researchers in – but not limited to – the fields of commerce, economics, sociology, political science, international relations, strategic studies and history.

The contributors in this volume are experts in their respective fields who have developed the respective chapters based on their lectures delivered at the UGC-sponsored Short Term Courses on Research Methodology organized by the Department of Economics, Jadavpur University, in collaboration with the UGC-Human Resource Development Centre, Jadavpur University during 2014–2016. The courses were targeted for and attended by MPhil and PhD research scholars working at different universities and institutes in India. Understandably, their feedback and observations on the lectures have helped the authors in developing their lectures into chapters for this volume.

We take this opportunity to thank all the authors for their support and cooperation to undertake this endeavour. Without their contributions it would not have been possible to bring out this volume. Comments from the anonymous external reviewers engaged by Routledge India had been extremely useful as well. We also thank Ms Shoma Choudhury, commissioning manager of Routledge India, for her

continuous encouragement and advice right from the inception of the series and this volume. Excellent support from Ms Brinda Sen and other technical staff at Routledge cannot be forgotten as well.

Our sincere thanks go to Prof. Suranjan Das, Vice Chancellor of Jadavpur University, since it was his idea to disseminate knowledge, generated in academic programmes conducted by the UGC-Human Resource Development Centre of Jadavpur University, through publication of edited volumes like this. He has always been a source of inspiration for us in endeavours like this. We also thank Dr Pradip Kumar Ghosh, Pro Vice Chancellor, Jadavpur University; Sri Gour Krishna Patanayak, Finance Officer, Jadavpur University; and external members of the Local Programme Planning and Management Committee of UGC-HRDC, Jadavpur University, for all their help and encouragement. We also cannot but happily remember the support provided by all the staff at HRDC, particularly, Mr Prabir Chatterjee and Ms Chaitali Mukherjee, who made the process of publication of this volume smoother.

Last but not least, we thank Ms Shrimoyee Ganguly, research scholar at the Department of Economics, Jadavpur University, for her academic inputs as well as conceptualization of the cover image for the book series, and Mr Prithwish Bhowmick of Amar Ekushe for logistic support in this regard.

Rajat Acharyya  
Nandan Bhattacharya  
May 2019





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# INTRODUCTION

*Rajat Acharyya*

Over the years research methodology as a subject matter of study has gained growing importance not only in pure academic discourses but also for research students as it has been enforced upon the institutes of higher learning in India by the regulatory bodies, such as the University Grants Commission, as a necessary precondition for research degrees. But this aura of regulation in research, emphasizing too much the techniques and measurement, has somewhat bypassed more fundamental questions, such as what exactly constitutes research methodology in social sciences and debates over quantitative and qualitative methodologies. At the same time, there have also been rather insufficient academic attempts to put together whatever academic and scientific discourses that we have on both these dimensions and how the methods and tools at hand can be used for research questions that cut across different disciplines and fall in wider socio-political-economic contexts. In the Indian context, insufficiency of academic discourses becomes even more apparent. Though there has indeed been some insightful exploration of debates over research methodology in the social and cultural contexts of India, there has been no sustained engagement.

Research methodology in social sciences is not and cannot be uniquely defined. Research methodologies are as diverse as the different disciplines or paradigms in social sciences. However, while research methodologies or techniques may differ widely in respect of approach, objective, language and expression, the common trait is that it intends to train the researcher how to examine whether any causal relationship exists between different events or observations; how to evaluate, interpret or predict outcome of an event; and how to produce objective or subjective knowledge from occurrence of events and observations of facts.

Within this broad perspective of research methodologies, there are two distinctively different but equally important approaches. One is the qualitative, which focuses on reconstruction of causal-relationship or impact-evaluation through logical reasoning based on different accounts of observed facts and their subjective

evaluations by other researchers; the other is the quantitative techniques, which delves into the construction of causal-relationship through quantification of observations, events and their outcomes in numeric forms. Whereas the former is primarily interpretative in nature, the latter is more of a predictive kind. Part I of this volume discusses the differences and debates in these two approaches and the epistemological issues involved in research methodologies in general. Part II deliberates upon debates on research methods, and Part III discusses methods of conflict analysis and evaluation of development programmes. Part IV of the volume introduces different quantitative techniques of research and how those can be used in analysing events data of both qualitative and quantitative nature and research questions in larger contexts that go beyond the boundaries of specific disciplines.

In the first chapter of this volume, 'Methodological or epistemological issues in social research', Achin Chakraborty raises certain epistemological issues critical to the understanding of diversity in research methods in social sciences. He argues that the 'actual practice of research in social sciences is too rich in diversity and innovativeness to be disciplined by a few prescriptive norms'. There are several distinct motivations as well which drive research inquiries in social sciences. In this context, he distinguishes between explanatory (the 'why' question) and descriptive (the 'what' question) analysis or research questions. Then there is the research question of 'evaluation and assessment of the good and the bad' that leads to evaluative inquiry. All these types of research inquiries that he discusses fall in the *positivist* paradigm.

Part II of the volume consists of three chapters. In her chapter, 'Towards a pragmatic centre: debates on qualitative methodology', Samita Sen emphasizes the fundamental debates on research methodology across the world, that concerns fundamental questions about whether there is a need and a role of methodology in social science research, the paradigm wars and the more prosaic debate between quantitative and qualitative methodologies, all of which are closely interconnected. She talks about interconnected paradigm wars of three kinds. First is the research methodology versus anti-methodological traditional scholarship, interpretation or judgements versus evidence. The second paradigm war draws us to the qualitative versus quantitative *methods* and scepticism over recent attempts to combine both. The third one is conflict between evidence-based methodologies, mixed methods, interpretive and critical theory schools. These conflicts have been taken as the entry point for discussion of five commonly used qualitative methods of social sciences: ethnography and narrative methods, mixed method and grounded theory and interviews and focus group discussions in the context of feminist method.

In 'Ethnographic fieldwork: the predicaments and possibilities', Amites Mukhopadhyay argues how conditions of governance under colonialism led to ethnography's interest in other cultures. He provides an account of ethnography's emergence in the Indian context and documents the debates of the late 1980s when ethnography as a positivist practice came under the scanner. Such debates marked a critical rethinking of ethnography as an instrument of anthropological imagination.

The question of diversity in research, particularly in the discipline of economics, has been analysed by Soumik Sarkar and Anjan Chakrabarti in their chapter,

'Diversity in economics: an examination and defence of heterodox approach'. Often a normative perspective of research may warrant a heterodox approach, but what they object to is that theorizing the economy cannot but be heterodox. The authors put two epistemological questions at the centre of their discussion: 'what is theory?' and 'what distinguishes one theory from another?' They argue that the contrasting forms of determinism and non-determinism and entry point serve as the foundation of constructing different theories and of inter-theoretical comparison.

Part III of the volume focuses on theories of conflict analysis in social sciences, measuring development, and evaluation of public development programmes. In real life, we encounter conflicts in every stage of our decision making, whether economic decisions, political decisions or decisions of any kind and in any sphere of life. Potential conflict situations arise because as individuals or as group-members (whether it is a social or an economic group we belong to), we pursue our self-interests and our aspirations, capabilities and possessions of means to achieve our interests different from each other. Pursuit of self-interest is conceived through individuals having characterized as rational agents, and this is a building block of a wide spectrum of social science research. It is because our self-interests differ and conflict with those of others and that we are rational agents and behave non-cooperatively even in situations when cooperation could have been better for the aggregate. Game theory provides us a tool for choosing strategies in best pursuance of our self-interest in conflict situations and non-cooperative environment. Such tools become more engaging when we do not have sufficient or complete information regarding the environment, including other rational agents whom we interact with. Swapnendu Bandyopadhyay, in his chapter on 'Game theory: strategy design in conflict situations', introduces researchers to such game theoretic tools in a wide variety of situations, such as international relations and political diplomacy, power supremacy, crime detection, ethics and morality. With non-technical introduction of optimal choices of non-cooperative strategies by two agents in terms of well-known and generalized games, he elaborates upon their applications in specific cases like regional conflict, bribery and corruption, surrogate motherhood and auction.

In social sciences one major research question is assessment or evaluation of benefits of a development policy, whether it is a poverty eradication programme, a health programme, a targeted education programmes (such as Kanyashree Prakalpa), an employment generation programme or a targeted policy of social inclusion. Impact evaluation is a technique of evidence-based research whereby acceptability of a development programme amongst potential beneficiaries and the long-term outcomes of it are measured and assessed. Arijit Dutta, in her chapter titled 'Impact evaluation: A simple need and a difficult choice of methodology', discusses challenges of impact assessment, construction of counterfactuals and associated problems and different methodologies of impact evaluation and their uses in India, such as randomized control trials, propensity score matching and difference-in-difference methods.

Construction of indices and studying their trends is an alternative approach of evaluating and predicting outcomes of a public policy programme. Indices are

useful constructions to measure multi-dimensional socio-economic and demographic characters of an economy and its population, such as poverty, health, education and human development, in terms of a one-dimensional numeric value. The issues assume further relevance in social sciences as we often confront both qualitative as well as quantitative variables. The qualitative variable is measured ordinally, and it is subject to fluctuation and different scales or degrees in perception-based study. Given these dimensions, appropriately constructed indices reflect relative position of an individual based on various numeric and non-numeric characteristics. In 'Construction of different types of indices: some numerical examples', Sushil Halder elaborates on the construction of different indices, their theoretical underpinnings and rationale and their limitations in reflecting different dimensions of development.

Chapters in Part IV of the book discuss different dimensions of evidence-based research methods and predictive analysis. Data, which may be both quantitative and qualitative, is the key element of it; as such, at the core of evidence-based research lies the method of data collection. However, in contrast to observation as a method of data collection in qualitative research, survey and questionnaire are the main forms of method of data collection in the quantitative research. Tanmoyee Banerjee (Chatterjee), in the chapter on 'Designing a primary survey-based research', discusses different aspects of primary survey to collect information regarding socio-economic features of a group of individuals on which official sources of information either are insufficient or shed no light. Such aspects concern ethical issues related to primary survey-based research, a comparison of different modes of survey – such as face-to-face and telephonic interviews and email – and finally design of questionnaire depending upon the research question at hand.

In evidence-based quantitative research, though the target is to make predictions about a population, surveys for data collection cannot be made over the entire target population, except in case of census, simply because of the time, effort and money that such complete enumerations will take. But census data may not always help a researcher get his or her required information either since these capture only decadal information and may not cover all dimensions of socio-economic attributes of population. Thus, surveys are conducted on a sample or sub-group of population with some representative attributes of the entire population. The issue at hand then is how to select the sample of population in the best way to make a prediction or an inference of the population characteristics based on information collected on characteristics of the sample to address a set of research questions. There are different sampling techniques, and applicability of these techniques varies with the nature of the research question at hand. Malabika Roy introduces the researchers to these techniques and their applicability in her chapter titled 'Sampling methods: a survey'. Most relevantly, in the context of this volume, she discusses non-random sampling methods that are more useful to address research questions in wide areas of social sciences but which are not covered adequately in standard text books, in addition to probability sampling, which is the most adopted method in physical sciences and in economics.

Having designed the suitable sample and collected all information from that sample of population relevant for the research question at hand, a researcher needs to draw conclusions about the population characteristics based on the sample observations. Statistical inference concerns itself with this dimension of the evidence-based quantitative research. There are two dimensions: estimation and hypothesis testing. In his chapter, 'An introduction to statistical inference', Sugata Sen Roy elaborates upon these dimensions with the help of quite a wide variety of examples. His discussion of estimation and hypothesis testing also takes the readers through some essential mathematical rigour.

In a predictive analysis, the major problem faced by a researcher is the direction of cause-and-effect relationships between events (or variables capturing such events) and identification of such relationships from observations or data on such events. This problem is prevalent not only in economics but also in a wide variety of disciplines, such as demography, sociology, physical education and development studies. An endogeneity bias arises when we estimate an incorrectly presumed unidirectional causality. In the chapter on the 'Problem of endogeneity in social science research', Arpita Ghose discusses the nature, sources and consequences of such endogeneity bias. The chapter also highlights two related issues: the problem of identification, which is concerned with whether all the parameters of the system can successfully be estimated, and the endogeneity problem arising out of omitted variables and measurement errors.

The last chapter of the volume, titled 'Quantitative methods for qualitative variables in social science: an introduction', Ajitava Raychaudhuri introduces the quantitative techniques for analysing qualitative data. Qualitative data may take a wide variety of forms, such as binary form – in research questions such as probability of survival of cancer patients, for example, the variable under consideration would be whether the patient has survived or not – or ordered variables in terms of rank. In such cases standard methods of quantitative analysis fails, and one needs special techniques to estimate and analyse statistical relationships from the qualitative data. Ajitava Raychaudhuri introduces the researchers to two such techniques, called logit and probit, which transform discrete binary variables into continuous variables that are amenable to statistical estimations.



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## **PART I**

# Epistemological issues





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# 1

## METHODOLOGICAL OR EPISTEMOLOGICAL ISSUES IN SOCIAL RESEARCH

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### 1 Introduction

The courses in research methodology seem to have been driven by the widely held notion that carefully drawn methodological principles would tell us how to do research *scientifically* (or social-scientifically?). And once they are drawn, the next obvious step would be to *appraise* an actual piece of research or a research programme in terms of those principles. In other words, the logical sequence turns out to be from a set of prescriptive principles to the practice that is supposed to follow those principles. In economics, for example, philosophers of science were believed to hold the key to how to do ‘economic science’, even though several groups outside mainstream economics (e.g. Marxists, Austrians, Institutionalists) have had their shared methodological approaches. What has been common amongst the practitioners of economic research – both within and outside the mainstream – is that both sides have viewed methodology as offering a set of prescriptions on what constitutes legitimate practice. In this view, the common concern of methodological discussions is essentially normative and is based on philosophers’ attempt to justify knowledge claims.

In this chapter, we take the opposite route. We argue that there is enough evidence to show that actual practice of research in social sciences is too rich in diversity and innovativeness to be disciplined by a few prescriptive norms. Therefore, in section 2 we begin with the invocation of the diversity of practices and a rough classification of different types of research inquiries, each of which is ostensibly driven by a different motivation. Research inquiries are not always explanatory – or as economists tend to suggest, predictive. Apart from explanation and prediction there are several other motivations that drive social research. A major area, for example, deals with the normative issues involved in assessing states of affairs or changes therein. For example, an issue like how development of a country or a region is to be assessed is

evaluative in nature. Of course, the brief account of different types of social research presented here is far from exhaustive. In section 3 we discuss how an explanatory kind of research question is dealt with within the positivist–empiricist framework. In particular, the respective roles of theory (or explanatory framework), data and method are discussed. In section 4, we raise a few issues about normative–evaluative kind of research. In section 5, we briefly discuss the post-positivist approaches in social research, and in section 6 we conclude.

## 2 From practice to methodology

The commonplace view about social research is overwhelmingly explanation-oriented, where the central question is ‘why’. Why is the labour force participation rate of women low in India? Why are some states better at human development than others? Why have so many farmers committed suicide in India in the recent past? Answers to these questions take a causal form, even though the method usually deployed to establish a causal explanation can accomplish the job only imperfectly. Nevertheless, most policy discussions are based on some understanding of the causes and their effects on various outcomes. In other words, the essential nature of inquiry here is *explanatory*. Inquiries of this kind end up indicating or ‘establishing’ some causal connections between choices or actions of agents (individuals, groups, governments, corporations etc.) and outcomes. However, the self-conscious practitioners of statistical or econometric techniques know rather well that at best their techniques establish some *association* between variables, rather than a causal connection. One must take a big leap of faith to claim an associational observation between, say,  $x$  and  $y$ , as a causal one, even though certain econometric techniques, such as the Granger causality test, claim to establish causal connections between variables. Thus, we might self-consciously seek to establish some association between entities, in which case the nature of inquiry would be *associational* or *relational*, rather than *explanatory*.

Besides explanation and finding association, one can identify several other motivations which drive research inquiries. When a study is designed primarily to describe what is going on or what exists, without entering into the analysis of underlying relationships or causal connections that are not so apparent, it is *descriptive*. A question such as ‘how has GDP of India grown in the post-reform period’ falls in this category. To answer this question one has to describe the pattern of growth in India’s GDP between, say, 1991 and the present. However, there is no such thing as ‘pure description’, as description involves conscious methodological choice.<sup>1</sup> As in this apparently simple question, one has to decide on whether the average annual rate of growth or the trend rate of growth should be calculated, whether the period should be divided into sub-periods and the average or the trend growth rates in the sub-periods should be noted and so on.

Different underlying motivations seem to dominate different disciplines. In economics, for instance, prediction is considered to be the most important motivation behind theoretical and empirical inquiry. In mainstream economics, the standard

methodological route is to set up a model of behaviour of agents (individuals, firms etc.). Starting from a set of axioms about behaviour of the agents, conclusions are derived using deductive mathematical logic. The methodological approach is therefore called hypothetico-deductive. Such models based on deductive logic are expected to predict future outcome. This dominant view was made explicit by Milton Friedman in his widely known paper 'The Methodology of Positive Economics' (Friedman [1953]). Friedman argued that the assumptions made by economists while modelling individual behaviour should be judged 'by seeing whether the theory works, which means whether it yields sufficiently accurate predictions', not by the 'realism' of the assumptions. Amartya Sen, however, holds a different view:

Prediction is not the only exercise with which economics is concerned. Prescription has always been one of the major activities in economics, and it is natural that this should have been the case. Even the origin of the subject of political economy, of which economics is the modern version, was clearly related to the need for advice on what is to be done on economic matters. Any prescriptive activity must, of course, go well beyond pure prediction, because no prescription can be made without evaluation and an assessment of the good and the bad.

(Sen [1986, p. 3])

Thus, 'evaluation and an assessment of the good and the bad' gives rise to yet another altogether different kind of inquiry, which is *evaluative*. For an evaluative inquiry one applies certain normative criteria to judge states of affairs. For example, a question such as, 'Is gender inequality more in country A than in country B?' apparently falls in the descriptive category. But on closer scrutiny, it becomes clear that there is no obvious way of assessing gender inequality with a comparative perspective. Even if one restricts oneself to this question, ignoring such related questions as why gender inequality is more in one country than in another, it turns out to be non-trivial as explicit value judgements with moral philosophic underpinnings are deeply involved. Amartya Sen often makes a distinction between evaluative<sup>2</sup> exercises and descriptive-analytic or predictive-prescriptive exercises, as in the earlier quotation, and emphatically points out that the motivation behind the evaluative type of inquiry is no less important than that behind others. The entire theoretical literature on measurement of inequality, poverty and human development falls in this category.

All these types of research inquiries briefly described here roughly fall in the paradigm which can be called *positivist*. In the next section we elaborate on the notion of paradigm and the epistemology of positivism.

### 3 Positivist-empiricist practice

There is no simple formula to establish any connection between specific 'causes' and 'effects'. Three basic ingredients of social research are (1) some *ideas* about

how things are or how change takes place, (2) *data* or observations on ‘facts’ and (3) *methods* that integrate ideas and observations. By *method* we mean a set of tools or techniques informed by an approach which is applied in a research inquiry. But *methodology* is concerned with the framework within which particular methods are appraised. In other words, methodology deals with the broader question of ‘how we know what we know’ and is somewhat close in meaning to what we understand as epistemology. Ideas are obtained from various theories. They may often look like commonsense. But if they are part of a theoretical framework one can expect logical coherence in the ideas, which commonsense does not guarantee.

What is theory? Before we come up with an imprecise answer to this question, it would be helpful if we accept that theory can be defined only within a *paradigm*. Roughly speaking, a paradigm is a combination of a set of underlying beliefs about the ways things are and specific ways of inquiring about how things are, how they change, how they are connected with or influenced by each other and so on. In other words, a paradigm can be identified with specific *ontological* and *epistemological* positions. For many of us who work in what is loosely called ‘development research’, a kind of *positivism* seems to be the underlying paradigm. In this version of positivism the core belief is that reality is out there and that by gathering ‘facts’ it is possible to find out what is happening in reality. The researcher is assumed to stand apart from the observed and produce objective knowledge. How does he or she go about it? First, the researcher identifies separate aspects of reality and expresses them as ‘variables’. Then he or she goes on examining the relationships between variables. This involves both observation and reasoning based on arguments acceptable within the paradigm. Within the positivist paradigm, a theory is expected to answer our ‘how’ and ‘why’ questions in the most generalized way with a coherent logical structure. Generalizability is at the core of theoretical statements.

Someone with an empirical bent of mind and relying less on theory for illumination often tends to say ‘facts speak for themselves’. As a matter of fact, facts hardly speak for themselves. One has to sort out relevant from irrelevant facts at the outset. Without some prior idea about the nature of the phenomena, without some propositions, assumptions etc., there is no way this can be meaningfully done, according to a positivist. Deciding that observation X or Y is relevant marks the start of a theory. In this paradigm, theory means a logically valid chain of reasoning starting from certain premises called postulates. Postulates are taken as axiomatically given and contain certain terms that are representative of persons, organizations, things, actions, states etc. found in the world of experience. A meaningful analysis presupposes that the terms are unambiguously defined.

In this positivist-empiricist paradigm *hypothesis testing* seems to take the pride of place. It is a commonly held view that any proposed research in social science must specify at the outset the hypotheses to be tested. Admittedly, certain types of social research do require the use of hypotheses. They can be useful in helping to find answers to ‘why’ questions and therefore are developed at the outset to set the direction. However, precise specification of the hypotheses is neither necessary nor appropriate in many cases. In particular, when explanation is expected to come