

# Forging “Methodological Inductivism” in the Interests of Better Science: Encouraging Methodological Inductivism as a Harbinger of Meaningful Change in Different Kinds of Scientific Endeavour

Sujay Rao Mandavilli

Institute for the Study of the Globalization of Science

**Abstract:-** We begin this paper by defining various pertinent and relevant terms such as the term inductivism in science, hypothetico-deductivism, and subsequently also provide the definitions of various other terms such as a methodology which naturally also include and encompass terms such as research and scientific methodology, scientific methods, scientific techniques, scientific processes and scientific procedures; we then proceed to lay down the bare essentials of what we would like to call “Methodological inductivism”, and also provide a justification and a *raison d’être* for the same. We also discuss other allied, related and contingent approaches in the market such as method triangulation, methodological holism, methodological individualism, methodological pluralism, etc in a fair level of detail. We also present, list and lay down bare and in great detail, the various steps involved in the aforesaid technique of “Methodological inductivism”, and also analyse and discuss the various advantages of the this approach. We also discuss why this could be a defining characteristic of contemporary science, and could help distinguish modern science from we would like to call legacy science, and discuss how this could propel science to an altogether new trajectory and take it to new heights besides forging a healthier collaboration among scientists and researchers across disciplines and geographies. It could also reduce gaps in a multi-speed civilization and lead to scientific progress at the speed of light.

## I. INTRODUCTION

*“The world is moved along, not only by the mighty shoves of its heroes, but also by the aggregate of tiny pushes of each honest worker” – Helen Keller*

*“It is literally true that you can succeed best and quickest by helping others to succeed.” – Napoleon Hill*

We begin this paper by defining various terms such as the term inductivism and inductive approaches in science (we had discussed this concept in great detail previously, and had contrasted it with deductive approaches as well), hypothetico-deductivism (which refers to the science and art

of formulating hypotheses, and then deriving conclusions therefrom), and subsequently provide the definition of various terms such as a methodology which would include research and scientific methodology, scientific methods, scientific techniques, scientific processes and scientific procedures; we then lay down the bare essentials of what we would like to call “Methodological inductivism”, (which in turn refers to the art and science of collating techniques, methods, processes and procedures in science and aligning them for the greater purposes of a common good) and providing a justification and a *raison d’être* for this approach and technique. This, we believe must be carried out and orchestrated by a small group of dedicated individuals committed to the cause of science, and to the healthy growth and the balanced development of science, and individuals who believe that the time has come to trickle down the benefits of science to the common man, and help and allow it advance social and cultural development everywhere, particularly in regions where social and cultural empowerment is stagnant or lagging.

We also discuss and deliberate on other allied, related and contingent approaches in the market such as method triangulation, methodological holism, methodological individualism, methodological pluralism, etc in a fair and a granular level of detail and relate them to the defined and proposed concepts in our paper as well. We also present, list and lay down bare and in great detail, the various steps involved in the above-mentioned technique of “Methodological inductivism”, and also analyse and discuss the various components and advantages of the aforesaid approach. We also discuss why this could be yet another defining characteristic of contemporary science, and could help distinguish modern science from what we would now confidently like to call legacy science, and could propel science to an altogether new trajectory and take it to new heights besides forging a healthier collaboration among scientists and researchers within and across disciplines and geographies. It could also reduce gaps in a multi-speed civilization and lead to scientific progress at the speed of light, with benefits for society and cultural progress as a whole. We also believe in pragmatism and pragmatic science, and science that can be put to proper use to solve

real-world problems and burning issues of the day. This is somewhat lacking at the present time, but must change in due course as ivory tower approaches get relegated to the background<sup>1 2 3</sup>

#### ➤ *Inductivism and Inductive Approaches*

There are two classical approaches in scientific method and in scientific reasoning. But, what exactly does the inductive method or inductive reasoning (this is also sometimes referred to as just induction) mean? The term inductive is generally used to connote and describe a pattern of reasoning that involves using a large number of specific and diverse observations often in different and diverse contexts and situations, to derive a clear set of consistent patterns and relationships, in order to subsequently arrive a general conclusion or a broad but reasonably comprehensive outline; thus, all forms of conjecture are eliminated, jettisoned and castigated in favour of a systematic and a methodological approach. This approach was originally conceived and developed by the Greek polymath Aristotle some 2300 years ago. We had championed this approach in an earlier paper, and had also held this approach to be vastly superior to the deductive approach, subject of course to time, cost and budget considerations. This assertion is made because inductive approaches involve a large amount of data collection which can be both laborious and time-consuming.

This approach has either spawned other approaches or is related to other approaches such as grounded theory and nomothetic approaches. The latter pertains to theorization and hypothesis-construction. (Trochim 2006) The hypothetico-deductive approach is much more commonly used in the real-world, and inductive approaches are often combined with deductive approaches. To put it in layman's terms, inductive approaches move from the specific to the general, i.e. specificity to generality, while in case of deductive approaches, the order is reversed. (Uggen & Blackstone, 2004) In case of inductive approaches one grand theory is eventually formulated, while in the case of deductive approaches, a theory is tested against new data, and multiple predictions made. Induction is also often correlated with statistical induction and statistical inference. Inductive approaches are often associated with qualitative research, though this is by no means a hard and a fast rule. An inductive-deductive approach (both approaches taken together) is often referred to as a scientific method. Grounded theory, as described by Martin and Turner in 1986, is a grounds-up theory-discovery methodology.<sup>4</sup>

<sup>1</sup> Schutt, R. K. (2006). *Investigating the social world: The process and practice of research*. Thousand Oaks, CA: Pine Forge Press

<sup>2 2</sup> Copi, I.M.; Cohen, C.; Flage, D.E. (2006). *Essentials of Logic* (Second ed.). Upper Saddle River, NJ: Pearson Education.

<sup>3 3</sup> Publishing, Walch (2004). *Assessment Strategies for Science: Grades 6–8*. Portland: Walch Publishing

<sup>4</sup> WWW: The Scientific Method Robert V. Blystone and Kevin Blodgett Department of Biology, Trinity University, San Antonio, TX 78212 Submitted December 7, 2005; Accepted January 3, 2006

#### ➤ *Hypothetico-Deductive Approach*

The hypothetico-deductive method as proposed by the German writer Carl Hempel and others, is a commonly used method or technique used in scientific inquiry, and hypothesis testing and formulation. This technique and approach are said to have originated with the Dutch physicist Christiaan Huygens, but has been greatly refined and reworked upon over the years. According to this technique, a hypothesis is initially formulated using some preliminary data, but one which may not be entirely true or correct in all respects. This hypothesis or premise is then tested with or validated against more and more real-world data. It is then either proven to be entirely or wholly true, is moderately or significantly modified and reworked upon, or completely rejected and castigated. This approach is more closely aligned with the deductive approach and with the principle of falsification but varies more markedly with the inductive approach and grounded theory. This approach is also known as the HD approach in short, or the de facto scientific method. There is yet another approach to reasoning which is known as abductive reasoning, and we had discussed this briefly in an earlier paper.<sup>5 6</sup>

#### ➤ *Nomothetic Approaches*

The terms nomothetic approaches and idiographic approaches are widely used terms particularly in the social sciences. These terms were initially thought to have been used by the German philosopher and intellectual scholar Wilhelm Windelband to describe two distinct approaches to knowledge acquisition. The term nomothetic is commonly equated with generalization, pattern discovery, and the execution of a large number of studies in order to propose and formulate laws and identify other characteristics and traits. The term ideographic, on the other hand, refers to standalone studies. Both nomothetic and ideographic approaches are used in the social sciences; for example, ethnographers mostly use ideographic approaches in the course of their fieldwork. We believe these terms can be widely used in other fields of the sciences as well, but to varying degrees of efficacy. We also then have the concepts of critical, unique and revelatory cases. Critical cases refer to those cases which are critical to the understanding of a particular study; unique cases are those cases which are unique in relation to a context; revelatory cases are those cases which reveal unique facets or aspects pertaining to a study. These two approaches (i.e. nomothetic and idiographic approaches) are fundamentally and essentially as different as chalk and cheese and refer to different philosophical approaches and tendencies to carry out or execute a study.

<sup>5</sup> Millon, Theodore, with Roger D. Davis. (1995). *Disorders of Personality: DSM-IV and Beyond*, 2nd ed. New York: John Wiley & Sons. ISBN 978-0471011866

<sup>6</sup> Evans, C., Carlyle, J., & Paz, C. (2023). Rigorous idiography: Exploring subjective and idiographic data with rigorous methods—The method of derangements. *Frontiers in Psychology*, 13, 1007685. <https://doi.org/10.3389/fpsyg.2022.1007685>

## II. DEFINITION OF A METHODOLOGY

A research methodology (The term is thought to have had its origins in the Latin term *methodologia*, but came into wider English usage around the year 1800) may be defined as a structured and a systematic approach that is used by scientists, researchers and engineers in order to collect, collate, analyse, and interpret different kinds of quantitative or qualitative data to test hypotheses or seek answers to scientific questions. (The term is invariably tied to the idea of research which itself comprises of several activities which, in the words of Clifford Woody and others, involves the constant definition and redefinition of problems, the formulation of hypotheses or proposed solutions; the collection, organization and evaluation of deductions in order to arrive at specific conclusions which are in turn tested to ensure their validity) The term methodology is also sometimes confused with, or used interchangeably with, method, though there are indeed some differences between the two. A research methodology is also akin to a plan for carrying out scientific research methodologically and helps researchers maintain their focus and keep them on track and aligned to their goals. It is also a broader and a more overarching area of study than just a method and can encompass areas and topics as wide apart as data analysis and science communication. Several aspects must be taken into consideration before an appropriate research methodology is chosen, and factors such as cost constraints, time limitations and ethical concerns must also be taken into account and consideration. Research methodologies are often either implicitly or tacitly followed and understood, or explicitly stated, often at the beginning of a paper or in a separately earmarked section which includes aspects such as methodological choices made, data collection tools and methods, and data analysis tools and methods as well.

A well-structured and a comprehensive (also pertinent) research methodology helps ensure the internal and external validity and consistency of research findings besides pointing to high quality research. There are three common types of research methodologies in widespread usage and currency, and these are quantitative methodologies, qualitative methodologies, and mixed-method methodologies, and either of the three can be chosen based on the objective of the study. The term methodology is often more comprehensive (and is also used in a more elaborate and an unrestricted sense) than methods and comprises and encompasses formal studies and analyses of methods (with benchmarks and systematic overviews) as well with accompanying and concomitant processes. It also often refers to a methodologically and epistemologically consistent set or group of processes and methods and is ensuingly wider-arching in scope. The idea of the term methodology stems and emanates from the fact that science and the activities it encompasses, needs to be composed of empirically provable steps and methods, and those which leads to an unbiased and a non-partisan analysis. Somewhere down the line, we believe the core objective and philosophy of science has been lost to the murky waters of parochialism and careerism. As such, a reboot and a comprehensive may be in order.

➤ *Having a Good, a Sound and a Robust Research Methodology has the Following Distinct Advantages:*

- It is useful to other researchers who want the replicate the research or extend it in suitable and meaningful ways and directions.
- A sound and a robust research methodology helps researchers ensure that their findings and outcomes are valid in all contexts and situations, highly reliable and free from all kinds of biases, prejudices and errors.
- It also ties research to ethics and makes sure that research employs ethical methods and is consistent with various principles of ethics at all times, and at all levels.
- It provides complete transparency and traceability; and questions on the research can be answered at any time, and issues quickly and easily resolved and sorted out.
- A research methodology provides a consistent framework and a coherent set of guidelines for researchers to clearly define research questions, define and formulate hypotheses, and define and set objectives.
- It readily helps researchers to identify and ascertain the most useful and appropriate in the context research designs, sampling tools and techniques, and data collection and analysis strategies and methods.
- A good and a robust research methodology also helps researchers in planning their research activities efficiently, and helps ensure optimum usage of time, human and non-human resources.

➤ *Scientific Method*

Methods are much more mundane, prosaic and restrictive than methodologies; they therefore encompass a smaller set of tools and techniques. A methodology, therefore, combines not just bona fide and valid methods, but also adds processes, procedures, tools and techniques onto them in a harmonious and a highly comprehensive and a holistic fashion. A methodology is often more explicit and well-orchestrated than a method, though this may not always be the case. The distinction between a method and a methodology is often sought to be made based on the stage it pertains to or refers to in the reference or a context of a scientific study, but this is again not a rigid or a dogmatic rule or supposition. However, methods are the vehicles and the foundational pillars methodologies rest on, and ride upon. The latter will have minimal meaning without the former. The term method is thought or said to have been derived from the French word *la methode*, but which can be further traced back to older Latin and Greek roots. The ancient Greek word *methodus* refers enquiry, particularly scientific enquiry and scientific investigation. The famed Oxford English Dictionary defines the term scientific method as ‘as a method or procedure that has characterised natural science since at least the seventeenth century, consisting of systematic, methodological, structured and careful observation, measurement and experiment, and the formulation, testing and modification of developed. Hypotheses.’<sup>7</sup>

<sup>7</sup> Sperber, Dan, 1997. “Individualisme méthodologique et cognitivisme,” in R. Boudon, F. Chazel & A. Bouvier (eds.)



A scientific method (encompassing various methods such as survey methods, experimental methods, and historical methods) may therefore be defined as a set of general procedures or well-defined steps from which a systematic approach logically emanates. It also provides a context and a direction for scientific research. It also contains a series of steps such as formulation and the definition of a hypothesis, gathering and collection of data both for and against the hypothesis from various reliable sources, testing the hypothesis, establishing and setting the relationships between dependent and independent variables, refining the hypothesis further, etc. In the view of researcher George Lundberg, scientific method consists of three fundamental basic steps, namely systematic observation over a protracted period of time, classification of data and analysis and interpretation of data. Through these three steps, scientific method accomplishes not only verifiability of the facts, but also cements trust in the validity of conclusions. (Lundberg 1946) The scientific method was developed primarily during the renaissance and the enlightenment periods, and several important scientists like the sixteenth century philosopher Francis Bacon (and author of "Novum organum") contributed to the development of scientific method. There is also some variation between scientific method as it applies to the social sciences and scientific method as it applies to the physical sciences, though we would like to see the chasm being bridged to the extent possible or practicable, in due course.<sup>8</sup>

#### ➤ *Techniques*

A technique is a set method of carrying out a task or performing a task. The word technique may also refer to skilfulness, proficiency, expertness and dexterity. The natural connotation of the word and the term technique lays great emphasis on the actual performance and execution of a task. In a positive connotation, it is also associated with genius, mastery, craftsmanship and talent. A scientific technique therefore refers to and encompasses any systematic way of obtaining information about a scientific topic or a study that is of a fundamentally scientific nature in order to obtain the desired information or a desired result.

#### ➤ *Process*

A process refers to a series of systematic and defined steps or actions (or a progressive and interdependent steps or action items) that are undertaken in order to achieve a particular end goal or objective. Processes may sometimes encompass procedures, and procedures may sometimes be subservient to them. Processes are also said and thought to be subservient to a scientific method and a scientific methodology, and the last two are said to be of a fundamentally higher order. In the natural world, the term process refers to a naturally occurring series of events, though in the scientific world, the steps forming a process of steps are human defined. Some thinkers like Paul

Feyerabend and Karl Popper have spoken against the perceived benefits of a highly structured or inflexible methods, methodologies, processes and procedures; consequently, science and scientific method have largely and generally become more free form in the last couple of decades.

#### ➤ *Method Triangulation*

The idea of method triangulation is used in qualitative research, quantitative research as well as mixed methods research. The idea of triangulation connotes the use of multiple methods in order to develop a comprehensive, structured and multi-layered understanding of phenomena (Patton, 1999). As a part of this approach, multiple hypothesis, theories, methods, and data sets are used to understand, comprehend and thoroughly grasp a research question. This approach may at times be complex and uneconomical, but can help increase the validity, the credibility and explanatory power of research. It can also help minimize cognitive biases, and errors of perception, omission and commission too. Altrichter et al. state that triangulation "gives a more detailed and balanced picture of the situation." (Altrichter 2008)<sup>9</sup>

#### ➤ *Methodological Holism*

The term methodological holism refers to an approach and a fundamental orientation in research and detailed systematic analysis (particularly in the social sciences, but also in the social science, wherein the avowed objective, goal and aim of the research or the study is to understand and investigate the phenomenon under study in its totality as unique and apart from its component parts, rather than to break it down into smaller and manageable parts (usually known, easily observable and understandable or familiar parts and components). This approach is ancient and can be traced back to the Greek philosopher Plato. When extended to the realm of social studies. The properties of a society or a culture should be understood by studying and analysing that culture as a whole, not just its parts individually.<sup>10</sup>

#### ➤ *Methodological Individualism*

In different fields of the social sciences, the term "methodological individualism" refers to a framework that ascribes social phenomena to the aggregation of performance by individual actors. The importance of group dynamics is greatly underestimated in this approach which is essentially a micro-level or a bottom-up and a highly individualistic approach. This approach was introduced by Max Weber, and was later expanded upon by other thinkers, researchers and scholars. Needless to say, this approach may be somewhat limiting and restrictive in its breadth and scope. Some researchers also take the term to mean the usage of a single methodology or a single class of

Cognition et sciences sociales, Paris: Presse Universitaires de France, pp 123–136.

<sup>8</sup> Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers' Distributors

<sup>9</sup> Rothbauer, Paulette (2008) "Triangulation." In Given, Lisa (Ed.), "The SAGE Encyclopedia of Qualitative Research Methods." Sage Publications. pp. 892-894.

<sup>10</sup> Altrichter, H., Feldman, A., Posch, P. & Somekh, B. (2008). *Teachers investigate their work; An introduction to action research across the professions*. Routledge. p. 147. (2nd edition)

methodology in scientific research as opposed to more composite and amalgamated ones. We therefore consider it in our paper.

#### ➤ *Methodological Pluralism*

The term Methodological pluralism refers to an approach wherein a variety of sources of information are consulted and used in research, including the belief that no one research method is inherently superior to another, and the belief that no one research methodology will suffice to explain social or non-social scientific phenomena as data and methods need to be cross-verified from a wide variety of sources in order to enhance validity, reliability and consistency. (Barker & Pistrang, 2005) The term “pluralism” also has various ontological and epistemological connotations, and in reference to a study of entities; these connotations and classes of definitions are however somewhat far removed from our approach.<sup>11 12</sup>

#### ➤ *Steps in this Approach*

The following sequential steps would constitute a part of what we would like to refer to as “methodological inductivism”.

- Reviewing literature: The first step would be to review all the essential, basic and the advanced literature in the market with respect or regard to the topic in question in order to understand the nature of the work that has previously been carried out. Therefore, a review of past scientific studies would constitute an essential part of this approach.
- Therefore, all past scientific studies must be reviewed in order to elicit all steps pertaining to the scientific method. Thus, all explicitly and implicitly defined and stated methods and methodologies used must be understood. The techniques, processes and procedures used in the scientific study in question must also be listed out if they are of some use to posterity and the general advancement of science. All the steps in this part and in the previous part must also be executed or carried out each time a new study is conducted. Thereby, essentials must be extracted from all studies to the extent that they are pertinent to our approach.
- As a part of this process and approach a repository of methods, processes, and techniques must be maintained, inventorized, classified and catalogued appropriately and in a structured and a relevant manner.
- Appropriate qualifiers and caveats must be used. For example, it must be stated in which circumstances and contexts methods, methodologies, tools and techniques should be used, and in which contexts methods, methodologies, tools and techniques should not be normally used.
- Appropriate disclaimers can be inserted if the reviewer does not subscribe to the methods, methodologies, tools and techniques fully or has some reservations.
- Two or more studies should be reasonably interlinked if ratification of old research through data and evidence can be done.
- New methods, methodologies and techniques can be created by combining two old methods, methodologies and techniques.
- The reviewer must identify core methods, methodologies, tools and techniques.
- The reviewer must identify peripheral and auxiliary methods, methodologies, tools and techniques, and those that are unlikely to be used in the normal course of events.
- The reviewer must Identify methods, methodologies, tools and techniques to be used in special situations.
- The reviewer and assessor may merge methods and techniques, but only in situations where it is justified (Method aggregation).
- Method tweaking and modification (Method modification) may also be carried out to make it more widely applicable in a wider variety of contexts and situations.
- These approaches may also be baked into scientific method if possible.
- Annotations can be provided, if required: Explanatory notes and guidance notes to other researchers can be meaningfully provided in situations where it would make eminent sense to do so.
- Thus, the use of sociological ninety ten rule can be carried out here. We could even refer to it as the “Methodological ninety ten rules”. Thus, main methods, and supplementary methods or special methods must be identified.
- Databases and meaningful repositories of techniques, methods and methodologies must also be built up in parallel, but these must naturally serve some practical use.
- Dubious or untested methods and methodologies can be left out, or qualified or even chasticized.
- Advantages and benefits of this approach
- Can provide a heuristic tool to researchers: This approach and technique can provide a valuable heuristic tool to researchers by building up a dynamic databases of methods, methodologies and processes.:
- This approach can lead to inventories, databases and repositories of methods, methodologies and processes being built up over a period from which researchers can easily and readily pick and choose.
- Healthy collaboration and camaraderie among researchers: This approach fosters a healthy collaboration and camaraderie among researchers by reducing and modulating a wide diversity of perspectives into a narrower, albeit healthy one.
- Can lead to more reliable scientific output: This approach can lead to more reliable scientific output as time-tested techniques are widely disseminated and used.
- Can lead to an expansion of scientific output: This approach can potentially lead to an expansion of

<sup>11</sup> List, Christian and Kai Spiekermann, 2013.

“Methodological Individualism and Holism in Political Science: A Reconciliation,” *American Political Science Review*, 107: 629–642

<sup>12</sup> Parsons, Talcott, and Edward Shils (eds.), 1951. *Toward a General Theory of Action*, New York: Harper & Row.

scientific output as more reliable methodologies, tools and techniques are gainfully employed in all scientific endeavours and pursuits.

- Can eliminate bad research design or bad research strategy: Can eliminate bad research design, and lead to better research by design, better research by default, and better research by conceptualization.
- Can lead to methodological and institutional coherentism: This approach can lead to methodological and institutional coherentism by pre-empting a divergence of paths, and this was a concept we espoused and propounded in an earlier paper. We would also like to see some form of meaningful coherentism emerge across a wide variety of disciplines, but this would in all likelihood, take time.
- Can lead to cross-cultural research design: This approach can lead to a better cross-cultural research design, as ideas and views from researchers from all parts of the world can be culled and put to productive use.
- Can lead to easily available situation or context-specific solutions: This approach can lead to easily available situation or context-specific solutions as a wide variety of methods and techniques are available for selection.
- Can improve scientific method in general: Needless to say, this approach can greatly improve scientific method in general: This is a fundamental benefit of our approach which can be harnessed and eminently realized.
- Can help revisit and revalidate old research: This approach can help revisit and revalidate old research: Thus, the inherent and intrinsic strengths along with fundamental weaknesses and limitations can be assessed and reassessed from time to time.
- This approach can also inevitably lead to methodological pluralism and method triangulation; these are two concepts we discussed threadbare in our paper. This approach can also lead to methodological holism as well.

### III. CONCLUSION

We had begun this paper by defining various terms such as the term inductivism in science, the oft-utilized and oft-cited concept of hypothetico-deductivism, and had subsequently furnished the definition of various terms such as a methodology including research and scientific methodology, scientific methods, scientific techniques, scientific processes and scientific procedures; we had also laid down the bare essentials and fundamentals of what we had called “Methodological inductivism”, and had provided a justification and a *raison d’être* for this concept. We also discussed other allied, related and contingent approaches in the market such as method triangulation, methodological holism, methodological individualism, methodological pluralism, etc in a fair level of detail. We also presented, listed and laid bare and in a fairly great level of detail, the various steps involved in the technique of “Methodological inductivism”, and also analysed and discuss the various advantages of the aforesaid approach. We also discussed why this could be a defining characteristic of contemporary science and could help distinguish modern science from what we called legacy science, and could propel science to an altogether new trajectory and take it to new heights

besides forging a healthier collaboration among scientists and researchers. We also explained why It could also reduce gaps in a multi-speed civilization and lead to scientific progress at the speed of light. All said and done, this paper would constitute an important part of our long-standing globalization of science movement. We leave it to other researchers to take forward this approach in meaningful ways.