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Making the use of Inductive Approaches, Nomothetic Theory-Building and the Application of Grounded Theory Widespread in the Social sciences: A Guide to better Research and Theorization in the Social Sciences

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Abstract:- This paper evaluates both inductive and deductive methods with respect to theory building particularly in the social sciences. The former is an approach for drawing conclusions by proceeding from the specific to the general, while as per the latter, a hypothesis is usually developed and subsequently tested based on further evidence. This paper also evaluates nomothetic approaches in opposition to idiographic or stand-alone approaches with respect to theorization or theory-formulation as well, and recommends that a combination of the two be used. It also discusses the application of grounded theory in social sciences research besides other approaches to theorization as well. While choosing a appropriate research method is the prerogative of the researcher, based on the research question involved, the researcher's personal inclinations, besides time and cost considerations, this paper hopes to generate awareness of more globalized and inclusive approaches to scientific endeavour. This is as such, our fifth paper on the philosophy of science, and extends our earlier work which primarily focused on the importance of the social duties of every researcher and scholar, the principle of exceptionism or the sociological ninety ten rule, the certainty uncertainty principle, and the importance of cross-cultural research design. This paper is also therefore the logical culmination of all our earlier endeavours, and forms an integral part of our "Globalization of science" movement, with particular emphasis on the social sciences.

I. INTRODUCTION

This paper evaluates both inductive and deductive methods with respect to theory building particularly in the social sciences, though most concepts and ideas can easily be carried forward to other sciences as well. The former, which is also akin to inductive reasoning, is a bottom-up approach for drawing conclusions by proceeding from the specific to the general (observations are culled from various contexts, and patterns and generalizations sought without compromising on diversity of ideas and opinion), while as per the latter, (this is likened to a top-down approach) a hypothesis is usually developed and subsequently tested based on further evidence in different contexts. Loosely defined, inductivism is "the idea that theories can be derived from, or established on the basis of, facts." .An auxiliary approach is the hypothetico-deductive approach which is widely used in the sciences: according to this approach, a hypothesis is first proposed, and proven or falsified as the case may be, based on further empirical data and observations.

This paper also evaluates nomothetic approaches (based on nomology or law-building) in opposition to idiographic or stand-alone approaches with respect to theorization or theory-formulation as well, and recommends that a combination of the two be used. It also discusses the application of grounded theory in social sciences research (This approach generates research output and derives laws based on practical, real-world data) besides other approaches to theorization as well. While choosing a appropriate research method is the prerogative of the researcher, based on the research question involved, the researcher's personal inclinations, philosophies and ideals besides any other considerations such as time and cost considerations, this paper hopes to generate awareness among researchers and scholars on more globalized and inclusive approaches to scientific endeavour, which we believe can have a ripple and cascading effect on the quality of scientific output. It will also reduce the latency time for the acceptance of new scientific ideas, and can lead to "scientific progress at the speed of light." It would also endow scientific activity with greater respectability across culture and civilizations. Thus, although many researchers may already be aware of these research methods and techniques, this paper seeks to generate a greater awareness on the need to adopt them more widely in the interests of culture-neutral scientific output.

This is as such, our fifth paper on the philosophy of science, (and our fourth on scientific method) and extends our earlier work on the philosophy of science which was primarily focused on various topics and issues in the sciences such as the importance of the social duties of every researcher and scholar above self-centric considerations, the principle of exceptionism also known as the sociological ninety ten rule, the certainty uncertainty principle for the social sciences, and the importance and key characteristics

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of cross-cultural research design. All these proposals were aimed at improving the quality of research particularly in the social sciences. This paper is also therefore in a way, the logical culmination of all our earlier endeavours over the past two decades, and forms an integral part of our "Globalization of science" movement, with a particular emphasis on the social sciences. Although this paper generates no new theories, it emphasizes certain ideals with the objective of generating better scientific output. This paper also espouses the need to integrate the principles of this paper with the principles proposed in our earlier papers, so that truly better quality scientific output can result in diverse scientific pursuits and cultural contexts, with a resultant improvement in the quality of life in diverse social and cultural contexts. [1] [2] [3] [4] [5] [6] [7]

II. INDUCTIVE APPROACHES

The idea of inductive reasoning was first developed by Aristotle around 300 BC in "Posterior Analytics". The term he used was epagoge, which Cicero translated into Latin as induction. In 1620, Francis Bacon developed another approach to inductivism that involved the observation of minute and varied observations to uncover nature's secrets. William Whewell found enumerative induction to be not very convincing and, despite the dominance of inductivism, formulated the concept of superinduction where facts could be bound together by superinducing upon them what he called a new conception. This could be flawed or accurate, but exhibit consilience or the prediction of inductive generalizations in multiple areas. In the 1870's, C S Pierce recognized induction, but proposed abduction in addition to induction. More than half a century later, the philosopher Bertrand Russell stated that the principle of induction was neither rationally provable nor empirically verifiable, but should be accepted because of its natural evidence and consequences. Around the year 1960, Ray Solomonoff proposed the theory of universal inductive inference, a theory of prediction based on observations. It could, for example, predict the next symbol based upon a given series of symbols.

The major difference between inductive and deductive reasoning is as follows: On one hand, inductive reasoning aims at developing a new theory based on grounds up evidence, while on the other hand, deductive reasoning aims at testing or ratifying an existing theory. (Trochim 2006) To put it differently, inductive reasoning moves from specific observations taken from diverse contexts and situations and eventually seeks to make broad generalizations from them. Inductive reasoning also makes use of participants or subjects views and then seeks to weave wider and broader inter-connected themes. It therefore accords great importance to observation, and uses observed or measured characteristics of individuals and social phenomena to make generalizations. Deductive reasoning works the other way around, and is based on the concordance of multiple premises that are generally held to be true. It makes a logical conclusion or a tentative, preliminary and working hypothesis based on such premises, and tests such premises further based on additional data collected. These two approaches are therefore known as the bottom-up approach and the top-down approach respectively. (Creswell and Plano Clark 2007) These two approaches are commonly used in different types of research, and it is not uncommon to combine them as well in different meaningful and productive ways. Inductive approaches are however much more common when one has to start from scratch, or when there has previously been no data or evidence accumulated or built up, or when there is no pre-existing theory to test. Deductive reasoning makes much more sense when one has a rough or a crude hypothesis to test.

The first step involved in inductive reasoning is observation. Different types of observations may be made in diverse contexts. This type of approach can also be logically and meaningfully followed in a wide variety of areas of study; for example we may observe that a particular example of a model of car produced by a certain manufacturer has a high number of manufacturing defects. We may also observe that a particular flight operated by a particular carrier is delayed on a particular occasion. The second stage is an inductive approach is to seek patterns; for example, we may observe that several other examples of the same vehicle produced by the same manufacturer have a large number of manufacturing defects, or that flights operated on the same route by the same airline get delayed on many occasions. Explanations are also sought to explain patterns of observations, and these would represent hypotheses or theories, which may be one or many, and simple or complex in nature. The next stage is to arrive at preliminary conclusions based on a large number of observations. Thus, abstract and universal laws on the operative dynamics of the social universe are arrived at. These preliminary conclusions are further tested to arrive at

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[2] The scientific method: An evolution of thinking from Darwin to Dewey, Henry. M. Cowles, Harvard University press, 2020
[3] Research Methodology: Tools and techniques, CR Kothari, New Age Publishers, Second revised edition
[4] Operationalizing cross-cultural research design: Practical, cost-effective, and a minimalistic application of cross-cultural research design to minimize cultural bias in research and reconcile diverse viewpoints IJISRT, April 2023 Sujay Rao Mandavilli
[5] Social Responsibility over Academic freedom: Emphasizing Ethics and Codes of Conduct geared for a Scholar's duties towards science, society and the education system in Twenty-First Century Science Sujay Rao Mandavilli IJISRT September 2022
[6] Unveiling the Sociological Ninety-ten rules for Social Sciences research: Towards better hypothesis formulation in the Social Sciences in the interests of higher quality research and intellectual multi-polarity Sujay Rao Mandavilli Published in IJISRT, February 2023
[7] Elucidating the Certainty uncertainty principle for the Social Sciences: Guidelines for hypothesis formulation in the Social Sciences for enhanced objectivity and intellectual multi-polarity Sujay Rao Mandavilli IJISRT, March 2023

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a final conclusion. Often, principles and broad generalizations are also drawn from these conclusions, and these may be applied to the entire universe or population. These are known as inductive generalizations. The truth of a conclusion in an inductive argument is probable. In a deductive approach, it may be more certain, if the premise is correct.

Inductive reasoning is widely used in qualitative research (where it is often indispensible), though it may sometimes be used in quantitative research as well. This approach is also to a certain extent is compatible with both positivism and post-positivism. Positivism or sociological positivism which was formulated chiefly by August Comte holds that facts and laws can be derived from sensory experience, and that societies operate and function on the basis of certain set laws much like the physical world. The doctrine of postpositivism on the other hand, argues that the identity, of a researcher influences what they observe and impacts their conclusions as well. Postpositivism therefore, seeks to pursue objective answers by recognizing, and work within the operating framework of such biases. It is also compatible with phenomenology which holds that knowledge is subjective and arises from the lived experience of human beings. It is also compatible with intersubjectivity the main postulate of which is subjectivity. Subjective data is not based on facts, but rather on a person's beliefs and views, and is thus open to further reinterpretation. These can also at times be systematically studied, and meaningful conclusions drawn. On the other hand, anti-positivism or interpretivism as it is sometimes called, argues that objectivity is impossible in the social sciences; this as such, represents an extreme position or a point of view.

However, by our approach, samples must be drawn from a wide variety of sources, and samples must be obtained scientifically taking all cultural contexts and considerations into account. We had discussed the bucketing and categorization of cultures in an earlier work. Thus, the approach we recommend is a much more scientific, systematic, comprehensive and culture-sensitive variant of the standard inductive approach. Thus, the sampling strategy must be comprehensive, and must include a wide variety of cultures, since our emphasis has always been on cultural variation. However, if a research activity is applicable only to a culture or a set of cultures, it must explicitly state so. In any case, not all research would study phenomena across the entire gamut of world cultures (studies are typically narrower in scope, though broader generalizations may eventually be made), and this would also be time-consuming and expensive. If this kindly of approach is followed, it would in our opinion and view, be vastly superior to the deductive approach. Thus, the related errors of hasty generalization (in such a case, a conclusion is attempted to be drawn about all or many instances of a phenomenon on the basis of just one or a few instances of that phenomenon), faulty generalization (for example, if even a large sample shows only grey cats, one may erroneously conclude that all cats are grey; likewise, if the tossing of a two sided coin throws up tails one hundred times consecutively, there is no reason to believe that the next toss will not throw up heads) and biased sample (or non-representative sample, or a sample that favours a certain group of people; this can happen due to a poor sampling strategy, but we emphasize a lack or cultural awareness) must be avoided at all costs. Another related concept is that of inductive learning; this is essentially the discovery of new rules by observing a large number of examples. This is in marked contrast where students or learners are given a set of rules, and asked to apply them in different contexts and situations.

Patterns cannot always be drawn, and over-generalizations can be fallacious. Thus, exceptions must be actively sought for every hypothesis or observation, and we had referred to this as the 'Sociological ninety-ten rule', or exceptionism. A class of observations or phenomena may warrant to be studied separately, and exceptions can be synchronic or diachronic. Theorization and generalization can also prove to be problematic in some cases. However, inductive reasoning can remain a valid tool for identifying patterns, and identifying various types of exceptions to those patterns as discussed by us in that paper. Wherever this is not possible, idiographic study can be used. All this can reduce the risks and dangers associated with confirmation bias which can sometimes arise from a deductive process, or a hypothetico-deductive approach. As always, cost and time considerations must be taken into account too, but some research questions may warrant very detailed answers, and in such cases, the time and effort spent on research can be justified. [8] [9]

Inductive reasoning in contrast to deductive reasoning allows for a conclusion to be false, even if all of the premises are true. Therefore, in inductive reasoning, an argument's premises can never guarantee that the conclusion is true; therefore, inductive arguments are never conclusive, but can be modified as new data emerges. On the other hand, an argument is considered to be strong when, assuming the argument's premises are true, the conclusion is most likely to be true. An inductive argument is often called plausible, probable, likely, justified, or reasonable, but never absolutely certain. This type of a reasoning may also create other problems at times; for example, we may argue, based on an analysis of existing life forms, that all life forms may depend on water in some way; this may be eventually be falsified as we may discover some form of life that does not need water. Thus, the limitations of this approach have been pointed out by David Hume, Karl Popper, and other philosophers of science, though their observations have been criticized as well. It may have been indeed likely that they were looking at the whole issue from the prism of mathematics or logic. We also add the dimension of culture here, and state that an argument is more sound for any or most social science research studies, if all cultural considerations and exceptions are taken into account. Since all variations cannot be known or predicted,

[8] Publishing, Walch (2004). *Assessment Strategies for Science: Grades 6–8*. Portland: Walch Publishing

[9] Copi, I.M.; Cohen, C.; Flage, D.E. (2006). *Essentials of Logic* (Second ed.). Upper Saddle River, NJ: Pearson Education.

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conclusions all always uncertain, or subject to change. This is the way to go in social sciences research, even though conclusions are subject to the availability heuristic and the predictable-world bias (order is presumed to exist among observations, while that may not be the case), the strength of conclusions can improve greatly with the passage of time, or can even be modified wherever necessary; inductive logic is therefore, not truth preserving.

Formal rules of inference must also be developed as a part of the inductive approach, and some confirmation bias can also exist. Of course, other social science research techniques can also be used, and critical, unique and revelatory cases can also be studied. Cultivating and inculcating an inductive mindset is also essential for the development of a scientific temperament. However, the reliability of conclusions reached increases as the qualitative, and not just quantitative scope of data increases. This is also related to the principle of statistical inference which is a method of making decisions regarding the parameters of a population, based on a random sampling.[10] [11]

The types of inductive reasoning include generalization, inductive prediction, analogical argument, statistical syllogism, and causal inference, besides enumerative induction and eliminative induction. Let us now examine these concepts one by one.

- *Inductive Generalization*

An inductive generalization takes as its starting point, a premise about a sample and reaches a conclusion about the entire population taken as a whole. The observation or a set of observations that are obtained from a sample or a set of samples which are scientifically arrived at, are therefore projected onto the broader population as a whole. For the achievement of a high degree of accuracy of reasoning, the sample size (or number of people in the sample size), as well as the diversity of the sample are of paramount importance, and these need to be significantly and substantively large and represent various characteristics of the population as well. Thus, the sample must be statistically representative of the entire population. This approach is often known as statistical generalization, and this approach often leads to statistical projections. This approach can also be combined with qualitative research techniques (i.e. research that is based on non-numerical data, and research that captures people's attitudes, perceptions, beliefs and feelings), and often, anecdotal evidence (evidence based on individual experience and observations) which leads to anecdotal generalization can be used as well, though this is subject to cognitive bias, or other fallacies such as argument from anecdote.

We however recommend that a wide variety of qualitative techniques be applied in the social sciences as these would suit most fields of the social sciences much better, However, quantitative techniques can sometimes be used; quantification techniques as applied to the social sciences can be used as well for some kinds of analysis; these ascribe numerical values to a set of observations. Operationalization techniques, on the other hand, turn abstract phenomena into precise and measurable values. These are sometimes used in social sciences research as well. [12]

- *Inductive Prediction*

An inductive prediction usually draws a conclusion about a future, current, or past instance based on a pre-existing sample of instances. An inductive prediction also relies on a data set consisting of specific instances of a phenomenon, and makes predictions about aspects that are not yet known. However, the inductive prediction concludes with a statement regarding the probability that a single instance may or may not have an attribute shared or not shared with other instances. This approach also expects that the future will be analogous to the past in many ways, and makes predictions based on past instances.

- *Analogical Arguments*

Argument from analogy or analogical arguments is another very common type of inductive argument or reasoning, in which perceived similarities are used to infer further similarities that are yet to be observed. This approach was first explored by John Stuart Mill and others. Analogical reasoning or induction is widely used for decision making in the real world, and this type of reasoning is used in the sciences as well. For example, if a person is happy with a Toyota car, he may decide to buy one more, and become a loyal customer. In science, experiments on laboratory rats are based on the premise that physiological similarities between rats and humans exist, and that these lead to certain similar reactions to a drug. We can also argue, based on experience that better educated peop0le are less superstitious, or that people from poorer countries produce lower quality research. Analogical reasoning is not usually guaranteed, meaning results are only highly probable. This also lends itself to a false analogy at times, which often greatly weakens arguments from analogy. Sometimes, existing theories can be applied in new contexts using arguments from analogy. This method has also spawned other derivatives such as the Geometric method.

- *Statistical Syllogism*

A syllogism is a type of logical argument or reasoning that uses a certain form of reasoning to arrive at a conclusion based on propositions that are assumed or held to be true. A statistical syllogism which is also otherwise known as proportional syllogism (or direct inference) is a type of a non-deductive syllogism, and this type of

[10] A general inductive approach for qualitative data analysis David R. Thomas School of Population Health University of Auckland, New Zealand

[11] Compare and Contrast Inductive and Deductive Research Approaches By L. Karen Soiferman University of Manitoba April 2010

[12] Newton, Issac (1999) [1726 (3rd ed.)]. Philosophiæ Naturalis Principia Mathematica [Mathematical Principles of Natural Philosophy]. The Principia: Mathematical Principles of Natural Philosophy

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syllogism contrasts quite markedly with deductive syllogism. Inductive syllogism argues, using inductive reasoning, from a generalization that is held to be true for a particular case, and often uses qualifying words such as almost, never, frequently, often, rarely and so on. For example, if from a large population of multi-coloured balls, a large sample of balls is drawn, and are found to be only red or yellow. It is argued using this method that the population consists entirely of red and yellow balls. Thus, it is also possible for the premises to be true, and the conclusion false; however, this is unlikely in most cases. [13]

III. CAUSAL INFERENCE

A causal inference is a field of inquiry that seeks to draw a conclusion regarding the presence or absence of a causal connection based on the conditions of the occurrence of an effect. It may also study the underlying assumptions involved, and make predictions as necessary. A proof of the correlation of two things may often indicate a causal relationship between them, but additional factors must usually be taken into consideration in order to establish the nature of the causal relationship. The phenomenon of causal inference is applicable to a wide variety of sciences, and several new techniques to determine causality have been proposed in recent decades.

- *Enumerative Induction and Eliminative Induction*

It is also necessary to talk about Enumerative Induction and Eliminative induction. Enumerative induction is a widely used method of inductive reasoning in which a conclusion is constructed depending on the number of instances that support it. Therefore, the conclusion becomes stronger and stronger if more and more instances supporting it are found. For example, since all forms of life known to man till date are composed of cells, it is reasonable to conclude that all other forms of life not yet discovered will be comprised of cells, too. This form of induction is often synonymous with simple induction or simple predictive induction, and is a type of inductive generalization.

Eliminative induction (which is sometimes also referred to as variative induction), is another method of inductive reasoning in which a conclusion is typically constructed on the basis of a wide variety of instances that support it. This can be contrasted with enumerative induction, because unlike it, eliminative induction is reasoning based on different kinds of instances that support a conclusion, and not just the number of instances that support it. The strength of conclusions increases based on the increasing number of instances found to support it in some way. This type of inductive reasoning also typically uses a wide variety of methodologies such as quasi-experimentation to evaluate rival hypotheses as well, and is generally held to be a very important part of the scientific method. Although, often, in the real-world, rival hypotheses are sought to be eliminated, we have always argued that different explanations can apply in the real-world in different contexts, particularly different social and cultural contexts. This represents our core philosophy, and is at the heart of our belief system. [14] [15] [16] [17]

- *Deductive Approaches*

Deductive reasoning, also called deductive logic, is another kind of approach to logical reasoning in which a researcher progresses from general ideas to specific logical conclusions, and also often draws inferences as well through techniques combined in “rules of inference” which are definitory rules. This philosophy of science which accords primacy of position to deductive approaches is known as deductivism. Several prominent theorists such as Rene Descartes contributed to the development of the deductive method, with contributions also made by Gerhard Gentzen, Stanislaw Jaskowski and others.

Prominent rules of inference are Modus ponens (affirming the antecedent) and Mods tollens (the law of contrapositive). It is usually contrasted with inductive reasoning, where the researcher starts with specific observations and arrives at general conclusions. It is usually used to test an already pre-existing or pre-developed theory rather that to develop a brand new one. Thus, a pre-existing theory is a starting point for deductive research. The idea of deductive reasoning is often synonymous with the English verb to deduce, while the idea of inductive reasoning is often synonymous with the English verb to induce. An example of a testable or falsifiable hypothesis could therefore be one that low-cost airlines have a poor safety record. Further data is then collected (and subsequently analyzed) to further test and ratify the hypothesis; sometimes data is also collected that will refute the hypothesis, or cause it to be rejected.

The data collected forms a part of a research strategy that is used to confirm or refute the hypothesis, and draw further conclusions as applicable. Data can also have expected patterns, and attempts are therefore usually made to fit observed data into these expected patterns. Therefore, the conclusions are true if the premises are true, and the method of reasoning is also correct; Inversely, if the conclusion is false, either the premise is false, or the reasoning is invalid. Therefore, the argument "all frogs are reptiles; no cats are reptiles; therefore, no dogs are frogs" is always true because both its premises are true. Invalid forms of deductive reasoning are also referred to as fallacies. The relationship between a premise and a conclusion is often referred to as a logical consequence. This idea was explored in detail by the logician and mathematician Alfred Tarski.

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[14] Research methodology: A step by step guide for beginners , Third edition, Ranjit Kumar, Sage publications, 2011

[15] Research design: Qualitative, quantitative and mixed method approaches, John W. Creswell, Sage publications, fourth edition, 2014

[16] RESEARCH METHODOLOGY: TOOLS AND TECHNIQUES Dr. Prabhat Pandey Dr. Meenu Mishra Pandey © Bridge Center, 2015

[17] Fundamental of research methodology and statistics, Yogesh Kumar Singh, New Age publishers, 2006

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The conclusions are sometimes valid in a wide variety of situations, and usually, some degree of objectivity does result. The time and effort involved in this method is usually much less than that of inductive reasoning, and as such, it is extremely useful when time is the constraint. However, this approach, though widely used in mathematics and the computer sciences, may not be suitable for social sciences studies, and we therefore strike a cautionary note here. These approaches may lead to over-generalizations and confirmation bias as well, as a wide variety of possibilities and perspectives may be overlooked. It may also be important to mention here that the field of cognitive psychology is used to formally investigate the mental processes responsible for deductive reasoning. Overall, deductive reasoning is different from ampiliative reasoning which comprises inductive reasoning and abductive reasoning. [18] [19] [20]

IV. DRAWBACKS OF DEDUCTIVE REASONING

Deductive reasoning may lead to faulty decisions or errors may be made at times in reaching conclusions. Thus, for this method to be successful, a wide variety of comprehensive literature must be the starting point, but this may not always be available. The process as a whole may therefore, often lend itself to errors, and erroneous conclusions may be reached. If a major statement is false or invalid, it must logically also follow that the conclusion may not also make sense. Also, this kind of method is usually applicable to fields of study such as mathematics, logic, cognitive sciences and other precise sciences, (it also has some applications in intelligence testing and artificial intelligence) though it may have some application in historical studies. It may not make much sense in most fields of the social sciences such as Economics, Sociology and Psychology. It therefore, may have limited application when personal opinion and subjective interpretation is involved. It also may not be useful where new and hidden information needs to be discovered, and as such not information-discovering, though existing information may at times be presented in new ways. Also, for qualitative research, a purely deductive approach would not be preferred, and an inductive approach would be required as the research problem may itself be reformulated after the process of data collection has begun. However, researchers have half-knowingly and erroneously succumbed to the temptation of using this approach in many fields of social sciences as well leading to half-conclusions or outright misleading conclusions based on a narrow Euro-centric context. It does not require much intelligence to deduce this, and Eurocentrism in science which began around four centuries ago, was either blind or oblivious to the realities of the other parts of the world.

This approach appeared to have been used fallaciously and unreasonably in other fields of research far removed from Economics such as a study of the Aryan problem where data on replacement of languages in outlying regions (outside the Central Asian urheimat from where migrations are postulated to have taken place) must be collected systematically, and an inductive approach followed. Alternatively, researchers could have qualified their work as being applicable for certain contexts only, most but did not do so; attempting to impose conclusions drawn from a limited, European context is indeed problematic, and must rapidly and abruptly come to an end. This approach may also be indirectly tied to other undesirable consequences such as scientism, as western cultures tried to project their intellectual superiority to the rest of the world, and confound their audiences with theories that had little relevance or applicability for such cultures.

Our movement, termed the globalization of science seeks to remediate this, as we believe that science as it is practiced today (particularly social sciences) if far from ideal, and rather unfortunately remains essentially Eurocentric; hence, this paper. However, scientific revolutions must occur in other parts of the world in tandem, (scientific output in many cultures across the world is appallingly low) otherwise true and meaningful change can never manifest itself, and the character of social sciences research may remain flawed. We have stressed the need for emic approaches to research and cross-cultural approaches as well; we have been drawing interesting analogies all along: for example men cannot normally be coaxed into launching a feminist movement (or a women's emancipation or a liberation movement), and Dalits or low-caste Hindus would be highly unlikely to support the Hindutva movement in all its incarnations or forms. This essentially boils down to conflict of interest, but more representative science can put an end to conflict of interest. [21] [22]

- *Abductive Reasoning*

Abductive reasoning which is also sometimes called abductive inference, abduction, (or retroduction) is a kind of logical inference that seeks out the simplest or most likely conclusion from a set of observations made. Thus, if we see cigarette stubs lying on the floor, we can conclude that the person is a chain smoker, and that another packet of cigarette will be purchased. Similarly, if the glass is wet in the morning, it means that it rained the previous night. This form of reasoning is the third approach in reasoning after deductive and inductive approaches. This approach was first proposed and developed upon by American philosopher Charles Sanders Peirce towards the end of the Nineteenth century. Even though this approach yields a plausible conclusion, it cannot definitively verify it. There was a renewed interest in this method towards the end

[18] Wilson, J. (2010) "Essentials of Business Research: A Guide to Doing Your Research Project" SAGE Publications
19 Babbie, E. R. (2010) "The Practice of Social Research" Cengage Learning
20 Gulati, PM, 2009, Research Management: Fundamental and Applied Research, Global India Publications

[21] Snieder, R. & Larner, K. (2009) "The Art of Being a Scientist: A Guide for Graduate Students and their Mentors", Cambridge University Press
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of the twentieth century as this approach began to be employed in various sub-fields of the computer science. Abductive reasoning can be widely used in social sciences research too, and can be used to complement inductive approaches. Thus, it may not normally be used as a stand-alone method in complex social sciences research, but combined with inductive and other techniques as necessary.[23] [24] [25]

V. HYPOTHETICO DEDUCTIVE APPROACH

The hypothetico-deductive method is a crucial component of the scientific method and is akin to a cyclic pattern of reasoning and observation. This approach is first used to generate theories and hypotheses, which are falsifiable, and subsequently test them based on additional data. These theories or hypotheses are used to explain common phenomena. Thus, this approach essentially consists of two parts, the first being the generation of new theories or hypotheses (this is also known as the hypothetico portion), and the deductive part or portion, where conclusions are drawn from the stated hypothesis through additional testing against data obtained. Thus, the hypothesis may be fully accepted, partially accepted or modified or rejected (i.e. falsified). It is falsified if the test outcome runs contrary to the predictions of the hypothesis. Sometimes rival theories or hypotheses are evaluated against data collected to see which theory is best corroborated by evidence. This approach can be made to work if theories are tested against data collected in diverse social and cultural contexts, however time-consuming this may be. However, there must be a readiness to revise, abandon or qualify theories as necessary (This has never been done, and even theories developed through this method have remained Eurocentric in orientation); as such we cannot discount or discredit this approach completely. It should be left to the researcher to decide which approach works best in a given context or situation. The chief justification for this approach is that all data to formulate or test hypotheses may not be available from the start, or it may be uneconomical to collect it in all at once. In such cases, a crude working hypothesis works best.

- *Nomothetic Approaches and Idiographic Approaches*

The nomothetic approach is another approach to theory building, and it can be used to generate and derive new laws as well. It derives general principles or generalizations by examining a population of individuals. This approach is contrasted with idiographic research which represents a stand-alone approach. The term 'nomothetic' can be traced to the Greek word 'nomos' which means 'law', ‘proposition of the law’, or the ‘ability to law down the law’. However, the terms nomothetic and idiographic were developed by Wilhelm Windelband and others as two distinct approaches to knowledge. This approach often uses large quantities of statistical data for analysis. Thus, this approach often employs quantitative techniques, though it can accompany qualitative data as well. This approach is used in various fields of study such as philosophy, psychology and in law, but with different meanings.

In sociology and anthropology, nomothetic approaches represent a generalized understanding of a given case or the use of generalizations in describing properties. In other fields such as historiography, it may be synonymous with acquiring a broader perspective of issues, along with an appreciation of the contexts of facts as well, and the establishment of covering laws as applicable. In social sciences research, both nomothetic and idiographic approaches can be used. This is because while individuals or groups possess certain unique properties, generalizations can also sometimes be drawn. Thus, deriving generalizations and formulating laws is the reason for nomothetic approaches, though it can also be used to test relationships between variables (conclusions reached through this method are highly probabilistic); these can indeed be drawn in various fields of social sciences research, though idiographic research is often carried out in the humanities. Idiographic approaches often warrant an in-depth study of a certain case in a stand-alone mode.

Thus, there is a dilemma and a quandary a social science researcher often faces: he does not know which of these two approaches to use. There are no set rules for this, and the researcher must use his discretion always. However, in some cases, laws cannot be derived, and this approach will fail. A classic example of this is the number of years between the date a researcher publishes a path-breaking paper, and the date or year in which he wins the Nobel prize: there may be no clear patterns here, and attempts to draw generalizations will always fail. In some fields of the social sciences, nomology is the “science of laws”; thus, it proposes that observed phenomena can be generalized, and universal laws also known as scientific laws can be formulated. This term is often traced back to the Greek philosopher Aristotle. This approach can be extended to other fields of science as well. [26] [27]

VI. GROUNDED THEORY

Grounded theory is a methodology that is largely used by social scientists, and was developed by social science researchers such as Barney Glaser and Anselm Strauss; it is usually accompanied by qualitative techniques. Per this approach, theories and hypotheses are constructed using real-world data collected from the field; this data is then systematically analyzed with data collected for other sources, also employing grounded theory. This approach,

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which we highly recommend for social sciences research, employs the inductive method of reasoning. This method therefore contrasts markedly and fundamentally with the hypothetico-deductive method used in other fields of research. This approach may begin with a research question, but as more and more data is collected, ideas and concepts become apparent to the researchers. These concepts and ideas are not pre-conceived, but always emerge from the data. Also, this approach is usually used along with qualitative methods, and statistical techniques are not widely used. As per this approach, data is also often grouped into higher level categories, which become the basis of new hypotheses or theories. Of course, such approaches can be fulfilled and realized through the use of valid social science research technique; Ethnography, which we described in detail in two of our papers, is one such technique; the two would essentially complement each other. A proper sampling strategy must be used too so that diverse populations are studied, and this approach can be used along with the case study method as well. As such, all facets and dimensions of a study must be understood before conclusions are drawn.[28] [29]

VII. CONCLUSION

This is our fifth paper on the philosophy of science, (and our fourth on scientific method) and extends our earlier work on the philosophy of science which was primarily focused on various topics and issues in the sciences such as the importance of the social duties of scholars and researchers above personal considerations, the principle of exceptionism which we also called as the sociological ninety ten rule, the certainty uncertainty principle for the social sciences, and cross-cultural research design. Although the concepts set out in this particular paper have been pre-developed by other researchers and scholars, awareness among social scientists and researchers of these methods, tools and techniques is often low, (with Eurocentric paradigms reigning supreme in many fields of the social sciences even to this day) hence the justification for this work. We strongly believe that these approaches when studied along with our earlier proposals on the philosophy of science and scientific method, will led to a better quality of scientific output, and a better quality of live across diverse contexts and cultures. This paper is therefore as essential and integral part of our 'Globalization of science' movement, and forms a crucial, intervening link between many of our papers.

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