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Baking Innovative and Creative Thinking Techniques into Scientific Method: Towards Innovative and Creative Techniques as an Intrinsic Part of Scientific Method for Higher Scientific and Research Output

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Abstract:- The core objective of this paper is to investigate and propose methods and means through which various classes of innovative and creative thinking techniques which include both existing techniques in popular current usage, and those yet to be conceptualized and theorized can be baked into scientific method both integrally and intrinsically, and in a natural and a harmonious fashion. This we believe can lead to faster and more comprehensive scientific progress across disciplines and geographies and usher in a new era of scientific research by increasing the rate of scientific output. We begin this paper by carrying out a brief overview of the key concepts of scientific method, its characteristics and its history, and also refer to our previous observations and discussions on scientific method by referencing our previously published works over the years. We also define and propose categories of individuals by whom we believe this approach can be meaningfully adopted and implemented, and also lay bare the purported objectives of this approach. Last but not the least, we review existing approaches to innovative and creative techniques, and drive home a very crucial and a critical point: the entire field of creative and innovative techniques is apparently in its infancy yet, and more innovative and creative techniques need to be conceptualized and gestated in the years and decades to come including those specific to scientific theorization.

I. INTRODUCTION

- *The True Sign of Intelligence is not Knowledge, but Imagination – Albert Einstein*
- *Innovation is Seeing what Everybody has seen and Thinking what Nobody has Thought- Dr Albert Szent Gyorgyi*
- *If you do not express your own original ideas, if you do not listen to your own inner voice and being, it goes without saying that you have betrayed yourself- Rollo May*

The core avowed objective of this paper is to investigate, formulate and propose methods, techniques, concepts and means through which we believe various classes of innovative and creative thinking techniques including both existing techniques in wide or popular current practice or usage, and those yet to be conceptualized, formulated and theorized can be baked into scientific method both integrally and intrinsically, and in a harmonious, regularized and a systematic fashion. This we believe, can lead to faster and more comprehensive scientific progress across disciplines and geographies and usher in a new era of scientific research. This would we hope and anticipate, bring the era and the age of the hitherto slow and western-centric pace of scientific progress with particular reference to various fields of the social sciences to an end, and shepherd in what we have always called "scientific progress at the speed of light". It also naturally will, we anticipate reduce gaps in a multi-speed civilization and step up scientific output from underrepresented regions of the world. It will also accelerate the process of technological change given that fact that technological innovation and technological ideas have always had their roots in basic and applied science driven by robust scientific method. At the heart of our approach is therefore the democratization and universalization of scientific methods in the best interests of science and scientific output. This will we hope lead to what we call a grey revolution everywhere.

We begin this paper by carrying out a brief overview of the key concepts of scientific method, its characteristics and its chequered history, and also refer to our previous observations and discussions on scientific method by referencing our previously published works particularly in the past couple of years. We also define and propose categories of individuals by whom we believe this approach can be meaningfully adopted and implemented, and review the purported objectives of this approach as well. . Last but not the least, we review existing approaches to innovative and creative techniques, (and those which are in wide or popular currency) and drive home a very crucial point: the field is apparently in its infancy yet, and more innovative and creative techniques need to be conceptualized and

gestated in future. To this effect, we invite insights from scholars and research of different hues and colours, and representing different cultures (particularly underrepresented cultures) from different parts of the world. Much more importantly, we also propose that innovative and creative techniques must be formulated crucially by researchers and scholars, and those well-versed in all aspects of the scientific method. We also concomitantly look forward to a new class of innovative and creative techniques specific to scientific theorization, and those that can be used in various other facets of research as well, particularly social science research. [1]

II. SCIENTIFIC METHOD

A scientific method may be defined as an empirical method for developing, postulating and acquiring knowledge that has been known since ancient times and hoary antiquity with some crucial inputs by the Ancient Greeks such as Thales, Aristotle, Plato and Socrates, but has particularly come of age since the seventeenth century with newer and notable contributions by Francis Bacon, Rene Descartes, William Whewell, John Herschel, John Stuart Mill and more recently by Karl Popper. The term "scientific method" was first applied in the Nineteenth century but has now become widely popular, and is often used in daily life. The entire approach of scientific activity involves the making of careful observations, the application of rigorous but healthy skepticism with regard to observations, the reigning in of cognitive assumptions and cognitive biases and prejudices, the configuration and application of a universalized approach, etc. Scientific method also involves the conduct of careful scientific experiments and rigorous observation under controlled settings, with suitable and apposite measurement techniques, and the formulation of testable hypotheses as well. Scientific method must be rigorous, controlled, precise, meticulous and must produce valid, measurable, repeatable and verifiable results. It is also largely based on the principle of empiricism, and this principle has guided most scientific activity over the ages.

The entire body of human knowledge and the study of acquisition of human knowledge forms an intrinsic part of the science and field of Epistemology, and the principles of the field of Ontology apply to scientific method as well, albeit to a smaller extent and degree. The results of a scientific study may be initially tentative and preliminary, but they are naturally eventually polished, refined and honed to perfection over ensuing periods. Scientific method may vary from discipline to discipline based on the nature of inquiry, or may be tweaked for individual scientific activity, but in essence remains to the same for all fields of human inquiry. It is also largely based on discipline, hard work, creativity and imagination. For example, inductive approaches may be used in some cases, and the deductive approaches in some other cases or areas, and also the much-championed technique of hypothetico-deductivism. Scientific method also distinguishes and demarcates science from pseudoscience, poor quality science and non-science. It also aids in scientific research which is a structured hunt or an organized inquiry for new information, and is a method of finding answers to questions in a structured way; The new Oxford English Dictionary defines research is "the scientific investigation into and study of material, sources etc in order to establish facts and the reach new conclusions". It is also the basis of a scientific temper and scientific reasoning. (Rajasekar at all 2006) (Slesinger and Stephension 1930) (Redman and Mory 1923)

In recent years, free-form approaches to science have become popular, that the methods and the derived results must be internally and externally consistent and reliable. New techniques such as the grounded theory method as proposed by Barney Glaser and Anselm Strauss and the principle of coherentism as proposed by WV Quine, have also become popular. The scientific method often begins with the selection of a research question or a research problem (often based on novelty or practicality) and a research design including the selection or dependant and independent variables; a hypothesis (a working hypothesis which is then usually followed by a refined hypothesis) which hay be based on a hunch often derived from gut feel is also constructed. Questions such as who, why, when and how are also often asked. More and more data or evidence is collected (including carefully selected primary and secondary sources of data) in support of, or against a hypothesis, and the hypothesis is then accepted or refuted (often after detailed testing, and a structured analysis of data through sampling, or adoption of quantification techniques), and new conclusions reached. Literature review is also carried out, and a study of both primary and secondary sources of date is fruitfully accomplished. A research method is indeed systematic; it cannot however be mechanical. The latter would be harmful to the best interests of science. A hypothesis may eventually morph into a law, and generalized principles may be derived from observations. Scientific method impinges on many fields of study, and hypothesis testing (including identification or null and alternative hypothesis, identification of type 1 and type 2 errors, one tailed tests and two tailed tests, etc) constitutes a distinct field of study within the realm of statistics. A scientific study may also be qualitative or qualitative, and either of these two approaches, or a mix of these two approaches is used for different situations. [2] [3] [4]

Research may also be descriptive or analytical, conceptual, correlational or empirical or a combination of all these. Thus, method triangulation is also used, just as data

[1] Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners,(2nd.ed.),Singapore, Pearson Education

[2] Fundamentals of research methodologies and statistics, Yogesh Kumar Singh, New Age international publishers, 2006

[3] Krishna Swamy K.N., Siva Kumar A.I., Mathirajan M., "Management Research Methodology (2006), Pearson Education, New Delhi

[4] Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers 'Distributors

triangulation is. Science communication (to the masses and other specialists) also constitutes a specialized sub-discipline within the ambit of science, with many novel and diverse principles applied to popularize science and to lead to heightened scientific awareness. Scientific research always requires subject matter expertise, and subject matter expertise may be combined with process knowledge judiciously. A researcher must also be highly motivated; he not only derives intellectual joy from his work, but is also happy to serve society in meaningful, productive and purposeful ways. For a more detailed understanding on scientific method refer to our previous publications in this field as well as general literature in this field. (Leech and Onwuegbuzie, 2005)[5] [6] [7] [8] [9] [10]

- *Objectives of the Integration of Innovative and Creative Thinking Techniques into Scientific Method*

The following are the core and the key objectives of the integration of innovative and creative thinking techniques firmly and robustly into scientific method, and the end must naturally be used as a means of study; to put it in other words, the innovative and creative techniques used must align with, be used in conjunction with, or form a part and parcel or the end goal or destination proposed to be arrived at through the means of a study. This would only constitute a short list at best; more and more benefits could materialize and fructify as time progresses, and all these would naturally catapult and propel scientific output to an altogether different and higher trajectory. The integration of innovative and creative thinking techniques into scientific method, must be carried out in all phases of scientific study, though we emphasize the need for a new class of innovative and creative thinking methods for scientific activity; hence, this paper. This will of course, need critical thought and cogitation, and the desire to unlock and harness one's creative potential. It would also demand and warrant other attributes such as the art of visualization and manifestation to a generous degree.

- *To Eschew Dogma and Rigid Thought*

A dogma (the term is thought to have originated in Ancient Greek and is thought to have been transmitted to English in the seventeenth century via Latin) may be referred to as a principle or an allied set of principles which are laid down by an authority or a rigid doctrine as being incontrovertibly true, and are held unquestionably by its proponents. The term dogma may also refer to as dogmas enforced by means of diktat by dictators or repressive and regressive regimes. Examples of such dogmas are dogmas of different major world religions or dogmas of different opposing ideologies or doctrines. Dogmas are therefore commonly found to various degrees in doctrines and philosophies such as communism, totalitarianism, fascism, laissez-faire capitalism, scientism, liberalism, conservatism, and the like. Science too may not be entirely free of dogmas and ideologies at the present time, though we have been espousing the cause of ideology-free and globalized science all along. Science has therefore been often blighted by ideologies such as scientism; these share all the hallmarks of an ideology or a dogma and have already acquired a wide pejorative connotation.

There are many types of atheism, and beliefs held may vary depending on the ideology practised and also the individual. Antony Flew, Michael Martin and other researchers have compared and contrasted positive (also known as strong or hard) atheism with negative (weak or soft) atheism. Positive atheism refers to a strong assertion that gods do not exist. Negative atheism includes may other forms of non-theism; some thinkers adopt neutral stances, while others are non-committal on the issue of the existence of God. Just as theistic evolution and intelligent design proponents have included Christian apologists such as Michael J. Behe, JP Moreland, and Stephen C. Meyer, rigid and confirmed atheists have included thinkers of the like of Richard Dawkins, Daniel Dennett, and the American biologist Jerry A. Coyne. Their doctrines may often border on dogma. Also refer to the "four horsemen" of the new atheism movement. Dogmas in science often translate into science that is of disputable or a questionable quality, or even translate to, in some cases, extreme peer-review bias. [11]

- *To Challenge Well-Established Notions*

Another objective of innovative and creative thinking techniques baked into scientific method is the discarding or abandonment of long held or long-standing shibboleths. A shibboleth is a less commonly used English term that may refer to a long-standing custom and usually outdated, (or sometimes untenable or plain wrong) belief, or a principle, that distinguishes a particular class or group of people from the rest of the population. The term is said to have

[5] 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

[6] Advocating output criteria based scientific and research methodologies: Why the reliability of scientific and research methods must be measured based on output criteria and attributes Sujay Rao Mandavilli IJISRT, August 2023

[7] 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

[8] 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

[9] Krebs, Robert E. (2004). Groundbreaking Scientific Experiments, Inventions, and Discoveries of the Middle Ages and the Renaissance

[10] Smith, Pamela H. (2009). "Science on the Move: Recent Trends in the History of Early Modern Science". Renaissance Quarterly. 62 (2)

[11] Stanglin, K.D. (2009). "Dogma". In Dyrness, William A.; Kärkkäinen, Veli-Matti (eds.). *Global Dictionary of Theology: A Resource for the Worldwide Church.* InterVarsity Press. *ISBN 978-0830878116.*

originated in Hebrew, from where it is thought to have been transmitted to English. Another related term is that of a canon which is sometimes associated with outdated concepts such as that of a Biblical canon. A canon may be defied as a rule, law, axiom or a principle (either right or wrong), on the basis of which something is judged, and is generally thought to be irrefutable or incontrovertible. An argument from authority or an appeal to authority, is a form of argument in which the opinion of an influential figure is used as evidence to support an argument. Examples of this still prevail in popular parlance and quotidian debate. Example" "Why is this true?" Answer: Because Swami Vivekananda said so. 'Why did Swami Vivekananda say so". Answer: "Because his mentor "Ramakrishna Paramahamsa said so". This is a form of a logical fallacy, and throws into serious doubt the sanctity of many presuppositions widely held to be true, and even those that are allegedly and supposedly arrived at through consensus and debate. Another major problem in today's science is the disconnectedness between the physical and the social sciences, (and the resultant non-appreciation of the role culture plays in the daily lives of humans) and the essentially Eurocentric nature of much of scientific activity, particularly in various fields of the social sciences.

- *To Lead to Greater Scientific Progress*

Scientific progress can be categorized into different types, and among these are discoveries of new phenomena, theoretical explanations for commonly observed phenomenon, syntheses of ideas and philosophies to produce new paradigms, tests of hypotheses and theories or hypotheses, communication of results to the public, etc. Examples of revolutionary and groundbreaking discoveries over the ages have included the Heliocentric model of the universe, Kepler's laws of planetary motion, Charles Darwin's theory of evolution, Mendel's laws of inheritance, the Big bang theory of the universe, and the discovery of others galaxies by the Hubble space telescope. Most contributions to pure, theoretical and foundational science have been made by European and American researchers, and the contribution of Asian is somewhat limited in this regard. Science and technology have blossomed and flourished in the United States and many important thinkers and intellectuals have made vital developments and enhancements in various fields of the sciences. Science in the USA has been heavily influenced by Enlightenment Age values, and the resultant emphasis on reason. Europe has been the base of some of the most notable, prominent and eminent scientists and researchers in various scientific disciplines, notably mathematics, physics, biology, chemistry, anthropology and engineering. European universities have also encouraged the promotion of science to a great degree, and European intellectual tradition has been heavily influenced by Greek intellectual tradition. Of late, Asian scientists and researchers have also contributed greatly to American and European science but their contributions are somewhat relatively limited at least at the present time. The abandonment of western-centric ideologies can also lead to greater output in some fields of scientific activity, particularly in various fields of the social sciences, if better scientific and research techniques such as inductive reasoning are applied. [12]

- *To Lead to Greater Scientific Progress in Underrepresented Regions*

Countries like India lag behind the rest of the world in most fields of scientific activity; most other developing nations in Asia and Africa fare much worse. After India's independence, Prime Minister Jawaharlal Nehru, initiated many measures to promote higher education and science and technology in India, and Indian institutes of technology were born. India also collaborated heavily in many spheres of scientific activity with the erstwhile and now defunct USSR. India also made some strides in space research, and earned the wrath and ire of many nations with its Pokhran nuclear tests in 1974. However, in most other domains of science, India's output has been less than stellar, though it is now slowly increasing. India's contribution to peer-reviewed journals has also greatly increased, though in many cases, the quality of scientific publications remains subpar. The number of citations for papers published in Indian journals is also abysmally low. The number of researchers in India per thousand or million of the population is way below that of even many other developing countries. India's investment in science and technology is also way below that of China and the United States of America.

Science and technology have also developed rapidly in China since the end of the cold war, the cultural revolution and the great leap forward. Chinese scientists are among the leading publishers in scientific journals, and Chinese researchers have even leapfrogged American and European researchers in some domains. The "863 plan" and the "Strategy for rejuvenating the country through science and education" have played a major role in fostering a scientific temper in China. Technology has also come of age in China, and Chinese firms have of late, played a major role in many cutting edge technologies. African nations have far lagged behind the rest of the world in both science and technology, and have a lot of catching up to do. Perhaps horizontal collaboration in science can help. This was a term we mooted a year or so ago. This approach can also enhance quality and reliability of scholarly output all over the world by leading to scientific methods that are of a much higher order and calibre. Well, the proof of the pudding lies in the eating, and we look forward to the results of our approach manifesting themselves in the years and the decades to come. [13] [14]

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[12] Want to speed up scientific progress? First understand how science policy works, Matt Clancy, Dan Correa, Jordan Dworkin, Paul Niehaus, Caleb Watney & Heidi Williams, Nature, 2023

[13] Udgaonkar, B. M. (26 December 1970). "Implementation of the Scientific Policy Resolution". *Economic and Political Weekly*. **5** (52): 2091, 2093–2095. JSTOR 4360884

[14] James Wilsdon; James Keeley (2007). "China: The next science superpower?" *The Atlas of Ideas: Mapping the new geography of science*. London: Demos. ISBN 978-1-84180-173-5.

➢ *To Democratize Science*

Research is not the field of the specialist only. As observed by W.C. Redford and V.V. Kamat, teachers and other intellectuals can also do research. However, they would need both intelligence and insight. We have also remarked very often that amateurs or non-specialists can contribute to science if the adopt disciplined and rigorous perspectives. This would be akin to citizens taking up journalism in what is called citizen journalism, and could help viewing or dissecting issues from new and novel perspectives. This observation was made by many other individuals too. For example, the Society of Amateur Scientists or SAS was founded by Shawn Carlson under the banner "helping ordinary people do extraordinary science", and has reportedly been doing extraordinary work. This approach may work because it allows for the wider public to challenge constructs espoused by a coterie, and can also help break down cabals as well quite systematically.

➢ *To Solve Social Problems*

We also look forward to a new generation of scientists both in the social sciences and in the other fields of sciences who can proactively solve social problems. We also look forward to new class of innovative and creative thinking techniques for the social sciences. However, sciences have not been put to productive and constructive use to solve pressing social problems as often or perhaps as widely as may be necessary despite the manifestation of some exceptions. An interesting example in the field of action research. This is a philosophy and methodology of research sometimes used in different fields of the social sciences, and was developed upon by Stephen M Corey and others. Innovation can help solve many social problems and lead to a better world. Examples are solutions to different social problems, different cultural problems, different economic problems, achievement of a perceived ideal state in society, solutions for empowering linguistic have-nots, better legislation to prevent hire and fire policies by employers, or the institution or continuation of employment at will policies, solutions for drug abuse, alcoholism, racism, economic inequality, car safety, government policy, the search and hunt for better economic development models, solutions for better social security and welfare, solutions for child abuse, better parenting techniques, better user interface in Microsoft or other software products, better voice, speech and handwriting recognition in Microsoft products and tools, strategies to improve education and attain universal literacy, methods, tools and strategies to end helicopter science, strategies in automated teaching techniques, jettisoning of outdated historical models, techniques to improve hypothesis formulation or religious reform. Thus, we hypothesize such techniques can be widely used in the social sciences, more widely than even the physical sciences, though our statement is open to interpretation, challenge and scrutiny.

Innovation must be practiced as a mindset, by force of habit and by dint of habit. We must also have objective based and objective driven innovation as well as issue based and objective driven innovation. We can also propose the term "Structured innovative thinking techniques for Social Sciences Research" (SITTSSR). The approach proposed in this paper indeed firmly adheres to this category. These are the four spokes in the wheel to make this happen, and these are 1. Intellectualism (twenty-first century intellectualism) (This is the pillar upon which innovative and creative thought and activism rest). 2. Innovative and creative thinking techniques as proposed in this paper. 3. Activism as necessary (science and non-science) 4. Structured apperception tests for socio-cultural change and theories of socio-cultural change as proposed and discussed by us over the years. This would constitute an extremely important pillar of socio-cultural change. Of course, our approach is only indicatory; there are many issues and methods that cannot be envisaged by any one scholar or individual; hence, the emphasis on creative and innovative thinking techniques that must be followed in letter and spirit.

➢ *To Challenge Eurocentric Biases*

Eurocentrism (also often known as western-centricity, western-centrism or euro-centricity) refers to the practice of seeing things from the point of view of European culture or cultures or form the point of view of European people, particularly from the point of view of western Europe or north-western Europe or the peoples inhabiting it; it may also refer to the innate or intrinsic belief of act of considering Europe or Europeans to be the most important "race" or civilization, a notion birthed in imperialism and colonialism. Questions and beliefs of race, colonialism, and Eurocentrism are now a prominent part of cultural studies, and this trend is only likely to accelerate in the future. Eurocentrism is often widely alleged to have impacted science and scholarly activity detrimentally, particularly fields like Indology; this is a widely held belief among South Asian scholars but is vehemently and vociferously denied by conservative European or American scholars of the likes of Michael Witzel and Gregory Possehl. The term "Eurocentrism" is relatively old; however, it increased in popularity beginning in the 1970's up to the 1990's. We also used it widely in our papers and in our publications, probably over a dozen times. Anti-Eurocentrism is often associated with the promotion of indigenous knowledge; It is also associated with the anti-colonial movements of thinkers like Edward Said, Chinua Achebe, Frantz Fanon, Jamaica Kincaid, Arjun Appadurai, and Gayatri Spivak. These took off briefly in the 1970's and 1980's, but since appear to have tapered off.

➢ *Saying no to Ideologies*

An ideology may be defined as a system of ideas and ideals, usually one which forms the foundation and the basis of economic or political theory and policy. It is also a collection of ideas with rigid content, usually normative, prescriptive and non-adaptive, and non-changing; Definition of ideologies have been provided by scholars such as A.L.C. Destutt de Tracy, David W. Minar and Terry Eagleton, among others, and we have discussed some of these in our previously published papers. Today most people view communism in negative terms, it is often widely associated with dictatorship, abuse of power, suppression of human rights, and poor economic performance, though this was not always the case; therefore, careful scholarship is required to

distinguish ideologies from non-ideologies. A criticism of the impact of ideology on scholarship also needs to be carried out, such as the negation of many postulates of Marxist, Hindutva, Dravidian nationalist, or Dalit nationalist scholarship, particularly in fields such as historiography,

➢ *Output Criteria Driven Scientific Endeavour and Scholarly Output*

We had discussed output criteria driven scientific endeavour and scholarly output in our paper "Advocating output criteria based scientific and research methodologies: Why the reliability of scientific and research methods must be measured based on output criteria and attributes" published in the year 2023. Among the output criteria we had discussed were objectivity, rigour, precision, reliability, internal and external validity and consistency, accuruacy, systematicity, verifiability, measurability, falsifiability, repeatability, reproducibility, credibility, coherence and coherentism, comprehensiveness, holism, transparency, abstraction, predictability, consistency, empiricism ethics-based research output, non-dogma and openness to research results, provisionality of research results and universal applicability. Therefore, research must be constantly benchmarked against such criteria; innovative and creative thinking techniques can help greatly, just as metrics driven scholarship can work wonders. For example, we can have various metrics for human welfare, scientific progress, lopsidedness of economic progress and scholarly activity, human progress and prosperity, reduction of paradoxes etc. This will lead to scientific progress at the speed of light, and can help reduce gaps in what we called a "multi-speed civilization". It will also lead to a grey revolution, and one that is characterized by a greater scientific awakening. Grey as the symbol of knowledge is attributed to the Bible, though blue and yellow are also sometimes associated with intelligence and competence. All scientific output must be in conformity with our principles of aeternsitism and omnimodism, and must also bring about social and cultural change to a reasonable or a great degree; there is however, no recipe set in stone, and innovative and creative thinking techniques can come in various hues and colours.

➢ *Types of Scientists and Researchers*

This approach can be used by many different types of scientists, researchers and scholars which include:

- *Mainstream Scientists, Researchers and Scholars*

A scientist refers to an individual who systematically gathers and uses research and evidence, to make hypotheses and test them, to gain and share new understanding of a phenomena and advance human knowledge. Scientists may further be characterized on the basis of their field of scientific activity, and on the basis of the tools, methods and techniques they typically employ. A researcher on the other hand, is a person who carries out systematic and rigorous academic or scientific research; at times, he may assist a lead scientist in research who typically dictates the direction and tempo of scientific research. Another widely used term is that of a scholar. A scholar is a specialist in a particular branch of study, and may be highly erudite; scholarship is associated commonly with sagesse and dignity. All the three terms discussed above carry distinct meanings, but may overlap in connotation.

- *Intellectuals*

An intellectual, like a scholar, is one who carries out activities pertaining to the intellect; he may possess or carry distinct personal qualities (or those acquired to academic initiation); these qualities are fostered and amplified in intellectually challenging atmospheres; hence, the presence of intellectuals has tended to vary widely from culture to culture, and from civilization to civilization.

- *Visionaries and Thought Leaders*

A visionary is an individual who possesses the ability to think about the future, plan for the future, or otherwise, be prepared for the future through the use of deep, cogitative thought, and imagination or wisdom. Visionaries are less common in conservative societies, but the presence of a large number of visionaries is a hallmark of the scientific and intellectual maturity of a society or a culture in general. A thought leader is similar yet distinct from a visionary. A thought leader is an individual who is recognized as an authority in a specific field. A thought leader is a person who is an expert in a given field area and whom others in that industry turn to for guidance. He also leads and promotes critical thought in that area or field. Another related kind of an individual is an idealist; an idealist is an individual who is guided more by ideals and less by pragmatic and practical considerations; he, however, is an important and a useful cog in the wheel, and often goads other people to action.

- *Revolutionaries, Non-Conformists and Challengers*

Revolutionaries, non-conformists and challengers are another important class of individuals who play a major role in scientific and societal progress by challenging established and prevailing norms, mores and attitudes and ushering in change and progress. These individuals also possess the ability to think originally and differently, but also are characterized by pragmatism and action. The term revolutionary is also sometimes associated with political revolutions, but some classes of revolutions such as the overthrow of the bourgeoisie by the proletariat have now become archaic and meaningless.

- *Awareness Generators*

The term awareness both in common parlance and in the social sciences is a concept that deals with the knowledge and perception of the occurrence of events. This kind of awareness is birthed in collective or personal experience, and in turn leads to various predictable outcome. Awareness generators are often a precursor for all forms of change and are necessary before an outcome can be executed, or change can be made to happen.

- *Movers, Shakers, Influencers and Change Agents*

Movers and shakers are individuals and people who have the most power or influence, and agitate most. They also take initiative for, or assume upon themselves agendas for change, and successfully orchestrate them and bring them to fruition. These are also often the people who often

bring about the most change, and influence other individuals to think like them. These people are also sometimes associated with science activism, and we consider science activism to be an integral part of scientific activity and endeavour as well, and one which employs innovative and creative thinking to a large degree. Thus, innovative and creative thinking techniques must be the fulcrum, the pivot and the anchor upon which many activities associated and allied with science rest. We can critique Hindutva, Marxist, Dalit or Dravidian misrepresentations of history, and even convincingly show that highly limited and biased approaches to historiography like Marxist historiography are dangerously counter-productive and can even encourage Hindutva even more. Marxist historiography also damages science, society and the education system with its pursuit of non-objectivity. We also have other categories of individuals such as muck rackers, rabble rousers, whistle blowers, and gaslighters, but these terms are not as commonly or widely used in science. In addition, some of these terms have a negative or a pejorative connotation. All such individuals often bring about a paradigm shift which is a fundamental change in underlying practices or assumptions. All categories of individuals must, however, be subservient to an underlying discipline and unity of thought. They must follow a coherent scientific method to some degree. A bad example to follow is the Indian Institute of Technology-Kharagpur's 2022 calendar on the theme of "evidence" for "rebutting the so-called Aryan invasion theory" which is now essentially defunct, "Rediscovery of the foundations of Indian Knowledge Systems", which covers the topics of "recognition of the underlying secrets of the Vedas" and "reinterpretation of the Indus Valley Civilization". This undoubtedly raised a hornet's nest and were quickly rubbished in many academic circles, but only forms a very small part of a large and an unfortunately growing list of examples of pseudoscience, both Indian and non-Indian.

III. REVIEW OF CREATIVE THINKING TECHNIQUES

We now review some standard and some pre-existing creative thinking techniques so as to cull out the basics and the essentials of such techniques. (Many of these, rather unfortunately, are not geared or fully equipped to solving problems in the real-world or in the social sciences. We also review the basic tenets of creative thinking techniques, and incorporate (or bake!) our own thinking and our own thought processes into these techniques such that most bits are covered. However, as no creative thinking techniques can be subject to hard and fast rules, or be ossified or set in stone, (This would represent an oxymoron of sorts, and would largely be self-defeating) these approaches are only indicative and illustrative. We request other innovators, thinkers, researchers and scholars contribute meaningfully to this exciting and challenging field. A large number of techniques proposed in our large number of published papers on scientific method (such as the sociological ninety-ten rules, the certainty uncertainty principle, the resolution of paradoxes, the inductive approach, cross-cultural research design, and the reduction of latency time for the acceptance of new scientific and research ideas also broadly fall into this category and field, but we do not wish that any area or field of study become limiting; hence, this proposition. To put it crudely and in layman's terms, the ball is now in other people's court.

➢ *Basic Tenets of Creative Thinking Techniques*

How does an individual improve his or her own creative thinking? There are a series of steps that can be laid out at broad level, and this includes, awareness generation both in terms of understanding the quantum of external knowledge available, and self-awareness. i.e. understanding one's own thought processes, and how the brain processes information. Another critical component of creative thinking techniques particularly for the social sciences is to equip oneself with a world vision, and proactively look for social problems and cultural bottlenecks. Other techniques such as a dimensional analysis or a slice dice analysis can be used to formulate new and meaningful ideas and solutions. Lead and lag areas in any domain can also be identified. Theories such as the theory of cultural lag in Anthropology as proposed by William F. Ogburn can also be vital benchmarks. Dialectical approaches and reflective equilibrium are two other important techniques. Individuals must equip themselves with the ability to understand other people's and culture's thought processes and points of view through formal emic and etic studies. These are some pre-existing ideas in various fields of the social sciences, but rather unfortunately, the chasm and the rift between the social sciences and other sciences remains rather wide indeed. Creating and generating awareness on this issue lies at the heart of our strategy, and our long two decades old travails. Thus, random questions must be asked, (even dreaming, structured thinking and cohesive thinking encouraged) one's own thought processes constantly reexamined and self-provocative questions asked. The end result must be the alteration of one's own mental state. People must discuss their own ideas with others in the field including with those whose perceptions do not tally or vary widely.

The following are the steps involved from our perspective. We must also state that Innovative thinking solutions for the social sciences can have a cascading effect on other sciences.

- Careful and continuous observation are necessary of the real and the social world.
- Look for and identify problems in everything in daily life; Thus, identify lacunae in everything by force of habit, and proactively identify the ills plaguing the world.
- Look for cultural problems and cultural bottlenecks as well, including those which are widely known and acknowledged, and those which are not widely known or acknowledged.
- Categorize problems, into local, non-local, more widely prevalent and universal problems for ese of understanding and convenience.
- Communicate problems to others, if it cannot be solved and create a wider social awareness on the issue.

- Identify how enablers or pillars of empowerment or dissemination can be improved (This is very important for innovation in the social sciences). Refer another section of this paper for greater clarity.
- Look for patterns of problems and carry out a root cause analysis.
- Develop touchpoints with other areas of study– technological and non-technological e.g. technology (for technological issues and concerns) pedagogy (for learning bottlenecks) etc. Thus, the expertise of other specialists must be judiciously put to use.
- Network with the right kind of people including both experts and non-experts. Acknowledge the fact that non-experts can also provide vital clues and insights.
- Look for the right kinds of peers and collaborators.
- Alert others, and ask them to take up the problem, if necessary and collaborate with others on the issues.
- Theorize. Theorize. Theorize.
- Propose out of the box solutions wherever possible.
- Collate out of the box solutions with already existing solutions.
- Propose deep-rooted inter-disciplinary solutions.
- Propose deep-rooted cross-cultural solutions.
- Combine with social science frameworks, paradigms, and research techniques.
- Look for inadequacies in social science frameworks, paradigms, and research techniques.
- Develop techniques for overcoming inadequacies in social science frameworks, paradigms, and research techniques and to identify how these can be improved.
- Implement new social science frameworks, paradigms, and research techniques.
- Include proposed educational system improvements in social sciences frameworks and paradigms.
- Combine with existing innovative thinking techniques.
- Combine with intellectualism, including twenty-first century intellectualism.
- Combine with science activism and non-science activism
- Combine with structured apperception techniques for socio-cultural change, and theories of socio-cultural change.
- Define solutions.
- Take all cultural factors into consideration, local and non-local.
- Take all non-cultural factors into consideration, non, and local.
- Propose local-specific and generalized solutions.
- Implement solution(s)

➢ *Characteristics of this Approach*

The following are the characteristics and the essentials of this approach:

- Can be easily used by the layman.
- Encourages people to keep their eyes and ears wide open at all times.
- Leads to a quantum improvement in innovation across societies and domains.
- Experts can be roped in, if necessary, as these techniques need not be driven by amateurs and novices alone.
- Leads to more people friendly and people centric solutions.
- Can be disseminated widely in schools, colleges and universities, and can be used by students and less experienced researchers along with more experienced ones.
- Other approaches can also be followed alongside, and we look forward to a plethora of new approaches being developed.

➢ *Enablers or Pillars of Empowerment or Dissemination*

The following are the enablers or pillars of empowerment or dissemination, and these have been tallied and merged with our papers on socio-cultural change. These were the ten enablers as per our approach which we refer to as the "Proactive-interactive-symbiotic approach to long-term cultural change". These can also be referred to as facilitators and are necessary to varying degrees if change has to be orchestrated and effected in any given society, and the internal synergies of any society have to be harnessed. 1. The strength of governmental institutions, the legal framework etc. 2. Technological empowerment 3. Educational systems and language policy 4. The cults, ideologies, thought worlds, and belief systems associated with a culture 5. Economic policy and economic infrastructure 6. Social inclusivity and strength of social institutions 7. Physical infrastructure 8. An assessment must also be made of a culture's value system 9. Harmony with nature 10. Social security. These would led to better educational systems, better technology, better transport, a more mature and aware social media and mass media, better social science research frameworks, paradigms and methods, better economic empowerment, less social discrimination, a better and more mature political framework, a better legal framework, evolved social, cultural and economic institutions, better scientific mindset and temper among the larger populations, and the dissemination of innovative thinking techniques among the larger population. These would in turn have a cascading effect on the quantum of scientific output in general, across different societies.

These could also combined with other pre-existing approaches for innovative and creative thinking in what may be called a composite or an ecumenical approach. Examples of such techniques and approaches include brainstorming techniques (including negative brainstorming, brainwriting, the Six Hats thinking techniques, five W's and one H method, the TRIZ technique proposed by the Soviet engineer and inventor Genrikh Altshuller, The theory of constraints as proposed by Eliyahu S. Goldratt, focus group discussions, the gallery method, story boarding, role playing, mind mapping and metaphorical thinking all of which are widely practiced today. However, we reiterate our statement that a new class of creative and innovative techniques for scientific method must emerge, (most of our papers on scientific method must be construed to have contributed to innovative and creative techniques as well) and another class of innovative and creative thinking

techniques for the social sciences. It is with this basic philosophy in mind that the entire efforts of this paper are guided and directed. [15] [16]

IV. CONCLUSION

The core objective of this paper has been to investigate and propose methods and means through which various classes of innovative and creative thinking techniques which include both existing techniques in popular current usage, and those yet to be conceptualized and theorized can be baked into scientific method both integrally and intrinsically, and in a harmonious fashion. We had also stated our belief that this would lead to faster and more comprehensive scientific progress across disciplines and geographies and usher in a new era of scientific research by increasing the rate of scientific output. Thus, we sought to drive home a very crucial and a critical point: the entire field of creative and innovative techniques with respect to scientific method is apparently in its infancy yet, and more innovative and creative techniques need to be conceptualized and gestated in the years and decades to come including those specific to scientific theorization. We believe that this will be a small step in the right direction, and a platform on the basis of which new ideas and thought patterns will emerge.

[15] Articulating comprehensive frameworks on socio-cultural change: Perceptions of social and cultural change in contemporary Twenty-first century Anthropology from a 'Neo-centrist' perspective Published in ELK Asia Pacific Journal of Social Sciences Volume 3, Number 4 (July 2017 – September 2017) Sujay Rao Mandavilli

[16] Blok, Vincent; Lemmens, Pieter (2015), "The Emerging Concept of Responsible Innovation. Three Reasons Why It is Questionable and Calls for a Radical Transformation of the Concept of Innovation", *Responsible Innovation 2*, Cham: Springer International Publishing