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Cementing "Optimization Techniques" in Social Sciences Research: Towards Non-Mathematical Optimization Techniques for the Social Sciences

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Abstract: The objective of this paper is to propose optimization strategies that can be applied with equal efficacy in various fields of the social sciences. Optimization is a widely used strategy and technique in mathematics and statistics. While some effort has been made to extend these techniques for various in the social sciences, we believe that they have not been able to break free entirely from their mathematical mold. Therefore, we essentially strive to adopt a non-mathematical approach that would at best border on a quasi-statistical approach, a term that we proposed, needed to be popularized, in a previous paper. We begin this paper by reviewing and presenting the core essentials of optimization techniques as they are currently applied and used in mathematics, and then present the essentials of our approach as a series of inter-dependant steps. We do hope anticipate and expect that this paper will go some way in ensuring that the social sciences break free from a mathematical format, and evolve and mature in a qualitative or a non-statistical direction. This is also naturally in keeping with the essential requirements of our globalization of science movement.

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I. INTRODUCTION

The objective of this paper is to propose optimization strategies that can be applied with equal efficacy in various fields of the social sciences in a no holds-barred fashion. Optimization is a widely used strategy and technique in both mathematics and statistics, particularly in the former. While some effort has been made to extend these techniques for various in the social sciences, we believe that they have not been able to break free entirely from their mathematical mold. Therefore, we essentially strive to adopt a non-mathematical approach that would at best border on a quasi-statistical approach, a term that we proposed, needed to be greatly popularized, in a previous paper. We begin this paper by reviewing and presenting the core essentials of optimization techniques as they are currently applied and used in mathematics, (by focusing and emphasizing on the essential and the widely used ones, and mentioning the rest only in passing) and then present the essentials of our approach as a series of distinct inter-related and inter-dependant steps. We do hope anticipate and expect that this paper will go some way in ensuring that the social sciences break free from a mathematical format, and evolve and mature in a qualitative or a non-statistical direction. This is also naturally in keeping with the essential requirements of our globalization of science movement. We believe that such approaches can be used unequivocally in many endeavours without reservation. We may strive to optimize individual benefit, or societal or collective benefit. Therefore, analysis may be performed at an individual level or a collective level. Everything would essentially boil down to the type of analysis being performed.

Optimization techniques are carried out either formally or informally. While we are mostly concerned with the former, informal techniques may also be presented in a formal format. For example, a person wants to remain a bachelor, but counterweighs it against social pressure. Which decision would he optimally take? What are the different alternatives and exceptions based on different vectors? Is it possible to derive any principles at all? A person wants to have less children but counterweighs it against social pressure? Which decision would he optimally take? What are the different alternatives and exceptions based on different vectors? Is it possible to derive any principles at all? Some people are also concerned about the environment before making decisions about child birth. How many people really are concerned, and how do they make their decisions? The next question is whether a man trusts his religious instincts or his scientific instincts. How do people generally behave? The next question is whether a man chooses to follow his ideology or discard it. How do people behave? An individual dies not know whether to choose profession A or B, to continue to work or to retire early, to work at all, or to squander his inheritance. How do people react under such circumstances? Much more importantly how do we guide people under various contexts and situations? Is it possible to derive any principles at all? Therefore, there is also an element of guidance involved here; it is expected that social science researchers would provide greater clarity throughout the research process, continue to

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formalize generalizable or non-generalizable principles, or guide uniformed and unsavvy individuals as required. We may have another question on allowing capitalists – whether to allow them or not? Here again all the pros and cons need to be identified. Identifying pros and cons is one of the foundational exercises to be performed here. Pros and cons refer to the advantages and disadvantages of something when evaluated against the backdrop of a decision making process. For example, if we are fixing or setting a syllabus or a curriculum, various aspects need to be borne in mind. A great deal of subject matter expertise is also required among other things.

➢ *What is Optimization?*

The commonly used English word optimization is thought to have been derived from the archaic Latin word "optimum" which means "the ultimate ideal" and "optimus" which means "the best." Therefore, to optimize means to consciously and to systematically bring something to its ideal state, and to a state where no improvement of any kind is possible. The term optimization is a widely used and applied term in both mathematics and statistics, though we believe it has been barely given the attention and recognition it deserves in the social sciences, where it holds enormous potential. As a matter of fact, we believe we have barely scratched the surface here; hence these proposals. In the sense and in the context in which the term optimization is currently used, it is nothing by a conscious and orchestrated act, a process, or a methodology that seeks to make an entity (for example, a design, a process, or a system) fully perfect, and as effective and efficient as practically possible. In mathematics and in statistics, mathematical and statistical techniques are primarily and chiefly used. From our perspective and our point of view, i.e., from the point of view of the social sciences, we believe qualitative techniques, i.e. non-mathematical or non-statistical techniques are optimal, or at best what we have called quasi-statistical techniques. While the term already exists, we had attempted to give it a new flavor, and a new direction.

Optimization is quite central and quite intrinsic to any problem which involves some degree of decision making, regardless of whether it is in the field of engineering, managerial studies, operations research, or in economics. The complex process of decision making therefore requires choosing the optimal or the best possible decision among a mix or plate of different attractive alternatives. Modeling is primarily and critically resorted to before the commencement of a optimization process. This allows us to break a problem or a concept down into its logical components, and understand and grasp it thoroughly and efficiently, besides enumerating the properties of the problem. While optimization problems and techniques have existed in some form or the other for aeons, they have assumed added importance in the context of the rise of computers and digital technology. This has also led to many forms of software applications becoming available to perform and execute optimization tasks; We however believe that the time has now critically arrived to give optimization techniques its due place under the sun in the social sciences. Mathematical optimization is sometimes subdivided into discrete optimization and continuous optimization. In the case of the former, variables are restricted to discrete variables such as integers, while in the case of the latter, they are not. [1] [2] [3] [4] [5]

➢ *What Is Maximization?*

Maximization, as a general process, may be said to refer to the act of making something as large or great as possible, (this is known as an objective function, and is often coupled with, or restrained by, one or more constraints) with numerous downstream and attendant benefits. This technique is of great and paramount importance in both mathematics and statistics. This, when concretized into a formal technique, can be applied to many contexts, such as profit maximization or utility maximization. It is therefore used in diverse fields of study such as business studies, economics, commerce, psychology, and mathematics. [6] [7]

➢ *What Is Minimization?*

Minimization is the exact opposite of maximization. To put it in plain and in simple words, minimization is the act of reducing something, usually a statistical or a mathematical function to the least possible amount or value, in order to derive a general benefit there from. Minimization linear programming problems are solved in very much a similar way as with maximization problems. However, the direction of the feasible and infeasible area are different, as is the direction of the arithmetical operator used with constraints. In this case, constraints are greater than or equal to a certain value, while in the case of maximization problems, they are less than or

[1] Panos M. Pardalos：Approximation and Complexity in Numerical Optimization: Continuous and Discrete Problems, Springer, ISBN 978-1-44194829-8, (2000)

[2] Panos M. Pardalos：Approximation and Complexity in Numerical Optimization: Continuous and Discrete Problems, Springer, ISBN 978-1-44194829-8, (2000)

[3] Panos M. Pardalos, and Mauricio G. C. Resende(Eds.)：Handbook of Applied Optimization、Oxford Univ Pr on Demand, ISBN 978-0-19512594-8, (2002).

[4] Wil Michiels, Emile Aarts, and Jan Korst: Theoretical Aspects of Local Search, Springer, ISBN 978-3-64207148-5, (2006).

[5] Der-San Chen, Robert G. Batson, and Yu Dang：Applied Integer Programming: Modeling and Solution，Wiley，ISBN 978-0-47037306-4, (2010).

[6] Mykel J. Kochenderfer and Tim A. Wheeler: *Algorithms for Optimization*, The MIT Press, ISBN 978-0-26203942-0, (2019).

[7] Vladislav Bukshtynov: *Optimization: Success in Practice*, CRC Press (Taylor & Francis), ISBN 978-1-03222947-8, (2023) .

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equal to certain values. The feasible region may also be unbounded here. [8] [9]

➢ *Optimization Techniques*

Optimization techniques refers to a diverse set of methods and techniques that are used to determine the best possible solution or a best possible set of solutions to a given problem; such an approach or techniques typically involves maximizing or minimizing an objective function while taking into account and consideration, specified constraints. There are many different types of optimization techniques in widespread use. For example, we may have classical optimization techniques such as linear programming, non-linear programming, convex optimization, integer programming techniques, etc. We may also have heuristic and metaheuristic techniques such as genetic algorithms, simulated annealing, particle swarm optimization, and ant colony optimization. We may also have numerical optimization techniques such as gradient descent, conjugate gradient method, and Newton's method. We may also use other assorted techniques such as multi-objective optimization, constrained optimization, and hybrid methods. Most of these are out of scope from the point of view of this paper; only the important ones are presented and discussed here. [10]

➢ *Linear Programming*

The term linear programming as it is widely understood refers to a powerful and widely used mathematical technique that is employed to determine an optimal solution (which may involve either maximization or minimization) of a linear objective function, subject to a set of specified constraints. This technique was developed in the 1930's by Leonid Kantorovich and Wassily Leontief based on earlier work carried out by Fourier and others in the early part of the nineteenth century. Therefore, we may seek to maximize profit, or minimize cost in most cases, as these would make eminent sense from a practical standpoint. The important concepts to be borne in mind here are objective functions, constraints, the area of feasible solution, the area of infeasible solution, and the optimal solution. We may convert greater than or equal to signs and less than or equal to signs to equalities by using artificial variables. We may also use slack variables and surplus variables at times to convert inequalities into equalities. The simplex method and the graphical method are often used to arrive at solutions. The former is a far more powerful tool, and can handle a wide variety of situations. Geroge Dantzig and others made important contributions to the field of linear programming. Other approaches and techniques are used for an analysis of multidimensional spaces such as the Nelder-Mead method and the amoeba method. We will not touch upon them here; however, for the purposes of any socio-cultural analysis, synchronic and diachronic analysis are indeed required. [11] [12]

For example, Let us try to optimize the function Z = 180 x + 200 y, subject to the constraints:
$5x + 4y \leq 80$
$10x + 20y \leq 200$
And $x \geq 0$
$y \geq 0$

by substituting x=0 and y=0 in each of the equations, we get the coordinates
(0,20) and (16,0) for the first equation, and
(0,10) and (20,0) for the second equation

The vertices can easily be represented in a graph, and the feasible region shown in a graph
Solving
$5x + 4y = 80$ and
$10x + 20y = 200$
We get x= 13 1/3 and y= 3 1/3
Therefore, Z= 3066.70

In case of a minimization function, the feasible region lies to the right hand side and above the intersection of the curves. In case of minimization functions, the constraints have greater than or equal to signs. For example, we may have the following problem:

A book keeper wants to employ two people, Mr X and Mr Y, to bind books. Mr X can bind 20 books per hour; Mr X earns Rs 15 per hour for binding books. Mr Y can bind 30 papers per hour; Mr Y earns Rs 25 per hour for grading papers. Each must be employed at least one hour a week to justify their employment. If the book keeper has at least 110 papers to be bound each week, how many hours per week should he employ each person to minimize the cost?

➢ *Operations Research*

Operation research (abbreviated to simply OR), is a widely-used and a widely taught scientific approach to decision-making that makes use of mathematical and analytical techniques to assist organizations in optimizing complex systems. Operations research often involves a series of sequential steps such as the identification of problems, the building of mathematical models, the analysis of data, and the implementation of solutions to enhance the overall efficiency and effectiveness of systems. Operations research is a highly interdisciplinary field of study, borrowing concepts heavily from diverse fields of study such as mathematics, engineering, and even economics, and other fields. The key aspects of operations research are problem solving, decision

[8] Rosario Toscano: *Solving Optimization Problems with the Heuristic Kalman Algorithm: New Stochastic Methods*, Springer, ISBN 978-3-031-52458-5 (2024).
[9] Immanuel M. Bomze, Tibor Csendes, Reiner Horst and Panos M. Pardalos: *Developments in Global Optimization*, Kluwer Academic, ISBN 978-1-4419-4768-0 (2010).
[10] Vo, Thuy D.; Paul Lee, W.N.; Palsson, Bernhard O. (May 2007). "Systems analysis of energy metabolism elucidates the affected respiratory chain complex in Leigh's syndrome". *Molecular Genetics and Metabolism*. **91** (1): 15–22
[11] Gerard Sierksma; Yori Zwols (2015). *Linear and Integer Optimization: Theory and Practice*. CRC Press
[12] Gerard Sierksma; Diptesh Ghosh (2010). *Networks in Action; Text and Computer Exercises in Network Optimization*. Springer

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making, mathematical modeling, simulation, queuing, and complex quantitative analysis for cost minimization, profit maximization, turnaround maximization, efficiency enhancement, optimal resource allocation and other endeavours. Operations research is widely used in supply chain management, inventory management, transportation, logistics management and other allied and related fields. [13] [14] [15]

➢ *Maximin and Minimax Problems*

A maximin problem is a kind of problem that seeks to find out the solution that maximizes the minimum outcome of a function across a given set of possibilities. To put it in a nutshell, it is concerned with determining the best of the worst-case scenarios. This stands in stark contrast to minimax problems, which seek to minimize the maximum possible loss. Both maximin and minimax problems are used for decision-making under uncertain conditions and scenarios, when a certain guaranteed level of performance is sought to be ensured. Maximin is also widely used in game theory to guarantee a certain payoff when a countervailing strategy is adopted by the opponent. Minimax is used to find the optimal strategy in a zero-sum game involving two players where one player's gain represents another player's loss. We also have important concepts here such as maximizer or max player who seeks to maximize his score and outcome, and minimize or min player who seeks to minimize his opponent's score our outcome. We also then have the concept of a game tree which represents all possible moves, scores and outcomes. Minimax regret is relatively less common but it seeks to minimize the maximum possible regret where regret is the difference between the course of action chosen and the best possible outcome. In such as case, a regret table is often used to aid in the decision making process. [16]

➢ *Game Theory*

Game theory is a mathematical framework for analyzing situations where multiple decision-makers interact, considering how their choices affect each other's outcomes. It's used in various fields like economics, political science, biology, and computer science to understand and predict strategic behavior. John von Neumann and John Forbes Nash contributed extensively to game theory. Essentially, game theory helps determine the optimal actions for individuals or groups in either competitive or cooperative scenarios. Game theory is a study of how individuals, groups of individuals or institutions make decisions in situations where their choices effect each other,. It analyses and insects how entities make an earnest attempt to achieve the best possible outcomes for themselves, while considering what bothers might do, or how they might act in a given situation. For this of course, a thorough knowledge of the rules is required. Game theory is being increasingly used with a great degree of success in political science, economics, besides a wide variety of allied fields to analyze, predict and model decision-making and behavior. There are many practical examples of game theory; for example we may seek to explain how chess players interact with each other, or how companies strategize planning and decision making processes while anticipating, predicting and evaluating their competitor's actions. The primary assumption here is that there are no biases and prejudices involved, and players are rational individuals. Perhaps these will be studied by social scientists at a later date. There are two primary types of scenarios here, namely cooperative and non-cooperative scenarios or competitive scenarios, and the names are self-explanatory. This classification essentially depends on whether each party wants to maximize or optimize his own outcomes at the expense of the other party or not. We also use Nash equilibrium here; in case of Nash equilibrium, the outcome of one player cannot be bettered while the strategies adopted by other players remain unchanged. On the other hand, we have the prisoner's dilemma, where an individual tries to act in self-interest, and this leads to a lose-lose outcome for both parties or both players. Zero sum game scenarios are not the only kind of scenarios in the practical world; there are other kinds of scenarios too. [17]

➢ *Approach for the Social Sciences*

We now present the postulated approach for optimization in the social sciences as we see and deem fit. Given that this is a nascent or a virgin field of enquiry, we propose that other researchers and scholars contribute their views as well in an open and a transparent format in order to boost a collaborative approach to the formulation of research strategies. This exercise must be carried out by researchers across a wide range of cultures, and cultures with different orientations and proclivities. In addition to of course more simple and basic techniques such as identifying, assessing, and if possible, quantifying the pros and cons of everything the following aspects must also always be borne in mind: We also look forward to other scholars, researchers and thinkers contributing, as this should by no means be a one-pronged approach.

➢ *Identifying Stakeholders*

A stakeholder may be said to refer to any individual, group, or interested party who has an interest in a specific activity and the outcomes of its actions, including its successes or failures. If the activity succeeds, stakeholders stand to benefit or gain, while if the activity fails, stakeholders automatically stand to lose. This equation may not however,

[13] Richard Vahrenkamp: Mathematical Management – Operations Research in the United States and Western Europe, 1945 – 1990, in: Management Revue – Socio-Economic Studies, vol. 34 (2023), issue 1, pp. 69–91

[14] R. E. Bellman, *Dynamic Programming*, Princeton University Press, Princeton, 1957

[15] Abraham Charnes, William W. Cooper, *Management Models and Industrial Applications of Linear Programming*, Volumes I and II, New York, John Wiley & Sons, 1961

[16] Hsu, Feng-Hsiung (1999). "IBM's Deep Blue chess grandmaster chips". *IEEE Micro*. **19** (2). Los Alamitos, CA, USA: IEEE Computer Society: 70–81

[17] *Gaffal, Margit; Padilla Gálvez, Jesús (2014). Dynamics of Rational Negotiation: Game Theory, Language Games and Forms of Life. Springer.*

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be so simple and straightforward, and many complex and convoluted scenarios or use cases may be present. Some very common examples of stakeholders include employees of an organization, customers, shareholders, investors, suppliers, and tax payers. Managing stakeholders is an extremely important activity, and this must be handled and performed with utmost care and caution because this is a win-win situation for all parties and individuals concerned. If stakeholders win, all other parties stand to win or to gain, while if the stakeholders lose, all other parties lose. This equation is of course subject to some valid and bonafide exceptions. This concept was first defined in the 1960's and popularized by R. Edward Freeman in the 1980's. This term has already been popularized, and is widely used today, in many fields of activity, and many walks of life. From the point of view of this paper, stakeholders need to be identified quickly and early, as this represents an important foundational stepping stone in the entire process. [18] [19]

- *Problem Identification*

A problem is something associated with a difficult or an awkward situation, and poses or presents an impediment or a challenge. It also represents in many or most cases, something that is difficult to deal with, comprehend or understand, and presents or poses insurmountable challenges or roadblocks. It may also in some cases, refer to a question that an individual tries to solve by ruminating, pondering or contemplating about it over a period. It may also refer to a situation, person, or an object that demands or warrants attention and needs to be properly dealt with or resolved: in the context of mathematics and sometimes statistics, a problem is something that is represented mathematically – i.e. numerically, or by means of a function or equation, and is solved through the application of mathematical or statistical principles. Our approach is however, primarily qualitative, and logic and reasoning must also be applied. Problems must be satisfactorily identified, and in unequivocal terms, before we can proceed any further. [20] [21]

- *Fixing Objectives*

An objective refers to something that an individual is trying to achieve; in other words, it is an aim, a goal or a target. It may also in many cases, comprise of a plan that is designed towards the attainment or fulfillment of a certain pre-specified goal or an objective. In another sense, the term objective may refer to a quantifiable and verifiable approach that is based entirely on fact and evidence, or sound and logical reasoning. This is contrasted with subjective, where processes are anchored on thoughts and feelings, sometimes even biases and prejudices. While absolute objectivity may not always be achievable, near-objectivity may be. This term is also allied with rigour, precision, accuracy and methodicity, though the meaning and connotation of each of the terms in somewhat different. We have also spoken about objectivity in mindset repeatedly, from which could be derived non-objectivity in mindset. This is just a small digression; coming back to the main point, a goal or an objective may be said to refer to a desired result that an individual or a group of individuals seek out, plan, and commit to achieve. Therefore, individuals must endeavour to attain and accomplish goals within a specific timeframe by setting timelines, and striving to adhere to them.

A goal is therefore more or less similar to a purpose or aim, which leads to the accomplishment of something that possesses a degree or semblance of value. Goal setting theory within the context of the social sciences was developed by Edwin A. Locke and Gary P. Latham a couple of decades ago. According to Locke and Latham, goals direct an individual's or an entity's attention and effort toward relevant goal-related activities, and boost persistence and determination as well. Sometimes, goal seeking is used to calculate backward to identify an input value that would result in a pre-specified output, and this kind of an analysis is coupled with a what-if analysis. Conflicting goals and objectives also need to be identified and resolved, and a single frame of reference arrived at. The differing objectives of different stakeholders also likewise need to be defined, at arrived at. Goals and objectives are mathematically fixed in case of optimization problems; our approach is however, entirely qualitative. [22] [23] [24]

Identifying problems may also require researchers to identify anchors, and pivots for identifying and presenting problems, and this would be extremely necessary and important for the purposes of a qualitative analysis. This represents a dimension around which the entire problem should ideally be anchored. We may also identify fulcrums which in physical terms is a point against which a lever is placed; here, however, it refers to something which plays a central or essential role in the definition or success of an activity, event, a paradigm, or situation. We must also

[18] Figge, F.; Schaltegger, S.: What is Stakeholder Value? Developing a Catchphrase into a Benchmarking Tool. Lüneburg/Geneva/Paris: University of Lüneburg/Pictet/ in association with United Nations Environment Program (UNEP), 2000

[19] Post, James (2002). *Redefining the Corporation: Stakeholder Management and Organizational Wealth*. Stanford University Press

[20] Mancosu, P. (ed., 1998), *From Hilbert to Brouwer. The Debate on the Foundations of Mathematics in the 1920s*, Oxford University Press, Oxford, UK.

[21] Abattouy, Mohammed; Renn, Jürgen; Weinig, Paul (2001). "Transmission as Transformation: The Translation Movements in the Medieval East and West in a Comparative Perspective". *Science in Context*. **14** (1–2). Cambridge University Press: 1–12

[22] O'Brien, J & Marakas, G. (2011). Supporting Decision Making. In B.Gordon (Ed.), Management Information Systems 10e (p. 409). New York: McGraw-Hill Irwin

[23] Miner, J. B. (2003). "The rated importance, scientific validity, and practical usefulness of organizational behavior theories: A quantitative review". *Academy of Management Learning & Education*. **2** (3): 250–268

[24] *Locke, E. A., Chah, D., Harrison, S. & Lustgarten, N. (1989). "Separating the effects of goal specificity from goal level". Organizational Behavior and Human Decision Processes. **43** (2): 270–287*

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understand the concepts of paradigms and concepts here. A concept is an idea or a basic framework around which a superstructure of ideas is built. A paradigm refers to a set of concepts and thought patterns which is used to relate to real-world problems and solutions. This would help us fix problems and identify objectives. We must also understand at this stage what to optimize, what to maximize, and what to minimize, though not in a mathematical sense. As two or more parties or individuals – or two or more scenarios – are involved in a social sciences problem, some degree of interpersonal analysis would be involved as well. As an extension of the above, we may also seek to identify vectors along which the problem is sought to be identified though always – one vector may be maximization of customer satisfaction- or minimization of customer dissatisfaction.

➢ *Identifying Scenarios*

A scenario, in loose terms, and in common parlance, refers a postulated sequence or development of cascading or non-cascading events. For example, we may envision different scenarios in which burglars break into a house, and take away valuable items. In such a case, we may postulate it as a series of interdependent steps; in some cases, we may also assign weights and probabilities to different scenarios. A scenario usually has not yet happened, or is likely to occur or arise in the future – for example we may envisage an apocalypse or a nightmarish third world war scenario. Scenarios may or may not occur, and is some cases, only one out of several scenarios might occur or arise. An occurrence might be dependent on other occurrences, or in many other cases, that might not be the case. Different scenarios must be envisaged early in the research process, and the best or the optimal one opted for wherever possible. [25]

➢ *Constraints and Limitations*

A constraint is defined as an internally-generated or an externally imposed limit or restriction. For example, we may have time, cost or budget constraints. The time available at hand many be say, n number of hours, while the budget is limited to x rupees. Cost constraints refer to financial constraints for an individual or for an organization. Such constraints would naturally have far reaching implications and far reaching consequences with many ramifications such as resource hiring – number and quality of resources – and profit derivation. They may also impact bigger picture aspects such as project feasibility. Most of these are represented mathematically or plotted graphically, and are solved mathematically or graphically in linear programming problems. However, our approach is predominantly qualitative with mathematical bits and pieces thrown in wherever required. Therefore, we essentially deal with non-mathematical constraint. We may therefore make use of social variables, cultural variables, sociocultural variables, economic variables, and socioeconomic variables, and identify constraints for each of these categories. [26] [27]

Let us take an interesting example. By the 1920's, the Ford Model T had become utterly outdated and obsolete, and calls and clamours began to escalate for its immediate replacement, both from within and outside the Ford motor company. Henry Ford however resisted as the Ford Model T was his brainchild, and also was the car that put the world on wheels. However, the realization eventually dawned on everyone that a replacement was inevitable, and work began in right earnest on what would become the Ford Model A. The new car had a 3300 cc, 40 bhp engine. Henry Ford's son wanted a more advanced car with more advanced features. The main constraint here was that the new car had to be sold at the same price as the old. Henry Ford resisted the adoption of new features, and even insisted on transverse springing and petrol by gravity feed. Let us now ask and pose the following questions: Could the engine power have been increased to 45 or even 50 bhp without increasing the cost of production? With the increased cost of production have at least been minimal and offset by increased sales? Could a better body design have been adopted? Would this have increased costs as well? Would such additional costs have been compensated by increased sales? Could customer feedback have been profitably been incorporated into the design to boost sales? Let us now attempt a deeper and a thicker analysis: Was low competition during the era responsible for manufacturer inertia and lethargy? If Ford had brought out a genuinely better model, would the competition have suitably reacted with better products of their own, and would everyone have lost out in the product? How would technology been impacted as a result? This is the type of qualitative research that we recommend. [28]

➢ *Contradictions*

A contradiction may be taken to mean a situation or a set of ideas that are primarily in opposition to one another, or operate in opposition to one another. For example, we may analyze (in a qualitative or in a non-mathematical sense), an individual preaching high morals publicly to society, while not following them himself. An individual may also declare publicly that he is an environmentalist but may waste previous resources such as electricity himself. In the field of logic and reasoning, a contradiction may involve a proposition that conflicts fundamentally either with itself or with a well-established fact. Contradictions can be determined non-mathematically and from a formal logical analysis. As a matter of fact, that is the approach we

[25] Steven Maras. *Screenwriting: History, Theory and Practice*. Wallflower Press, 2009. p. 91

[26] Xiaoqi Yang, K. L. Teo, Lou Caccetta (Eds.) : *Optimization Methods and Applications*, Springer, ISBN 978-0-79236866-3, (2001).

[27] Panos M. Pardalos, and Mauricio G. C. Resende(Eds.) : *Handbook of Applied Optimization*、Oxford Univ Pr on Demand, ISBN 978-0-19512594-8, (2002).

[28] Williams, Karel, Colin Haslam and John Williams, "Ford versus 'Fordism': The Beginning of Mass Production?" *Work, Employment & Society*, Vol. 6, No. 4, 517–555 (1992), stress on Ford's flexibility and commitment to continuous improvements

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recommend for the purposes of this paper. We may make reference to Aristotle's law of non-contradiction here, which is a very important integral part of the science of logic. It essentially states that something cannot be, and not be, at exactly the same point in time.

We may also draw our readers attention to the very important concept of TRIZ here. TRIZ is a very important problem-solving methodology with a wide and an impressive array of practical implications and applications. It stands for "Teoriya Resheniya Izobretatelskikh Zadatch" in Russian, or "Theory of Inventive Problem Solving" in English, and was developed by the famous Russian inventor Genrich Altshuller over a period in time. TRIZ relies heavily on data, research, and logic as a mechanism and a tool for identifying the root cause of problems and developing creative solutions accordingly. It relies on a systematic approach, pattern identification, and an emphasis on ideality, just as we have proposed in the case of the Ford Model A problem. TRIZ is widely used in both product development and product optimization. The Ford Model A did not succeed wildly here, at least in relation to the older Chrysler 70. Inconsistencies, both internal and external would be used as a platform for brainstorming, and conscientious improvement. For example, the great Indian intellectual giant spoke about riddles in Indian cultural, social and philosophical traditions to put it euphemistically, and used it to launch a tirade against untouchability with the Mahad Satyagraha or the Chavdar Tale Satyagraha of 1927. Similar sentiments led to the Vaikom Satyagraha of Kerala that was carried out in 1924-25. We may also have oppositions which are states of inconsistencies or disagreements. It may also refer to resistance or hostility. These may or may not be represented by counterexamples. Naturally as many social and cultural variables as possible must be taken into account or consideration in a sociocultural analysis, and we have been harping on this repeatedly for a long time now. Contradictions may be quantified to the extent possible or necessary, but not more, as this would prove to be counter-productive in the social sciences. This is demonstrated by our quasi-statistical approach and technique. Contradictions may also be resolved beneficially through cross-cultural research design, dialectical approaches, and auto-dialectics, concepts that we have been discussing off and on for several years now. [29] [30] [31] [32] [33] [34] [35] [36]

- *Paradoxes*

The term paradox is often used in many walks and many arenas of daily life, but in sometimes poorly understood. A paradox to put it in simple, and in easy to understand terms, refers to a statement that is logically self-contradictory, or a statement that throws up results that are contradictory to people's expectation. In such a case, valid premises and valid reasoning from valid or apparently valid premises may be used. However, it may still lead to an apparently self-contradictory conclusion or a logically untenable set of conclusions. Paradoxes, when examined carefully, meticulously, systematically or thoroughly, may throw up hidden meanings, or may offer vital clues for improvement or betterment. This is referred to as the hidden power of paradoxes but is seldom tapped into, or systematically made use of. As observed by Marcel Proust, the French literary critic, paradoxes if unexamined and unresolved lead to systemic prejudices, negatively impacting society. Therefore, paradoxes appear to be self-contradictory, but must be systematically analyzed on some meaningful basis to extract rich and vital clues.

In 1962, W. V. O. Quine classified paradoxes into three basic categories, namely veridical paradoxes, falsidical paradoxes, and antinomies. A veridical paradox appears to be self-contradictory or absurd, but is actually true, and when scrutinized, brings out valid and rich conclusions. For example, we have the barber paradox and the birthday paradox here, as well as the Monty hall problem. A falsidical paradox may contain one or more true statements, but the paradox is itself false. We have Zeno's paradox and Hooper's paradox to denote the latter. An antinomy refers to a contradiction between two reasonable subsidiary conclusions, rendering the main conclusion false or invalid. We had proposed a theory of paradoxes in the early part of 2024 in a paper titled "Paradox identification and paradox resolution in scientific endeavour: Reconciliation of contradictory rule sets in the interests of better theorization and hypothesis-building". Readers may read this paper in its entirety, and the number and the depth of paradoxes would negatively impact

[29] Differentiating strong data and evidence from weak data and evidence: Another heuristic for use in general and social sciences research Sujay Rao Mandavilli Published in IJISRT, June 2025

[30] Incorporating the concept of "Fuzzy logic" in social sciences research: An important heuristic for more diverse and meaningful social sciences research Sujay Rao Mandavilli Published in SSRN, June 2025

[31] Amplifying the importance of synchronic-diachronic approaches in social sciences research: Unleashing the power of this technique for better sociocultural analysis Sujay Rao Mandavill Published in IJISRT, July 2025

[32] Quantifying, measuring, and correlating sociocultural variables: An indispensable technique for diverse fields of the social sciences Sujay Rao Mandavilli Published in IJISRT, July 2025

[33] Towards 360 degree approaches to hypothesis formulation and evaluation: Another epochal milestone in twenty-first century science Sujay Rao Mandavilli Published in IJISRT, July 2025

[34] Aligning theorization and hypothesis-building with cultural and cross-cultural frames of reference: A heuristic aid to better theorization and hypothesis-building Sujay Rao Mandavilli IJISRT June 2024

[35] 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

[36] Popularizing auto-dialectics in scientific endeavour: A potentially productive tool in the interests of better and higher-quality science Sujay Rao Mandavilli IJISRT, June 2024

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the efficacy of a theory, hypothesis, a paradigm, or an outcome. Therefore, paradoxes may be internal or external, and must be resolved through dialectical approaches and reflective equilibrium. Identifying paradoxes and resolving paradoxes are also necessary for optimization, and we require a 360 degree approach. For example, we have the concept of externalities in economics, and these may refer to either positive externalities or negative externalities. [37] [38]

➢ *360 Degree Approach*

We must also adopt a 360 degree approach here, and all points of view must be taken into account and consideration. A through and a meticulous literature review must be accomplished and achieved, and this typically includes primary literature and secondary literature – sometimes, tertiary literature and tertiary sources may also be gone through, and this may include gazettes, bulletins, and census data. 360 degree approaches are often used in hypothesis formulation, hypothesis evaluation, research and investigations, and performance feedback and appraisals. As such, we recommend that such approaches and such techniques must be made use of for optimization (qualitative optimization) too, and all data and information must be readily available at hand. As Li Ka-Shing once famously stated, "We are rapidly approaching a new age of interdisciplinary research and synthesis. Knowledge cannot be merely a degree or a skill. On the contrary, it demands a broader vision, capabilities in critical thinking and logical deduction without which we cannot have constructive and sustained progress". [39]

➢ *Foundational Approach*

A foundation may refer to the base upon which something such as a building or an edifice is built or raised; it may also refer to the act of establishing something, on the basis of a foundation. It may refer to a principle, an idea and a project as well, and therefore, this term may be used both in an abstract sense, and in a concrete sense. We had authored a paper on foundationalism in science, and the name of the paper was "Building upon "Foundationalism" to achieve the objectives of contemporary science: How this can lead to faster scientific progress and inclusive science" in this paper, we reviewed the concept of foundationalism in scientific and non-scientific activity down through the ages and aeons. We also proposed the concept of forward linkages and backward linkages, and proposed approaches and techniques to distinguish and demarcate foundational knowledge from non-foundational knowledge, and sound concepts from unsound concepts. This aforesaid paper is of great use in comprehending the core essentials of the present paper, given the fact that an unsound or an inconsistent and incoherent foundation cannot be the basis of qualitative optimization techniques. [40]

➢ *Epistemic Coherentism*

The term "epistemic" means relating or pertaining to knowledge or to the extent or degree of its validation. The term is derived from the term epistemology which means the science of knowledge or the branch of science that deals formally with the enquiry of all forms of knowledge which is justified true belief. We have several branches of epistemology; for example, we have formal epistemology which makes extensive use of logic and reasoning which naturalized epistemology leans towards empirical methods. We had traced the history and scope of epistemology right from ancient Greece, ancient India, and ancient China, in our paper, "Implementing "Epistemic coherentism" in twenty-first century science: "Epistemic coherentism" as an essential pre-requisite of interdisciplinary and transdisciplinary research". In this paper, we had also reviewed the concept of coherentism which essentially means that a postulate an axiom, or as assertion cannot be studied in isolation, but must be examined against the backdrop of a wider set of ideas. Therefore, long term considerations must also take precedence over short-term considerations, and global considerations must take precedence over sub-regional considerations. We had therefore floated the concepts of aeternitism and omnimodism. We must also have prioritizations and tradeoffs as required. We also spoke about institutional coherentism and integrationism towards which we had dedicated two separate papers. [41] [42]

➢ *Logic and Reasoning*

Logical reasoning is an essential part of qualitative optimization, while it is not so central to canonical mathematical optimization. Logic, at its very fundamental core, refers to the formal study of reasoning, inference and argumentation. It lays down the essential principles and guidelines that govern sound and logical thinking and the process of making valid inferences. It encompasses the processes involved in both formal and informal approaches to logic. In sum, logic helps researchers determine whether a conclusion logically follows from a given premises or a set of premises, and whether an argument is arrived at based on sound or flawed bases. Reasoning supports logic, and logical reasoning is primarily a structured mental activity ad process

[37] Paradox identification and paradox resolution in scientific endeavour: Reconciliation of contradictory rulesets in the interests of better theorization and hypothesis-building Sujay Rao Mandavilli IJISRT, January 2024

[38] Paradox identification and paradox resolution in scientific endeavour: Reconciliation of contradictory rulesets in the interests of better theorization and hypothesis-building Sujay Rao Mandavilli IJISRT, January 2024

[39] Building upon "Foundationalism" to achieve the objectives of contemporary science: How this can lead to faster scientific progress and inclusive science Sujay Rao Mandavilli IJISRT, October 2024

[40] Implementing "Epistemic coherentism" in twentyfirst century science: "Epistemic coherentism" as an essential pre-requisite of interdisciplinary and transdisciplinary research Sujay Rao Mandavilli IJISRT, November 2024

[41] Instituting "Institutional coherentism" as a prerequisite for high-quality science: Another crucial step for winning the battle for consistent high-quality science Sujay Rao Mandavilli IJISRT, February 2024

[42] Emphasizing "integrationism" in twenty-first century science: Another useful tool to generate better scientific paradigms better quality science Sujay Rao Mandavilli IJISRT October 2024

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that employs rigour and precision. Logical non-sequitors must be eschewed, and a step by step process followed. We also prefer the term creative optimization for qualitative optimization, though the term has a different connotation at present. At present, it is mostly used in a marketing context. [43]

➢ *Conflict Identification and Conflict Resolution*

The term conflict essentially refers to a disagreement or clash between two or more people or groups of people holding opposing and contradictory ideas, beliefs, interests, or values. It often leads to, or manifests itself in the form of, struggles between individuals, groups of people, societies, cultures, or in some cases, even within a single individual. Conflicts may be minor or major; they may range from minor skirmishes and altercations to large-scale antagonisms and may be resolved either through peaceful means or through the use of violent methods. Conflict management is of great use here, as we will then be able to figure out who is right, and who is wrong. This can then lead to better optimization. Types of conflicts essentially include interpersonal conflicts, intrapersonal conflicts, organizational conflicts, civil wars and internal conflicts, and transnational or international conflicts. Causes of conflict may include differing values, differing perceptions, breakdown or inadequacy of communication, and power struggles. Resolution of conflicts can be accomplished through mediation, negotiation, arbitration, cultural brokerage, and the like. Conflict management refer to the process of managing conflicts, and mitigating the ill-effects of conflicts.

➢ *Identifying Vested Interests*

The term vested interest is a term used to identify a personal or a selfish reason for involvement or participation (or non-participation) in an undertaking or situation, especially arising from an expectation or anticipation of financial or other gain. Vested interests may be either individual vested interests or collective vested interests. Resolving vested interests is both and art and a skill, and requires investigation, root cause analysis and sometimes even dialogue and reconciliation. We had proposed all our concepts revolving around the general idea of vested interests in our paper, "Towards a formal analysis of "vested interests" as an intrinsic part of social science research techniques: Another crucial component of social and cultural progress". Readers are requested to read the aforesaid paper in its entirely. We had also discussed the concept of conflicts of interest here – this is a slightly different concept. We had discussed concepts such as lobbies, cliques, syndicates, cartels, cause groups, and cabals too. We had also discussed ideologies on many occasions; it is expected that readers will be familiar with the concept of a ideology and how it might affect decision-making. Therefore, a formal analysis of vested interests may be in order, and mitigating strategies adopted accordingly. This can at times be a complex process, and we had discussed it accordingly in the aforesaid paper. [44]

➢ *Win Win Paradigms*

Win-win paradigms refer to an approach in optimization where all the involved parties benefit equally, or more or less equally, from a solution or a decision outcome. Therefore identifying mutually agreeable solutions where everyone benefits and is happy is of extreme and crucial importance, rather than just one party gaining or unduly benefitting at the cost or expense of another. This technique therefore, emphasizes fostering mutual cooperation and collaboration, (not unfair competition) understanding different perspectives from a deep perspective, empathy, goodwill, and valuing the long-term relationship between individuals. This concept too naturally needs to be borne in mind during the entire process of optimization. This concept must be contrasted with win lose paradigms, where some parties win and some parties lose, and lose lose paradigms, where all parties lose.

➢ *Identifying Biases, Prejudices and Other Factors*

Biases, prejudices, malice, vendetta, rancor and other factors also need to be evaluated from time to time, as these can impact and affect the outcome of the decision-making process. These may need to be countered and the social science researcher needs to guide individuals as necessary if he is performing the optimization process. Biases may be either systemic or non-systemic, and usually refers to a disproportionate or unjustified weight against an idea or a principle. Prejudice refers to a preconceived notion that clouds an individual's judgment or his decision making process. We may also have malice which is a manifested or unmanifested ill-will against someone. Rancor refers to a resentfulness or a grudge a person holds against someone. Other factors such as ineptitude, lack of experience, lack of knowledge, lack of expertise or knowhow, lack of general awareness, dogma and ideology may play a role too. The social science researcher is expected to systematically and logically account for all these factors. Some other factors and aspects to be borne in mind are prioritization, tradeoffs, identifying overrides, mitigating negativities, identifying secondary and tertiary factors, etc. On the whole, a holistic assessment needs to be done.

II. CONCLUSION

The objective of this paper was to propose optimization strategies that can be applied with equal efficacy in various fields of the social sciences in a no holds-barred fashion. Optimization is a widely used strategy and technique in both mathematics and statistics, particularly in the former. While some effort has been made to extend these techniques for various in the social sciences, we believe that they have not been able to break free entirely from their mathematical mold. Therefore, we essentially proposed a non-mathematical approach that we believed would at best border on a quasi-statistical approach, a term that we proposed, needed to be greatly popularized, in a previous paper. We began this paper

[43] Walton, Douglas (26 August 2013). *Methods of Argumentation*. Cambridge University Press. pp. 250–2.

[44] Towards a formal analysis of "vested interests" as an intrinsic part of social science research techniques: Another crucial component of social and cultural progress Sujay Rao Mandavilli IJISRT, September 2024

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by reviewing and presenting the core essentials of optimization techniques as they are currently applied and used in mathematics, (by focusing and emphasizing on the essential and the widely used ones, and mentioning the rest only in passing) and then presented the essentials of our approach as a series of distinct inter-related and inter-dependant steps. We do hope anticipate and expect that this paper will go some way in ensuring that the social sciences break free from a mathematical format, and evolve and mature in a qualitative or a non-statistical direction. This is also naturally in keeping with the essential requirements of our globalization of science movement. We believe that such approaches can be used unequivocally in many endeavours without reservation.