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A COMPARATIVE STUDY ON THE PERCEIVED APPLICABILITY OF HONEY BEE MATING OPTIMIZATION ALGORITHM (HBMO) AND PARTICLE SWARM OPTIMIZATION (PSO) ALGORITHM BY APPLYING THREE FACTOR THEORY AMONG RESEARCHERS IN TAMIL NADU

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Abstract

The perceived applicability of honey bee mating optimization HBMO and Particle Swarm Optimization PSO among the research scholars in Tamil Nadu are understudied. The purpose of the present study is to address this dearth in the literature in three ways: (i) providing descriptive data related to the applicability of these algorithm in their area of study. (ii) Applying Three Factor theory to assess the perceived range of applicability of the two said theories and to develop, a theoretically-based model that predicts the applicability and robustness of the algorithm in comparative basis grounded on the perceptual data collected from the research scholars from all over Tamil Nadu. (iii) Attempting to compare the strength and form of correlation between the factors of influence and perceived applicability of the algorithms in the research process by the researchers. Self-report data were collected from Researchers in Tamil Nadu (n = 869), assessing the levels of individual personal belief factors in influencing the scholars perception of applicability of the algorithm for a range of issues, perception based on the results produced by the application of the algorithm. Perceptions formed in conformity with a group of researchers were analyzed through statistical tools. From the findings analysis, it is evident that perceptions of personal belief level and perception based on conformity with peer group perceptions have significant influences in predicting the applicability of the Algorithms. However, the study results suggest that empirical result is based in on the specified context and level of investigation on which it can produce similar or varied outcomes when the study is conducted to larger domain of subjects.

Keywords:

Honey Bee Mating Optimization, Particle Swarm Optimization, Three Factor Theory, Personal Belief System

1. INTRODUCTION

Several perspectives ranging from extensively heuristic to intensively algorithmic are offered to study and explain the applicability of the computational Intelligence in general and in particular the Algorithms like; Honey bee mating optimization (HBMO) and Particle swarm Optimization (PSO) during the last decade. The potential of these two algorithms in terms of its application are understudied. Specifically, the study of its perceived applicability among the researchers has not been documented to arrive at systematic findings in evidence for the higher range of applicability in several fields. Therefore, the perceived applicability of HBMO and Particle Swarm optimization among the research scholars in Tamil Nadu are studied. In pursuit of this, the present study has addressed this dearth in the literature in three ways: (i) providing descriptive data related to the applicability of these algorithm in their area of study. (ii) Applying Three Factor theory to assess the perceived range of applicability of the two said Algorithms. (iii) To develop, the applicability and robustness of the algorithm in a comparative basis grounded on the three factors responsible for perceptual applicability of data collected from the research scholars in Tamil Nadu.

2. EXISTING APPROACHES

2.1 HONEY BEE MATING OPTIMIZATION ALGORITHM (HBMO)

Abbass (2001a, 2001b) has proposed (HBMO) The honey-bee mating optimization algorithm which has been successfully applied to solve job shop scheduling, integrated partitioning/scheduling, data mining, 3-sat, nonlinear constrained and unconstrained optimization, stochastic dynamic programming and continuous optimization problems (see Baykasoulu et al. 2007). A honey-bee colony consists of queen(s) (best solution), drones (incumbent solutions), worker(s) (heuristic), and broods (trial solutions). The HBMO algorithm simulates the natural mating behavior of the queen bee when she leaves the hive to mate with drones (Abbass 2001a, 2001b). After each successful mating, the drone's sperm is added to the queen's spermatheca. Before the mating flight begins, the queen is initialized with some energy and only ends her mating flight when her energy level drops below a threshold (which is close to zero) (Afshar et al., 2007). At the end of the mating flight, the queen returns to the nest.

Then, the queen starts breeding by randomly selecting a drone's sperm from her spermatheca and performs crossover to produce a brood (one brood per crossover) which is then fed by a worker to enhance the broods (all new generated broods are enhanced by a worker). The number of workers used for the algorithm represents the number of heuristics.

If the fittest brood is superior to the queen, it replaces her. All other broods, and the former queen, are destroyed and then another mating flight is initiated, with a new queen and the same pool of drones.

The honey-bee mating algorithm shares two operators (crossover and mutation) with genetic algorithms but has two main differences. Firstly, HBMO always uses the queen (which is the dominant solution) and stores different drone's genotypes in her mating pool in order to create new broods by combining some parts of the queen genotypes with the same parts of the drone's genotype. Since the queen is the fittest individual, we hope that this will evolve better solutions. This kind of

combination leads the search towards better regions of the search space. In comparison, in genetic algorithms two parents are selected to produce new children. This may not be effective in exploring the search space since the selection mechanism employs probabilistic and random factors (e.g. roulette wheel the honey-bee mating algorithm shares two operators (crossover and mutation) with genetic algorithms but has two main differences. Firstly, HBMO always uses the queen (which is the dominant solution) and stores different drone's genotypes in her mating pool in order to create new broods by combining some parts of the queen genotypes with the same parts of the drone's genotype. Since the queen is the fittest individual, we hope that this will evolve better solutions. This kind of combination leads the search towards better regions of the search space. In comparison, in genetic algorithms two parents are selected to produce new children. This may not be effective in exploring the search space since the selection mechanism employs probabilistic and random factors (e.g. roulette wheel selection). Secondly, HBMO applies a local search at every iteration, which can be considered as an exploitation stage. By comparison there is no local search (exploitation) in standard genetic algorithms, although a mimetic algorithm can be used to incorporate this feature. In light of this characteristic features this algorithm is widely used by the research scholars worldwide and in the current study the factors that influence the applicability and preference of this algorithm is measured and compared with the applicability the other popularly use algorithm known as Particle Swarm Optimization PSO.

2.2 PARTICLE SWARM OPTIMIZATION (PSO)

Swarm Intelligence (SI) is defined as the collective behavior of decentralized and self-organized swarms. Well known examples of which are bird flocks and the colony of social insects such as ants and bees. SI is becoming increasingly important research area for computer scientists, engineers, economists, bio-informaticians, operational researchers, and many other disciplines. In 1990's two important approaches which are based on ant colony, called ant colony optimization (ACO), described by Dorigo et al. (1991) and based on bird flocking, called particle swarm optimization (PSO). Since the introduction of PSO in 1995 by Jameskennedy a social psychologist, it has been widely used to address non-linear continuous optimization issues. Whereas, at present it has been found successful for the following applications and fields i) tracking dynamic systems, ii) evolve weights and structure of neural networks iii) to analyze human tremor iv) for registering biomedical imaging. Numerous papers related to their applications have been presented to the literature and several survey papers regarding these studies have been prepared (Eberhart et al. 2001; Reyes-Sierra and Coello 2006; Blum 2005; Dorigo and Blum 2005).

Both approaches have been studied by many researchers and their upgrades versions have been described and applied to solve real-world problems in different areas. The first comprehensive survey on the algorithms related to the bee SI and their applications was prepared by Karaboga and Akay (2009c). The current study is the first attempt in the direction of assessing the strength and perceived applicability of the algorithms by the research scholars from all over Tamil Nadu, which could add to the literature of comparative study on the strength of the algorithms in a perspective based on the researcher's perception of the applicability.

3. CONCEPTUAL FRAMEWORK OF THREE FACTOR THEORY FOR THIS STUDY

Primary awareness of influencing factors that are responsible for the cognition of issues holds promise for improving the usability of real-time problem distributed during the process of addressing an objective oriented study or research. However, there is little principled information available about awareness that can be used by the people or the researchers in handling such situations. In this article, the author develop a conceptual framework of theory with three influencing Factors like: i) Influence due to the Personal belief, ii) Influence due to peer group and iii) influence due to the empirical results. For the purpose of identifying the influencing factor in the perceived applicability of computational algorithm for the research by the researchers in Tamil Nadu, the above mentioned factors are measured for its strength, correlation and frequency of influencing in applying for their research.

The author have built a three-Factor framework that examines the influencing potential in applicability of the Algorithm like : HBMO and PSO in their study and make use of this three factor theory for arriving at a comparative basis of study in measuring the significant factor that contributes for their preference of using specific algorithm.

The present study also highlights the importance of three factors through previous research on personal belief, peer group and empirical results effects. It also provides the research scholars with a vocabulary and a set of ground rules for analyzing their work situations, for comparing the two algorithms that are important to their research in application and problem solving in day-today situations.

4. RELATED STUDY ON PERSONAL BELIEF SYSTEM

According to Perry (1981) personal belief refers to beliefs about knowing and learning that reflects the views on what knowledge is, how it is gained and the limits and criteria for determining knowledge. Whereas, schommer, Aikins & Hutter (2002) suggest that personal belief consist of an individual's beliefs about the certainty of knowledge, the organization of knowledge and the controls the individuals has over knowledge. Perry has contributed to the study of epistemological development when some researchers investigating personal belief focused on attitude towards learning and knowledge. The outcome of the studies done by Perry found that, over time, people progressively developed more complex and integrated ways of viewing the world, with the dualistic view that knowledge is simple and certain and could be transmitted by authorities evolving into the relativist view that knowledge is complex, tentative and uncertain. Perry's (1981) conceptualization of epistemological development as a continuum was supported by researchers including Kitchener and King (1981) and Ryan (1984). However, whereas Perry's research suggested epistemological beliefs were unilateral, and

also advocate research that "specifically addresses" the beliefs of people relative to their behaviour (Ellinger & Bostrom, 2002). The Researchers investigating the personal values and beliefs suggest that the behavioural characteristics will differentiate one's understanding and foundation of belief from one another through assessing differences in the personal value and belief systems (Burns, 1978; Krishnan, 2001; Sarros & Santora, 2001a).

According to Lord & Emrich, 2000; Wofford & Goodwin, 1ude 1994, it is found that personal belief has the potential to understand and measure the metacognitive and cognitive processes that guide a person's attitude, thoughts and behaviours. A study by Wofford, Goodwin and Whittington (1998) explored the metacognitive processes of transformational and belief through analyzing behavioural outcomes from the people. The researchers found that thought processes associated with attitude and affective behaviours were indicators of belief cognitions. These cognitions then, in turn, predicted the strength of the personal beliefs. Thus, the study of personal attitude and cognitive processes and their influences on belief system is an important area of personal beliefs.

4.1 DIMENSIONS OF EPISTEMOLOGICAL BELIEFS

According to Gerzog (1982) and Schommer (1990, 1994) opposed five more or less independent epistemological dimensions:

- Simple Knowledge (knowledge is simple rather than complex),
- Certain Knowledge (knowledge is certain rather than tentative),
- Omniscient Authority (knowledge is handed down by authority rather than from reason),
- Quick Learning (learning is quick or not at all) and
- Innate ability (the ability to learn is innate rather than acquired).

Thus, a person holding naive epistemology along all five dimensions generally believes that:

- Knowledge is simple, clear and specific,
- Knowledge resides in authorities and is therefore unchanging,
- Concepts are learned quickly or not at all; and
- Learning ability is innate.

In contrast, a person holding sophisticated epistemology along all five dimensions generally believes that:

- Knowledge is complex and uncertain,
- Knowledge can be learned gradually through reasoning processes and
- Knowledge can be constructed by the learner.

Researchers including Arrendondo and Rucinski (1996), Brownlee (2000, 2001) and Berthelsen, Brownlee and Boulton-Lewis (2002) believe that epistemological beliefs can provide a basis for understanding what and how knowledge is used in the context of a people's profession. Recent investigations into the relationship between a researcher's personal epistemological beliefs and their research behaviours suggest that epistemological beliefs influence the choices and decisions a scholar makes in their application of the theory and model. A study found that researchers with relativistic epistemological beliefs use more Constructivist researching strategies than those with naive epistemological beliefs.

Research into the impact of epistemological beliefs on thinking and learning advocates that an individual's beliefs about the nature of knowledge and learning are linked to comprehension, meta comprehension and metacognitive capacity, interpretation and persistence in working on difficult academic tasks (Brownlee, 2000; Schommer, 1990, 1994; Schommer-Aikins & Hutter, 2002; Tasi, 1998). Posner et al. (1982) postulated that epistemological beliefs about knowing and learning in fact sieve all other knowledge As Perry (1981) and Belenky, Clinchy, Goldbeiger and Tarule (1986) have proposed that individuals with more sophisticated epistemological beliefs (e.g. relativistic) are more likely to engage in personal reflection and analysis about their understandings and use of knowledge. Individuals who believe in the complexity of knowledge are more likely to acknowledge the complexity of knowledge, to take multiple perspectives, to be more flexible and think in a time consuming, reflective manner. In a study on individuals'thinking about everyday complex issues, Schommer-Aikins and Hutter (2002) found that individuals who hold sophisticated epistemological beliefs appear to "thoughtfully guide their thinking" with their beliefs such metacognitive awareness differentiates mature epistemological beliefs from naive epistemological beliefs. Schommer-Aikins and Hutter (2002) contend that understanding the "implicit presence and influence" of epistemological beliefs will provide a "knowledge base" to enhance communication and public education about complex, ill-structured contemporary issues.

5. PEER GROUP EFFECT

Peer groups are ever evolving with multi factorial impact over the present peer group functions. Better understanding of peer group behaviors is necessary of people's growth and development. Since peer influence is a phenomenon that surround us every time the study of it never cease.

The chief objective According to Ryan (2002) Peer pressure refers to a group of people who were of same group who support people to do things or to keep from doing something else. It does not matter whether people personally willing to do it or not. Indirectly the peer pressure is known as peer influence which involves changing one's behavior to meet the perceived expectations of others. Castrogiovanni (2002) states that generally a peer group will have an average of five to six members of similar age and activities since the peer influence has the potential to have negative and positive effects on individuals performance and cognition. It certainly has greater role in the mode of functioning of research scholars on a daily basis. Though researchers have made interesting observations about peer relation of this paper concerns the testing and measurement of these peer group effects in assessing the applicability of computational optimization tools that are used for the research work by a group of research scholars. The influence of peer group in selecting a computational tool is chief concern in this study, though several

studies proved that peer group effect has affected the people's choice, function and behavior at different context and levels. Summers & Wolfe (1977) and Henderson Meiseowski, and Sauvageau (1978) have demonstrated that students perform at a higher level if their colleague are high achievers. This finding clearly reinforces that the level of achieving and acquiring knowledge in the academic domain peer influence has a greater footing in rooting people's function on a day to day basis.

The present study contributes to the current stock of peer group effects research by providing reliable identification of research scholars across Tamil Nadu by segmenting into three parts as Northern part, Central part and southern part of Tamil Nadu. This study has collected a large, representative data set that has not previously been employed in the estimation of peer effects.

6. EMPIRICAL METHOD EFFECT

Empirical method of research is a way of gaining knowledge by means of direct and indirect observation or experience. Empirical evidence (the record of one's direct observations or experiences) can be analyzed quantitatively or qualitatively. Through quantifying the evidence or making sense of it in qualitative form, so that a researcher can answer empirical questions, which should be clearly defined and answerable with the data collected. Many researchers combine qualitative and quantitative forms of analysis to better answer questions which cannot be studied in laboratory settings, particularly in the social sciences.

Recent work uses some combination of the following empirical methods: (1) Tagging of discourse phenomena in corpora; (2) Induction of algorithms or discourse models from tagged data; (3) Comparison of algorithm output to human performance; (4) Human scoring of an algorithm's output; (5) Task efficacy evaluation based on the domain; (6) Ablation studies where algorithm features are systematically turned off; (7) Wizard of Oz studies; (8) Testbeds of (parameterizable) dialogue models using computer-computer dialogue simulation;

The role of empirical methods is to help researchers discover general features by analyzing specific discourse phenomena or programs that interpret or generate them.

Sparck-Jones and Galliers (1996) call features performance factors and distinguish between environmental factors which are features of the task that are fixed from the system designer's viewpoint, system factors which reflect design choices, algorithm features, or other input factors, and system effects which are features that characterize the behavior of the system.

This approach leads to general theories via the following steps, which many readers will recognize as a variation of Cohen's EMPIRICAL GENERALIZATION STRATEGY (Cohen, 1995):

- Feature identification: identify features of the discourse, tasks, and context that may influence the target behavior;
- Modeling: develop a causal model of how these features influence the target behavior;
- Evaluation: assess the performance of the model (often implemented in a program) for producing the target behavior on the tasks and in the contexts for which it was devised;
- Generalization: once the model makes accurate predictions, generalize the features so that other discourses, tasks, and contexts are encompassed by the causal model, and test whether the general model accurately predicts behavior in the larger set of discourses, tasks, and contexts.

Therefore, this paper investigates the perceived influence in identifying the application of computational program tools for their research purpose.

Many past literatures have described a number of empirical methods available and provide information about the suitability and base for both understanding and selecting from the variety of methods applicable to empirical software engineering. They are controlled experiments, case studies, survey research and ethnographies etc.

7. OBJECTIVES OF THE STUDY

These objectives are listed as follows:

- To explore the perceived applicability of the computational algorithm's HBMO and PSO among the research scholars in Tamil Nadu.
- To find the strength of the HBMO and PSO algorithm based on three factor influences in the perceived applicability for research by the research scholars of Tamil Nadu.
- To examine the form and direction of relationship through correlation study between perceived applicability and HBMO, PSO algorithm.
- To compare the perceived applicability of HBMO algorithm and PSO algorithm by applying three factor theory in an empirical way.
- To empirically demonstrate the potential of personal belief and effect of peer group in influencing the applicability of computational algorithms for the research among the scholars in Tamil Nadu.
- To empirically demonstrate the potential of empirical results as a moderator in influencing the applicability of computational algorithms for the research among the scholars in Tamil Nadu.

8. METHOD OF STUDY

To achieve the objectives of the research, the methodology adopted for the current study is a multi-method approach that consists of the following strategies:

- Questionnaire survey method.
- Semi-structured interview.

Since the study is an empirical research, the data from the cross sectional study and from a self-administered questionnaire has been analyzed by employing descriptive statistics and inferential statistics.

The entire method of study is elaborated in different phases through which the study has been carried out. Furthermore, it describes the nature of Data collected for the research, research instrument used for the study, Pilot study, sample size, survey used for data collection and tools used for analysis of data.

The Research study carried out has three phases. It includes: Phase-I, Phase-II and Phase-III.

Phase-I: In the First phase, the aim of the study is to empirically prove the relationship between computational algorithms: HBMO and PSO and perceived applicability.

Phase-II: In the Second phase, the aim of the study is to prove that there is a significant influence of personal belief and peer group effect in influencing computational algorithms: HBMO and PSO towards perceived applicability.

Phase-III: In the Third phase, the aim of the study is to construct conceptual framework by applying statistical tools and to showcase the relative strength of the three factors in Influencing computational algorithms: HBMO and PSO and perceived applicability.

9. RESEARCH DESIGN

A multi-method approach is important for understanding the potential of influencing factors like personal belief, peer group effect and empirical effects in perceived applicability of computational algorithms like HBMO and PSO. The aim of this approach is to understand the meaning of like personal belief, peer group effect and empirical effects from a perceived applicability perspective. This approach also involves an investigation of why the researchers prefer to apply specific algorithms in their research. The use of multiple data-collection methods enables the researcher to complement the weaknesses and strengths of research problems moreover, to obtain convergent findings, and to promote a better understanding. This research is both quantitative and qualitative as it uses segmentation method. The present study has segmented the respondents from all over Tamil Nadu in to three parts (i) Northern part (ii) Central part and (iii) Southern part for the purpose of easy analysis. Table.1 shows the distribution of the sample as Northern part of Tamil Nadu, Central part and Southern part.

Table.1. The distribution of the sample as Northern part of Tamil Nadu, Central part and Southern part

Sl. No.	Part of Tamil Nadu	Sample size
1	Northern part	288
2	Central part	351
3	Southern part	230
	Total samples	869

Data Source: Primary data were necessary for addressing the information requirements of the research.

9.1 RESEARCH INSTRUMENT

A valid and reliable self-administered questionnaire is used as the research instrument for this study. The questionnaire was constructed to survey the personal data, profile, background and the preference computational algorithms by the researchers based on three factors personal belief, peer group effect and empirical effects. In terms of measuring the impact of three factors (i) personal belief, (ii) peer group effect and (iii) empirical effects on perceived applicability of computational algorithms.

Thereafter, statements are framed in a yes or no pattern questions and their response is recorded. Under the components: 1) personal belief, 2) peer group effect and 3) empirical results. So that each respondent will be filling up two questionnaires with 9 questions each one for HBMO algorithm and the other one for PSO algorithm.

Table.2. The phases of the study

Research Phases	Research Settings	Methods of data collection/analysis	Study population
Phase-I	Descriptive statistics	-	-
Person's correlation co-efficient	869	-	-
Three factor Theory	-	-	-
Personal belief	-	82%	32%
Peer group effect	-	75%	45%
Empirical results	-	79%	65%

9.2 STATISTICAL TOOLS

The objective of using the correlation analysis for this study is to substantiate statistically the following three facets:

- To identify the direction of the relationship between two variables in terms of positive relationship or negative relationship which in turn showcase the corresponding increase in one variable due to the influence of the other variable and vice-versa.
- To determine the form of the relationship whether linear, non-linear or a curved relationship based on the purpose of the study.
- To measure the degree of relationship to show the how well the data fit the identified from which is indicated by the correlation value 1.00 whereas a correlation of value of 0 indicates that there is no fit. The values in between represents the degree to which data points estimate the perfect fit. Moreover the numeric value of the correlation indicates the degree to which it has predicted the consistent relationship between the two variables. The values may be positive (1.00) or negative (-1.00).

Correlation analysis is used in this study to measure the relationship between the variables in question. Correlation is a statistical technique that is used to measure and describe a relationship between two variables. In this study, three characteristics are measured as follows:

9.3 DATA ANALYSIS AND FINDINGS

The data from whole sample of 869 respondents form all over Tamil Nadu was analyzed. In pursuit of this, a set of 9 questions for HBMO and PSO algorithm each are rated in a bipolar scale with the scores of 'No'= 0 and "yes'= 1. Therefore a maximum total range of score will be 9 which recorded for all the components put together as mentioned earlier. Thus the score of 9 shows a strong

influence for perceived applicability of HBMO or PSO Here, for the purpose of studying the role and influence of the components in a distinctive way the components are segregated into 3 parcels and each parcel share a score of 3 points and obtaining full 3 points in the respective parcel shows significant influence and reveal definite influence of the researchers in applying the algorithms in their research. A score of 2 discloses the moderate relation towards perceived applicability and less than 2 shows lower relation towards perceived applicability. And a score of 0 reveals that it is not significant to the researchers.

9.3.1 Details of the Questionnaire Format for this Study. Is Provided in Appendix-A:

Data are classified according to the method of collection from the selected computational algorithms and three factors for influencing perceived applicability in their research and analyzed to fulfill the objectives of the research. The analysis using descriptive statistics of the data gathered are calculated for each of the factors and perceived applicability among the researchers. Research hypotheses are mainly examined using Pearson's correlation, frequency analysis and percentage calculation. However, the data are analyzed at confidence levels of 99%, 95%, and 90%.

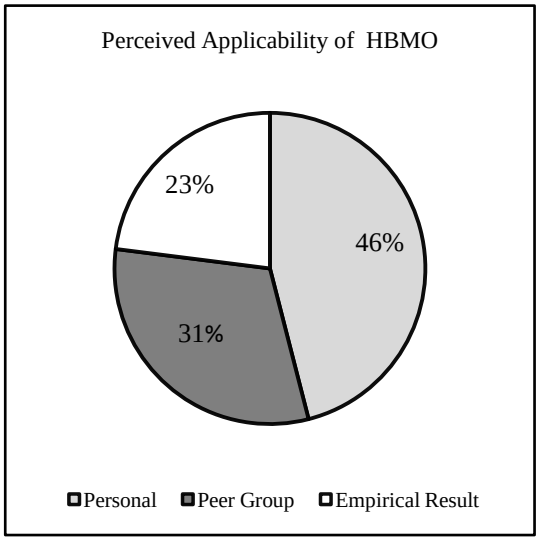

Fig.1. Perceived Applicability of HBMO
Personal - 46%, Peer Group - 31% and Empirical Result - 23%

The Fig.1 shows the percentage distribution of three factors influence towards perceived applicability of HBMO.

The Fig.2 shows the percentage distribution of three factors influence towards perceived applicability of PSO.

The Fig.3 shows the percentage distribution obtained from parts of the respondents towards frequency of influence of personal belief towards perceived applicability of HBMO.

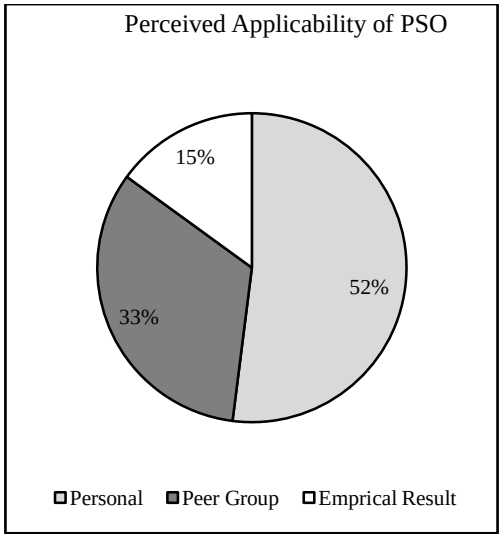

Fig.2. Perceived Applicability of PSO
Personal - 52%, Peer Group - 33% and Empirical Result - 15%

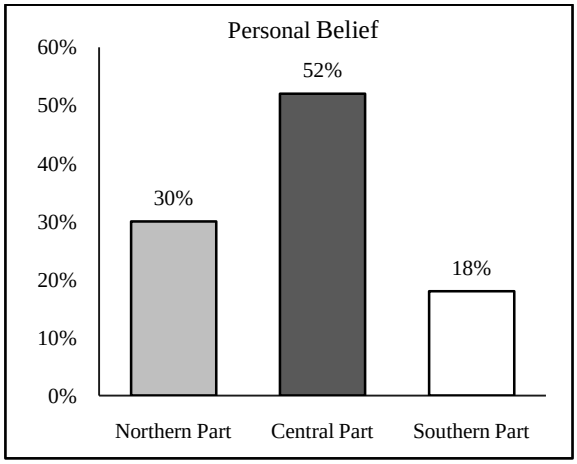

Fig.3. Personal Belief

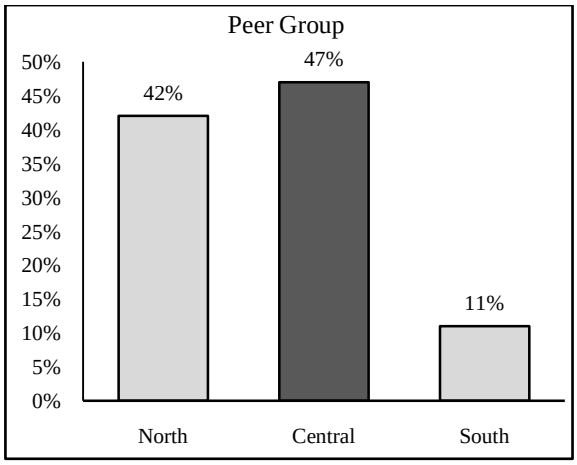

Fig.4. Peer Group

The Fig.4 shows the percentage distribution obtained from parts of the respondents towards frequency of influence of peer group towards perceived applicability of HBMO.

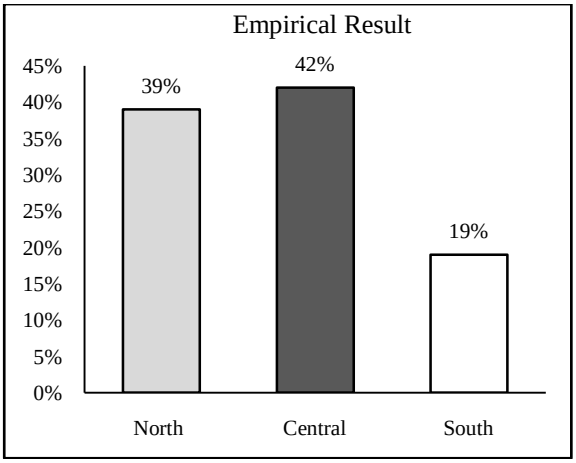

Fig.5. Empirical Result

The Fig.5 shows the percentage distribution obtained from parts of the respondents towards frequency of influence of Empirical results towards perceived applicability of HBMO.

Table.3. Weighted Average for Northern Part

Sl.No.	Comparison of Weighted Average of Perceived Influencing Factor			
	Northern Part			
	HBMO		PSO	
1	Personal Belief	30%	Personal Belief	23%
2	Peer Group	42%	Peer Group	48%
3	Empirical Group	28%	Empirical Results	29%

The Table.3 shows the comparison of weighted average of perceived influencing factor as percentage distribution between HBMO and PSO obtained from Northern part of the respondents of Tamil Nadu.

Table.4. Weighted Average for Central Part

Sl.No.	Comparison of Weighted Average of Perceived Influencing Factor			
	Central Part			
	HBMO		PSO	
1	Personal Belief	27%	Personal Belief	20%
2	Peer Group	40%	Peer Group	44%
3	Empirical Group	33%	Empirical Results	36%

The Table.4 shows the comparison of weighted average of perceived influencing factor as percentage distribution between HBMO and PSO obtained from Central part of the respondents of Tamil Nadu.

Table.5. Weighted Average for Southern Part

Sl.No.	Comparison of Weighted Average of Perceived Influencing Factor			
	Southern Part			
	HBMO		PSO	
1	Personal Belief	32%	Personal Belief	30%
2	Peer Group	45%	Peer Group	49%
3	Empirical Group	23%	Empirical Results	21%

The Table.5 shows the comparison of weighted average of perceived influencing factor as percentage distribution between HBMO and PSO obtained from Southern part of the respondents of Tamil Nadu.

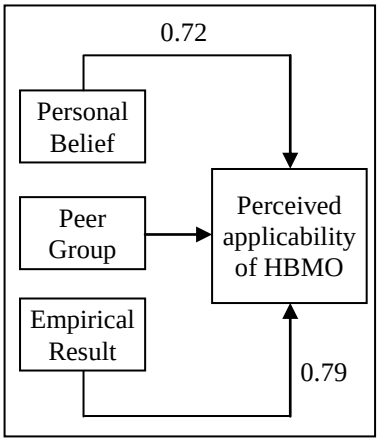

Fig.6. HBMO-Northern Part of Tamil Nadu

The Fig.6 shows the correlation values between three factors that influence the perceived applicability of HBMO among the researchers belonging to Northern part of Tamil Nadu.

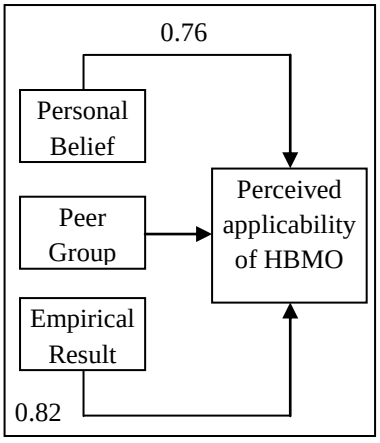

Fig.7. HBMO-Central Part of Tamil Nadu

The Fig.7 shows the correlation values between three factors that influence the perceived applicability of HBMO among the researchers belonging to central part of Tamil Nadu.

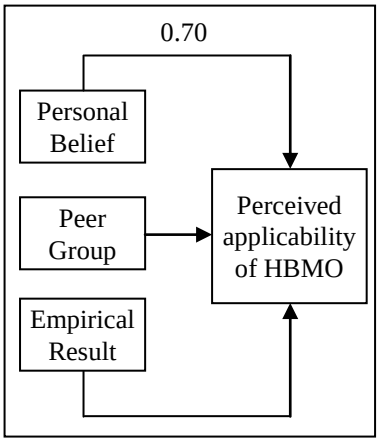

Fig.8. HBMO-Southern Part of Tamil Nadu

The Fig.8 shows the correlation values between three factors that influence the perceived applicability of HBMO among the researchers belonging to Southern part of Tamil Nadu.

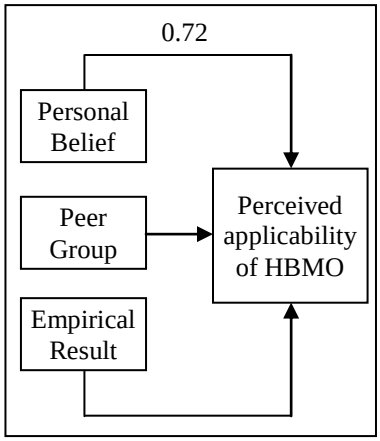

Fig.9. PSO-Northern Part of Tamil Nadu

The Fig.9 shows the correlation values between three factors that influence the perceived applicability of PSO among the researchers belonging to Northern part of Tamil Nadu.

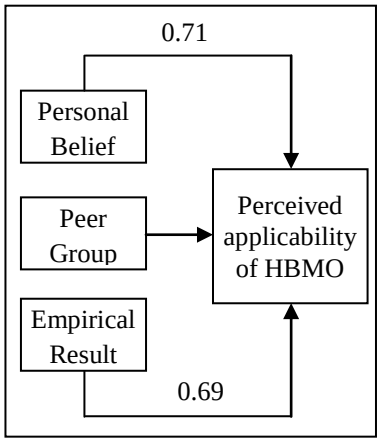

Fig.10. PSO-Central Part of Tamil Nadu

The Fig.10 shows the correlation values between three factors that influence the perceived applicability of PSO among the researchers belonging to Central part of Tamil Nadu.

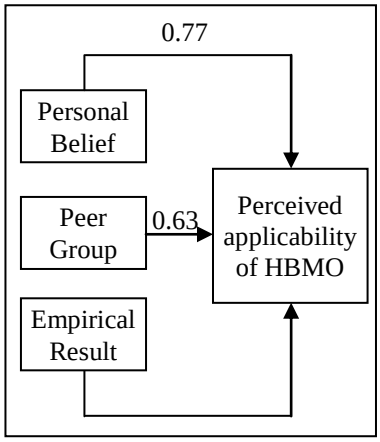

Fig.11. PSO-Southern Part of Tamil Nadu

The Fig.11 shows the correlation values between three factors that influence the perceived applicability of PSO among the researchers belonging to Southern part of Tamil Nadu.

Table.6. Correlation Value between Northern Part

Sl. No.	Comparison of correlation between three factors and perceived applicability			
	Northern Part			
	HBMO	R-value	PSO	R-value
1	Personal Belief	0.76	Personal Belief	0.72
2	Peer Group	0.82	Peer Group	0.65
3	Empirical Group	0.65	Empirical Results	0.61

The Table.6 shows the correlation values between HBMO and PSO of three factors that influence the perceived applicability among the researchers of Tamil Nadu.

Table.7. Correlation Value between Central Part

SI. No.	Comparison of correlation between three factors and perceived applicability			
	Central Part			
	HBMO	R-value	PSO	R-value
1	Personal Belief	0.71	Personal Belief	0.71
2	Peer Group	0.83	Peer Group	0.69
3	Empirical Group	0.70	Empirical Group	0.58

The Table.7 shows the correlation values between HBMO and PSO of three factors that influence the perceived applicability among the researchers of Tamil Nadu.

Table.8. Correlation Value between Southern Parts

Sl. No.	Comparison of correlation between three factors and perceived applicability			
	Southern part			
	HBMO	R-value	PSO	R-value
1	Personal Belief	0.71	Personal Belief	0.77
2	Peer Group	0.76	Peer Group	0.63
3	Empirical Group	0.61	Empirical Group	0.52

The Table.8 shows the comparison of correlation values between HBMO and PSO of three factors that influence the perceived applicability among the researchers of Tamil Nadu.

9.4 FINDINGS OF THE ANALYSIS

The findings of the selected factors which are shown in Fig.1 clearly indicate the relationship between the perceived applicability of HBMO algorithm and the selected three factors of influence. The percentage distribution shows the frequency of influencing factors among the researchers. Among three factors Peer group has 46% influence and personal beliefs has 31% while empirical results has only 23% influence in applying HBMO for the research among the scholars in Tamil Nadu. Whereas, the findings for perceived applicability of PSO suggest a little different influence distribution. It shows 52% of peer

group influence and 33% of personal beliefs and only 15 % of empirical results. From this it is evident that the empirical results influence is not very significant in perceiving the applicability of PSO algorithm among the research scholars in Tamil Nadu. Subsequently the % distribution of the respondents having influenced by personal belief belonging to three parts of Tamil Nadu indicates that 51% researcher of Central part and 32 % Northern part and 17 % Southern are being influenced Likewise, respondents influenced by Peer group demonstrates that 47% from Central part and 42% from Northern part, while only 11% from the Southern where being influenced. The distribution is shown in Fig.4 correspondingly, respondents influenced by Empirical results proves that 42% from Central part and 39% from Northern part, while only 19% from the Southern where being influenced. The distribution is shown in Fig.5.

Since the objective of the study is to find out the influences of the algorithm on a comparative basis the weighted average of the factors that influence the HBMO and PSO for each part of the respondents were measured and findings were obtained. Table.3 shows the results of Northern part which clearly indicates that peer group has more weightage in influencing both HBMO and PSO, because it has 42% and 48% average

Next significant weightage goes to personal belief having 30% and 23% for HBMO and PSO respectively. Finally the empirical results share a weightage of 28% and 29% average which implies that there is not much difference for HBMO and PSO. Similarly, Table.4 shows the results of central part which clearly indicates that peer group has more weightage in influencing both HBMO and PSO, because it has 40% and 44% average. Next significant weightage goes to empirical results having 33% and 36% for HBMO and PSO respectively. Finally the personal belief share a weightage of 27% and 20% average which implies that there is not much difference for HBMO and PSO.

Subsequently, Table.5 shows the results of Southern part which clearly specifies that peer group has more weightage in influencing both HBMO and PSO, because it has 45% and 49% average. Next significant weightage goes to personal belief having 32% and 30% for HBMO and PSO respectively. Finally the empirical results share a weightage of 23% and 21% average which implies that there is not much difference for HBMO and PSO.

Since the study objective includes examining the form and strength of relationship between the factors that influence the perceived applicability, Pearson's correlation test is carried out

Separately for HBMO and PSO with part wise like: Northern, Central and Southern part. Fig.6 shows the correlation values of the three factors. Peer group with value of 0.79 shows strong positive correlation in perceived applicability of HBMO among Northern part of the researchers of Tamil Nadu. Correspondingly personal belief with value of 0.72 shows strong positive correlation in perceived applicability of HBMO among Northern part of the researchers of Tamil Nadu. Subsequently, Empirical results with value of 0.63 shows moderately positive correlation in perceived applicability of HBMO among Northern part of the researchers of Tamil Nadu.

The Fig.7 shows the correlation values of the three factors. Peer group with value of 0.82 shows very strong positive correlation in perceived applicability of HBMO among central part of the researchers of Tamil Nadu. Correspondingly personal belief with value of 0.76 shows strong positive correlation in perceived applicability of HBMO among Central part of the researchers of Tamil Nadu. Subsequently, Empirical results with value of 0.65 shows moderately positive correlation in perceived applicability of HBMO among central part of the researchers of Tamil Nadu.

The Fig.8 shows the correlation values of the three factors. Peer group with value of 0.76 shows strong positive correlation in perceived applicability of HBMO among Southern part of the researchers of Tamil Nadu. Correspondingly personal belief with value of 0.70 shows strong positive correlation in perceived applicability of HBMO among Southern part of the researchers of Tamil Nadu. Subsequently, Empirical results with value of 0.61 shows moderately positive correlation in perceived applicability of HBMO among southern part of the researchers of Tamil Nadu.

The correlation test carried out for PSO and three factor influence has provided the following findings: Fig.9 shows that correlation values of the three factors. Peer group with value of 0.65 shows moderately positive correlation in perceived applicability of PSO among Northern part of the researchers of Tamil Nadu. Correspondingly personal belief with value of 0.72 shows strong positive correlation in perceived applicability of PSO among Northern part of the researchers of Tamil Nadu. Subsequently, Empirical results with value of 0.61 shows moderately positive correlation in perceived applicability of PSO among Northern part of the researchers of Tamil Nadu.

The Fig.10 shows that correlation values of the three factors. Peer group with value of 0.69 shows moderately positive correlation in perceived applicability of PSO among central part of the researchers of Tamil Nadu. Correspondingly personal belief with value of 0.71 shows strong positive correlation in perceived applicability of PSO among central part of the researchers of Tamil Nadu. Subsequently, Empirical results with value of 0.58 shows moderately positive correlation in perceived applicability of PSO among central part of the researchers of Tamil Nadu.

The Fig.11 shows that correlation values of the three factors. Peer group with value of 0.63 shows moderately positive correlation in perceived applicability of PSO among Southern part of the researchers of Tamil Nadu. Correspondingly personal belief with value of 0.77 shows strong positive correlation in perceived applicability of PSO among Southern part of the researchers of Tamil Nadu. Subsequently, Empirical results with value of 0.52 shows moderately positive correlation in perceived applicability of PSO among Southern part of the researchers of Tamil Nadu.

Finally the comparative analysis of the correlation between three factors and HBMO and three factors and PSO are computed and shown in the Table.6, Table.7 and Table.8. The findings clearly indicate that the peer group influence has a greater role in influencing the perceived applicability of the algorithms. And in the second place the personal belief has its role in influencing the applicability among the researchers. Finally the empirical results have relatively less influence in perceived applicability of the algorithm.

10. RESULTS AND DISCUSSION

From the results it has been proved that though the HBMO and PSO algorithms are used depending upon the issue and the context, the underlying influencing factors are revealed with

their relative strength and direction of influences. Thereby implying that peer group effect is one of the obvious factors in contributing to the perceived applicability of the algorithm and the next factor is the personal belief with least impact of empirical results for using the algorithm.

Though, it is found that peer group effect is the key factor in influencing the applicability, the combined effect of personal belief and empirical results would become a moderator in deciding the usage of specific algorithm.

11. CONCLUSION

Although this study is done with respondents from all over Tamil Nadu with three parts North, Central and South, the results indicate slight variation in terms of influencing factors from different parts and it implies that variance could to change in the influencing factors. Since, it is inferred that peer group has greater influence in applying the algorithm the selection of peer group becomes an important aspect which could have direct and indirect implications to the selection of algorithm and the results of the research as well. Therefore, it is warranted to pay attention to the selection and characteristic features of the peer of group in order to achieve effective and better results in the research being carried out by individual researchers. This finding is an important data with critical value for the researcher not to ignore during their research work.

In future more factors could be identified and analyzed to get comprehensive findings that could add more value to the present study.

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APPENDIX-AQUESTIONNAIRE FORMAT

Respondent's Profile:

- Are you a Research scholar or Faculty :
- Age:
- Gender :
- Years of experience in research :
- Affiliated Institute/ organization :
- I am in a position to provide my perception about

The applicability of HBMO / PSO in power systems, operational research

Dynamic systems, bioinformatics, multi-objective& mini-max problems:

Note: Please provide your response to the items stated below by a Tick mark. The data collected through this questionnaire is utilized purely for academic research purpose only. The information provided will not be shared or used by others.

Based on:

I – Personal Belief:

1) I personally believe that HBMO algorithm has the potential for wide range of applications.

YES	NO

2) I will certainly recommend applying HBMO algorithm to address real life problems.

YES	NO

3) I feel the structure of HBMO algorithm is easy to adapt to dynamic systems and arrive at strategies.

YES	NO

II – Empirical Results:

1) I have applied HBMO algorithm in my study and have obtained desirable empirical results.

YES	NO

2) Applying HBMO algorithm has flexibility of measuring and changing the parameter as and when required.

YES	NO

3) The reliability & validity of the results are highly significant when HBMO algorithm is applied for wide range of issues.

YES	NO

III – Peer Group:

1) Most of the research scholars whom I know have stated that they have been using HBMO for many studies.

YES	NO

2) I have decided to apply HBMO for my study because many literature studies and leading scholars have proved it wide range of application in real life problems.

YES	NO

3) My colleagues have rated my work very high when they learnt that I have used HBMO for my research work.

YES	NO

Thank you for your time and participation.

QUESTIONNAIRE FORMAT

Respondent's Profile:

- Are you a Research scholar or Faculty :
- Age:
- Gender :
- Years of experience in research :
- Affiliated Institute/ organization :

- I am in a position to provide my perception about

  The applicability of HBMO / PSO in power systems, operational research

  Dynamic systems, bioinformatics, multi-objective& mini-max problems:

Note: Please provide your response to the items stated below by a Tick mark. The data collected through this questionnaire is utilized purely for academic research purpose only. The information provided will not be shared or used by others.

Based on:

I – Personal Belief:

1) I personally believe that PSO algorithm has the potential for wide range of applications.

YES	NO

2) I will certainly recommend to apply PSO algorithm to address real life problems.

YES	NO

3) I feel the structure of PSO algorithm is easy to adapt to dynamic systems and arrive at strategies.

YES	NO

II – Empirical Results:

1) I have applied PSO algorithm in my study and have obtained desirable empirical results.

YES	NO

2) Applying PSO algorithm has flexibility of measuring and changing the parameter as and when required.

YES	NO

3) The reliability & validity of the results are highly significant when PSO algorithm is applied for wide range of issues.

YES	NO

III – Peer Group:

1) Most of the research scholars whom I know have stated that they have been using PSO for many studies.

YES	NO

2) I have decided to apply PSO for my study because many literature studies and leading scholars have proved it wide range of application in real life problems.

YES	NO

3) My colleagues have rated my work very high when they learnt that I have used PSO for my research work.

YES	NO

Thank you for your time and participation.