Online ISSN: 3049-0014

SSN JOURNAL OF MANAGEMENT & TECHNOLOGY RESEARCH COMMUNICATIONS

Vol (2) No (1)

Jan-Feb-Mar-Apr 2025

An Open Access International Peer Reviewed Quarterly Journal

Showcasing Current Academic Research in Management and Technological Sciences

Contents available every 3 months

Published by

Society for Science & Nature

CONTENTS

MNTRC

SSN Journal of Management & Technology Research Communications Volume 2 • Number 1 • Jan-Feb-Mar-Apr (2025)

SSN Journal of Management and Technology Research Communications

An Open Access International Journal of Management & Technological Sciences

Website: https://mntrc.in/about-us/

About Us

Society for Science and Nature, (SSN) Bhopal, India is a non-profit academic organization, founded in 2008 by academicians from all walks of life: literature, arts, science, technology and nature. The main objective of the organization is to work for the upliftment of the society and the community in large, imparting free services for quality education and research. The Society has been trying to integrate systems of values, ethics, and principles in the students, the future of country's tomorrow. The society has been carrying out academic and educational programs in the country for providing quality education, expertise and training to students and scholars, using state of the art technologies with experienced academicians, teachers, engineers, doctors and social scientists belonging to various disciplines.

Society for Science and Nature, has been publishing an academic international peer-reviewed journal since 2008: **Bioscience Biotechnology Research Communications**, which is in 17th year of successful publication. SSN has ventured into starting yet another international publication, **SSN Journal of Management and Technology Research Communications.** It is an open-access, international peer reviewed quarterly journal for publication of original research articles, exciting reviews, interesting case histories and perspectives in applied areas of management and technology, including biological and medical sciences.

The journal welcomes empirical and analytical papers, reflecting both methodological rigor and practical relevance as well as literature reviews and meta-analyses showcasing and promoting current academic research in upcoming areas of management, science and technology. The insufficient publishable research in the sub-continent, and the developing nations, on the intertwining between management and successful management of science and technology, particularly in areas like health, basic science, engineering, including computer sciences prompted the proposal of this new journal.

The experienced and highly qualified board of editors of this journal will aim to foster diverse investigations of management of science and technology research, encompassing various types of applied areas. We intend to evaluate the theoretical and practical perspectives, utilising a range of methodologies and data—including quantitative, such as surveys, lab experiments, and archival research, as well as qualitative approaches, including case studies and examining the different settings in Management, Science and Technology.

We are particularly interested in – but not limited to – the following research avenues in applied areas of **Management, Science and Technology:** Biological Sciences, Health Sciences, Physical Sciences, Natural Sciences and Engineering.

Our Vision: In the coming years we hope and wish that **SSN Journal of Management and Technology Research Communications** will try to maintain high standards of ethical and quality publication, as we believe that it is only quality which can fully utilize the science for our welfare!

We do have a vision to become an important force for pluralism—teaching and disseminating the research skills of management, in living with science and technology. **SSN Journal of Management and Technology Research Communications** strongly believes that it will achieve high standards of ethical and quality publication as we visualize that it is only quality, which can truly help shaping technology for our existence!

Complaint Policy of SSN Journal of Management and Technology Research Communications

Genuine complaints in Publication: Complaint or expression of dissatisfaction made in honest intention of improvisation are always welcome, as they provide an opportunity and instant moment of attaining quality. The editorial team of SSN Journal of Management and Technology Research Communications shall strive hard to establish, along with the publisher, a transparent mechanism for appeal against editorial decisions or any related matter of publication. If still there are any genuine complaints related to ethical publishing, we are always open to them for the sake of maintaining quality and ethics of publication.

Please write your complaint with Journal title, Vol No/ Issue No /Year /Page numbers, full title of the MS and necessary author details along with type of complaint. The complaint must be about something that is within the jurisdiction of SSN Journal of Management and Technology Research Communications, its contents or process such as authorship, plagiarism, copy right violation, multiple, duplicate, or concurrent publications/ simultaneous submissions etc. Similarly, undisclosed conflicts of interest, reviewer bias or competitive harmful acts by reviewers or any bias of apparent discontentment, backed by logic and judicial discretion will be immediately looked into without any bias and discrimination.

If the Editor receives a complaint that any contribution to the Journal breaks intellectual property rights or contains material inaccuracies or otherwise unlawful materials, a detailed investigation may be requested into, with the parties involved, substantiating their materialistic claims in writing, following the law of natural justice. We assure that we will make a good faith determination to remove the allegedly wrongful material or take actions as per law. All the investigations and decisions are to be documented to the Journal.

Our aim is to ensure that Management and Technology Research Communications follows best practices in publication and is of the highest quality, free from errors. However, we accept that occasionally mistakes might happen, which are inadvertently made or beyond human control, giving opportunity to all parties to decide the best to rectify.

Editorial Complaints Policy: The Managing Editor and staff of Management and Technology Research Communications will make every effort to put matters right as soon as possible in the most appropriate way, offering right of reply where necessary. As far as possible, we will investigate complaints in a blame-free manner, looking to see how systems can be improved to prevent mistakes occurring.

How to Make a Complaint: Complaints about editorial content should be made as soon as possible after publication, preferably in writing by email to editor@mntrc.in or by on-line submission at www.mntrc.in.

Article Withdrawal Policies Of Management and Technology Research Communications

Submission of an article to Management and Technology Research Communications implies that the work has NOT been published or submitted elsewhere, therefore, the journal is strongly against unethical withdrawal of an article from the publication process after submission. Once the article is submitted, it is the absolute right of the editorial board to decide on article withdrawals. For genuine withdrawal, the corresponding author should submit a request which must be signed by all co-authors explaining the explicit reasons of withdrawing the manuscript.

Accepted articles in final stages of publication if are withdrawn, will entail withdrawal fees. The request will be processed by the editorial board and only serious genuine reasons will be considered if possible. The decision of the editorial board will be final and not negotiable. Unethical withdrawal or no response from the authors to editorial board communication will be subjected to sanction a ban to all authors, and their institute will also be notified.

It is a general principle of scholarly communications, that the editor of a journal is solely and independently responsible for deciding which articles submitted to the journal shall be published. In making this decision the editor is guided by policies of the journal's editorial board and constrained by such legal requirements in force regarding libel, copyright infringement and plagiarism. An outcome of this principle is the importance of the scholarly archive as a permanent, historic record of the transactions of scholarship.

Articles that have been published shall remain extant, exact and unaltered as far as is possible. However, very occasionally circumstances may arise where an article is published that must later be retracted or even removed. Such actions must not be undertaken lightly and can only occur under exceptional circumstances. In all cases, official archives of our journal will retain all article versions, including retracted or otherwise removed articles.

This policy has been designed to address these concerns and to take into account current best practice in the scholarly and library communities. As standards evolve and change, we will revisit this issue and welcome the input of scholarly and library communities. See also the National Library of Medicine's policy on retractions and the recommendations of the International Committee of Medical Journal Editors (ICMJE) concerning corrections and retractions.

Article withdrawal

Only used for Articles in Press which represent early versions of articles and sometimes contain errors, or may have been accidentally submitted twice. Occasionally, but less frequently, the articles may represent infringements of professional ethical codes, such as multiple submission, bogus claims of authorship, plagiarism, fraudulent use of data or the like. Articles in Press (articles that have been accepted for publication but which have not been formally published and will not yet have the complete volume/issue/page information) that include errors, or are discovered to be accidental duplicates of other published article(s), or are determined to violate our journal publishing ethics guidelines in the view of the editors (such as multiple submission, bogus claims of authorship, plagiarism, fraudulent use of data or the like), may be withdrawn. Withdrawn means that the article content (HTML and PDF) is removed and replaced with a HTML page and PDF simply stating that the article has been withdrawn according to the Policies on Article in Press Withdrawal with a link to the current policy document.

Article retraction

Infringements of professional ethical codes, such as multiple submission, bogus claims of authorship, plagiarism, fraudulent use of data or the like. Occasionally a retraction will be used to correct errors in submission or publication. The retraction of an article by its authors or the editor under

If the Editor receives a complaint that any contribution to the Journal breaks intellectual property rights or contains material inaccuracies or otherwise unlawful materials, a detailed investigation may be requested into, with the parties involved, substantiating their materialistic claims in writing, following the law of natural justice. We assure that we will make a good faith determination to remove the allegedly wrongful material or take actions as per law. All the investigations and decisions are to be documented to the Journal.

Our aim is to ensure that SSN Journal of SSN Journal of SSN Journal of Management and Technology Research Communications follows best practices in publication and is of the highest quality, free from errors. However, we accept that occasionally mistakes might happen, which are inadvertently made or beyond human control, giving opportunity to all parties to decide the best to rectify.

Editorial Complaints Policy: The Managing Editor and staff of SSN Journal of Management and Technology Research Communications will make every effort to put matters right as soon as possible in the most appropriate way, offering right of reply where necessary. As far as possible, we will investigate complaints in a blame-free manner, looking to see how systems can be improved to prevent mistakes occurring.

How to Make a Complaint: Complaints about editorial content should be made as soon as possible after publication, preferably in writing by email to editor@mntrc.in or by on-line submission at www.mntrc.in.

Article Withdrawal Policies Of SSN Journal of Management and Technology Research Communications

Submission of an article to SSN Journal of Management and Technology Research Communications implies that the work has NOT been published or submitted elsewhere, therefore, the journal is strongly against unethical withdrawal of an article from the publication process after submission. Once the article is submitted, it is the absolute right of the editorial board to decide on article withdrawals. For genuine withdrawal, the corresponding author should submit a request which must be signed by all co-authors explaining the explicit reasons of withdrawing the manuscript.

Accepted articles in final stages of publication if are withdrawn, will entail withdrawal fees. The request will be processed by the editorial board and only serious genuine reasons will be considered if possible. The decision of the editorial board will be final and not negotiable. Unethical withdrawal or no response from the authors to editorial board communication will be subjected to sanction a ban to all authors, and their institute will also be notified.

It is a general principle of scholarly communications, that the editor of a journal is solely and independently responsible for deciding which articles submitted to the journal shall be published. In making this decision the editor is guided by policies of the journal's editorial board and constrained by such legal requirements in force regarding libel, copyright infringement and plagiarism. An outcome of this principle is the importance of the scholarly archive as a permanent, historic record of the transactions of scholarship. Articles that have been published shall remain extant, exact and unaltered as far as is possible. However, very occasionally circumstances may arise where an article is published that must later be retracted or even removed. Such actions must not be undertaken lightly and can only occur under exceptional circumstances. In all cases, official archives of our journal will retain all article versions, including retracted or otherwise removed articles.

This policy has been designed to address these concerns and to take into account current best practice in the scholarly and library communities. As standards evolve and change, we will revisit this issue and welcome the input of scholarly and library communities. See also the National Library of Medicine's policy on retractions and the recommendations of the International Committee of Medical Journal Editors (ICMJE) concerning corrections and retractions.

Article withdrawal

Only used for Articles in Press which represent early versions of articles and sometimes contain errors, or may have been accidentally submitted twice. Occasionally, but less frequently, the articles may represent infringements of professional ethical codes, such as multiple submission, bogus claims of authorship, plagiarism, fraudulent use of data or the like. Articles in Press (articles that have been accepted for publication but which have not been formally published and will not yet have the complete volume/issue/page information) that include errors, or are discovered to be accidental duplicates of other published article(s), or are determined to violate our journal publishing ethics guidelines in the view of the editors (such as multiple submission, bogus claims of authorship, plagiarism, fraudulent use of data or the like), may be withdrawn. Withdrawn means that the article content (HTML and PDF) is removed and replaced with a HTML page and PDF simply stating that the article has been withdrawn according to the Policies on Article in Press Withdrawal with a link to the current policy document.

Article retraction

Infringements of professional ethical codes, such as multiple submission, bogus claims of authorship, plagiarism, fraudulent use of data or the like. Occasionally a retraction will be used to correct errors in submission or publication. The retraction of an article by its authors or the editor under the advice of members of the scholarly community has long been an occasional feature of the learned world. Standards for dealing with retractions have been developed by a number of library and scholarly bodies, and this best practice is adopted for article retraction by us.

A retraction note titled “Retraction: [article title]” signed by the authors and/or the editor is published in the paginated part of a subsequent issue of the journal and listed in the contents list.In the electronic version, a link is made to the original article.The online article is preceded by a screen containing the retraction note. It is to this screen that the link resolves; the reader can then proceed to the article itself. The original article is retained unchanged save for a watermark on the .pdf indicating on each page that it is “retracted.”The HTML version of the document is removed.

Article removal: legal limitations

In an extremely limited number of cases, it may be necessary to remove an article from the online database. This will only occur where the article is clearly defamatory, or infringes others’ legal rights, or where the article is, or we have good reason to expect it will be, the subject of a court order, or where the article, if acted upon, might pose a serious health risk. In these circumstances, while the metadata (Title and Authors) will be retained, the text will be replaced with a screen indicating the article has been removed for legal reasons.

Article replacement

In cases where the article, if acted upon, might pose a serious health risk, the authors of the original article may wish to retract the flawed original and replace it with a corrected version. In these circumstances the procedures for retraction will be followed with the difference that the database retraction notice will publish a link to the corrected re-published article and a history of the document.

Open Access Policy Statement of MNTRC

SSN Journal of Management and Technology Research Communications is an open access journal which means that all content is freely available without charge to the user or his/her institution. Users are allowed to read, download, copy, distribute, print, search, or link to the full texts of the articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author for any used content, however all freely used content must be properly cited with details. This is in accordance with the BOAI definition of open access. The full text of all content SSN Journal of Management and Technology Research Communications is available for free and has open access without delay with no embargo period.

All research articles published in our journal are fully open access: immediately freely available to read, download and share. Articles are published under the terms of a Creative Commons license which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship, as well as the right to make small numbers of printed copies for their personal use.

A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository that is supported by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving. Open access is a property of individual works, not necessarily journals or publishers. Community standards, rather than copyright law, will continue to provide the mechanism for enforcement of proper attribution and responsible use of the published work, as they do now.

Licensing and Copyright Terms

Copyright

SSN Journal of Management and Technology Research Communications has an author-policy of copy right, where all the published content of its scholarly articles are retained by its authors, which can be used for immediate free access, permitting any user to read, download, copy, distribute, print, search, or link to the full texts of articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, provided the original article and source is correctly cited. All articles published by SSN Journal of Management and Technology Research Communications will be distributed freely under the terms and conditions of the Creative Commons Attribution License (CC-BY) https://creativecommons.org/licenses/by/4.0/. Thus, any one is freely allowed to copy, distribute, and transmit the article on the condition that the original article and source is correctly cited.

Licensing Policy

SSN Journal of Management and Technology Research Communications has a policy of licensing for use and re- use of the published content without any embargo period, following policy that its authors are copyright holders of their scholarly work, granting usage rights to others using Creative Commons licenses for this purpose.

Privacy Statement

The names and email addresses entered in the journal site will be used exclusively for the stated purposes of the journal and will not be made available for any other purpose and will not be shared to any other party.

Editorial Process

1. Manuscript Processing

Upon initial submission of the manuscript, the author will be acknowledged of the receipt via e-mail. Initially the article will be reviewed by any one member of the editorial team to judge the quality of the paper. Articles written in poor English language or not conforming to SSN Journal of Management and Technology Research Communications guidelines will either be rejected or returned to the authors to rectify the shortcomings. Manuscripts deemed proper are then forwarded to at least two subject experts to provide their unbiased input. Articles submitted to SSN Journal of Management and Technology Research Communications are evaluated according to their intellectual merit, without regard to the race, gender, sexual orientation, religious beliefs, ethnic origin, citizenship, political philosophy, or institutional affiliation of the author (s). Editorial decisions on manuscripts submitted to our journals are based on independent, anonymized peer review reports.

The journal is committed to an editorial process that is not compromised by financial or political influence, thereby actively seeking and encouraging submissions from underrepresented segments of the global scholarly communication ecosystem.Incomplete studies and manuscripts not in strict compliance with the journals policies will be strongly discouraged and rejected. Each type of article has a special format and should comply with the updated SSN Journal of Management and Technology Research Communications Instructions for authors / submission check List, published in its issues. All articles in SSN Journal of Management and Technology Research Communications are published under a Creative Commons License, International Attribution 4.0 BY-CC, meaning thereby a free unlimited use of the articles for academic purposes without any embargo.

We are particular in demonstrating conformance with established industry guidelines and best practices promoted by professional scholarly and academic quality publishing organizations such as: Committee on Publication Ethics (COPE) and Principles of Transparency and Best Practice in Scholarly Publishing. Acceptable manuscripts will be checked for data analysis and verification of references before the author will be notified about the status of the paper with any suggestions for modifications. Finally accepted articles will be forwarded to the printer for typeset and formatting, etc. and the proof will be sent to the authors for proof reading, before publication, to be obtained in a time bound frame.

2. Peer Review Policy

Unbiased, independent, critical assessment is an intrinsic part of all scholarly work, including the scientific process. Peer review is the critical assessment of manuscripts submitted to journals by experts who are not part of the editorial staff, and is, therefore, an important extension of the scientific process. Each article submitted to SSN Journal of Management and Technology Research Communications for publication is reviewed by at least two specialist reviewers of the concerned area. The dual anonymized review process is strictly followed and in certain controversial cases, the opinion of a 3rd reviewer can also be sought.

3. Conflict of Interest

For Authors:

All manuscripts for articles, including the original research data-based articles, reviews, editorials, perspectives, comments and letters that are submitted to SSN Journal of Management and Technology Research Communications must be accompanied by a conflict of interest disclosure statement or a declaration by the authors that they do not have any conflicts of interest to declare. All articles that are published in the journal must be accompanied by this conflict of interest disclosure statement or a statement that the authors have replied that they have no conflicts of interest to declare.

To facilitate this policy, all authors must privately disclose 'All their potential conflicts of interest' to the editor of SSN Journal of Management and Technology Research Communications at the time of submission. Authors should also disclose any conflict of interest that may have influenced either the conduct or the presentation of the research to the editors, including but not limited to close relationships with those who might be helped or hurt by the publication, academic interests and rivalries, and any personal, religious or political convictions relevant to the topic at hand.

Type of Declaration

If you are submitting your article to SSN Journal of Management and Technology Research Communications. make a 'Declaration of Conflicting Interests' please include such a declaration at the end of your manuscript, following any acknowledgments and prior to the references, under the heading 'Conflict of Interest Statement'.

If no declaration is made, the following will be printed under this heading in your article: 'None
Declared' Alternatively, you may wish to state that 'The author (s) declare(s) that there is no conflict of interest'

4. Plagiarism

According to Oxford University Dictionary, plagiarism is defined as using some ones else's ideas, words, data, or other material produced by them without acknowledgement. It is the unauthorized use or close imitation SSN Journal of Management and Technology Research Communications condemns all forms of plagiarism, following a very strict and vigilant policy of removing this malady. Within the academia, it is considered dishonesty or fraud and offenders are subject to academic censure. Plagiarism can be unintentional or intentional, reproducing academic material without appropriate credit to the original authors (Citations / References).

Similarly self -plagiarism is the re-use of significant, identical or near identical portions of one's own work without citing the original work. This is also known as recycling fraud. Worst form of plagiarism is to steal the whole article from some journal and publish it under one's own name in another journal.Plagiarism, fabrication, unethical or redundant publication grossly violates the editorial policies of SSN Journal of Management and Technology Research Communications which follows best practice guidelines given by the International Committee of Medical Journal Editors (ICMJE) and Committee on Publication Ethics (COPE), as mentioned in the Instructions for Authors of SSN Journal of Management and Technology Research Communications. SSN Journal of Management and Technology Research Communications. follows the COPE Guidelines in addressing potential redundant publication.

To avoid the need for corrective action after publication, please disclose any prior publication or distribution of your manuscript to the Editor when submitting your manuscript to the journal. It is important to ensure appropriate attribution to your prior publication of the material is included in the manuscript and that any quoted materials are identified as quotes so that readers of your article may reference the original work. **All authors submitting their MS to SSN Journal of Management and Technology Research Communications must complete and sign the ethical statement form and append the Plagiarism Check Certificate of their MS along with copy-right form (www.mntrc.in) failing which, their MS will not be processed further.** The Editorial Committee of SSN Journal of Management and Technology Research Communications will take appropriate action against any author found to be guilty of intentional plagiarism or exceeding the standard limits of plagiarism / similarity levels of the text matter in their MS.

The name of author(s) committing plagiarism or using similar text without appropriate citations will also be disseminated to concerned authorities. We do not tolerate plagiarism in any of our publications, and we reserve the right to check all submissions through appropriate plagiarism checking tools. Submissions containing suspected plagiarism, in whole or part, will be rejected. If plagiarism is discovered post publication, we will follow our guidance outlined in the Retractions, Corrections and Expressions of Concern section of these guidelines. We expect our readers, reviewers and editors to raise any suspicions of plagiarism, either by contacting the relevant editor or by emailing at editor@mntrc.in.

5. Ethical Issues

Clinical trials and studies conducted in animals (or not) must have been approved by an Institutional Review Committee (IRC). In the absence of such a formal ethics review committee, the Helsinki Declaration of 1975, as revised in 2000 and/or the Guide for the Care and Use of Laboratory Animals, as adopted and promulgated by the United States National Institutes of Health or Indian Council of Medical Research (ICMR) India must be followed. If doubt exists whether the research was conducted in accordance with the Helsinki Declaration, the authors must explain the rationale for their approach, and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study. In case of any study involving clinical trial, taking of informed consent of patients is mandatory.

1. On Ethical Issues:
Animal and Human Studies

Ethical declarations in research form an integral part during the submission process of a manuscript to a journal. SSN Journal of Management and Technology Research Communications , requires that the experimental conditions under which animal and human assays and tests are performed are as per standard protocols used worldwide.

Authors must make it clear in writing that the procedures they used were as humane as possible and have been compiled with the guidelines for animal care of their institutions or with national / international guidelines. Studies on animals must comply with the prevailing standards of animal welfare according to Indian Council of Medical Research Guidelines or Committee for the Purpose of Control & Supervision of Experiments on Animals (CPCSEA) in India, and likewise following similar conditions elsewhere, (Ethical Approval Committees/ Institutional Review Board with Approval Number is necessary).For details of animal studies please see : ARRIVE and Guide for the Care and Use of Laboratory Animals.

Studies involving human subjects / patients / and also if the manuscript includes case reports / case series, authors need to provide the following: Name of the Ethical Committees /Institutional review Board, they have obtained consent from along with approval number /ID. Authors should specifically mention that the study was in accordance with the Helsinki Declaration of 1975 (Human Research: Helsinki Declaration as revised in 2013, SCARE criteria etc).

Human Studies: Ethical Standards and Informed Consent

++For studies involving human subjects and volunteers, please indicate in the manuscript, in a section preceding the References, the following statement or an analogous statement that applies to your situation: "All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975 Human research: Helsinki Declaration as revised in 2013.

Case Reports: Case Reports should be followed as per the guidelines of SCARE criteria

Informed consent should be obtained from all patients for being included in the study." If any identifying information about participants is included in the article, the following sentence should also be included: "Additional informed consent was obtained from all individuals for whom identifying information is included in this article." If you have not included or cannot include this statement in your manuscript, please provide the reason or an alternative statement here and in the manuscript.

1. Disclosure of Interest

Author Contribution: Authors must mention the nature of contribution as per standard format.

Authors must provide details of any financial or personal relationships that might bias the work being submitted. In a section of text preceding the References, please provide relevant information for each author(s) with regard to any conflicts of interest. All submissions must include disclosure of all relationships that could be viewed as presenting a potential conflict of interest.

Acknowledgement of sources:

Proper acknowledgement of the work of others must always be given. Funding acknowledgement must be properly made with grant details, number etc.

Data access and retention: Authors may be asked to provide the raw data in connection with a paper for editorial review, and should be prepared to provide public access to such data.

6. Editorial Committee The Editorial committee comprises of the Editor- in-Chief, Academic Editors, Executive Editor, Managing Editor, Assistant Editor (s) and the editorial secretaries, who meet frequently to expedite the business of the journal. The editorial committee follows the guidelines provided by the International Committee of Medical Journal Editors in Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication which can be downloaded from http://www.icmje.org/

7. Advisory Editorial Board

An international advisory board comprising of members from diverse regions, with significant professional experience in different fields of biological and biomedical sciences helps the Editorial Committee in policy matters when needed. Senior advisory board members from India as well as abroad are members of the journal. Each member is selected due to the expertise and experience in the field of his/her specialization. Affiliations, biographies and addresses of all members of the Editorial Board is displayed on the website of SSN Journal of Management and Technology Research Communications.

Editorial Policies

Generally, functioning of the journal is overseen by an Editorial Advisory board, which consists of eminent and competent researchers in the field, who contribute by inviting contributions and proposing expert opinions on the suitability of submissions. The Editorial board consists of the following important positions:

Editor-in-Chief: The Editor-in-Chief is primarily the one responsible for activities conducted for the journal and maintains the right of final acceptance or rejection of manuscripts. An experienced academician with quality publications is appointed by the Society for Science and Nature, Bhopal India www.ssn.org the official Publishers of SSN Journal of Management and Technology Research Communications to oversee the entire publication process of the journal.

Executive Editor: Executive Editor is who directs processing of the manuscripts which entail soliciting manuscripts from potential contributors, assessing the suitability of the manuscript with respect to its scope, managing the peer review process, devising strategies for the progress of the journal, coordinating with the reviewers and board members, taking decisions on the revised submissions and occasionally assisting the Editor-in-chief in final acceptance or rejection of manuscripts.

Associate Editors: Their role is in handling in reporting to the Chief Editor, and supervision of the editorial team, managing submissions, assigning articles, overseeing publication schedules and other matters related to smooth functioning of the journal.

Academic Editors: Academic Editors are associates who will assist the Chief / Executive Editors in assessing the suitability of the manuscript with respect to its scope, managing the peer review process, devising strategies for the progress of the journal, coordinating with the reviewers and board members.

Editorial Board Members: The international editorial advisory board consists of a panel of researchers having expertise in the relevant field, who are appointed by the authorities of the journal for a specified term of 2 or more years. Editorial board members are required to: carry out peer-reviewing of submitted manuscripts, assess submissions based on the policy and scope of the journal, organize publication of thematic issues, invite new authors and submissions, provide editorials for thematic issues organized under their guest editorship.

Editorial Team: The editorial team is made up of experienced and highly qualified researchers and faculty members of different subjects who help the management of editorial process.

Peer Review

SSN Journal of Management and Technology Research Communications follows the anonymized peer-review procedure for submissions of all manuscripts to its journal. All submitted manuscripts, after initial evaluation for scope, originality, conformity to the journals instructions and check list, language and academic quality writing are then subjected to an extensive anonymized peer review in consultation with members of the journal's editorial board and independent external referees (usually two reviewers). All manuscripts/chapters are assessed in a time bound frame (usually a month with the reviewers), and the decision based on all the peer reviewers' comments, finally taken by the journal's Editor-in-Chief, is then conveyed to the author (s).

(Ethics, Duties and Responsibilities of Authors Reviewers and Editors, Plagiarism and its Control, Malpractices and Ethical statements) Link of copy right form and Plagiarism Check Statement.

i). Ethics

To maintain fair practice we at, Society for Science & Nature (SSN) Bhopal India, the official publishers of SSN Journal of Management and Technology Research Communications strongly believe in strictly following these guidelines for maintaining academic quality and scientific rigor.

These features include information about the methods of selecting articles, especially on the explicit process of external peer review; statements indicating adherence to ethical guidelines; evidence that authors have disclosed financial conflicts of interest; timely correction of errata; explicit responsible retractions as appropriate; and opportunity for comments and dissenting opinion.

We are deeply committed to fair practice of this publication, especially with regard to plagiarism, collaboration, originality, fraud and conflict of interests.

ii). Duties and Responsibilities of Authors

Authorship of the manuscript

Only persons who meet these following authorship criteria should be listed as authors in the manuscript as they must be able to take public responsibility for the content: (i) made significant contributions to the conception, design, execution, data acquisition, or analysis/interpretation of the study; and (ii) drafted the manuscript or revised it critically for important intellectual content; and (iii) have seen and approved the final version of the paper and agreed to its submission for publication. All persons who made substantial contributions to the work reported in the manuscript (such as technical help, writing and editing assistance, general support) but who do not meet the criteria for authorship must not be listed as an author, but should be acknowledged in the "Acknowledgements" section after their written permission to be named as been obtained.

The corresponding author should ensure that all appropriate co -authors (according to the above definition) and no inappropriate co-authors are included in the author list and verify that all co-authors have seen and approved the final version of the manuscript and agreed to its submission for publication. Authors of manuscripts of original research should present an accurate account of the work performed as well as an objective discussion of its significance. Underlying data should be represented accurately in the paper. There should be a clear statement of logical objectives and rationale / justification to take up the study. Study design must be robust and all methods used must be cited properly with standard references so that they can be reproduced easily. A paper should contain sufficient detail and references to permit others to replicate the work.

Discussion must have a critical and comprehensive account of statements supported by up-to-date references. Conclusions must be drawn which must corroborate the data and interpretation highlighting the novelty of the work. References need to be checked for their presence in both text and reference section with all links of refrences from Google Scholar, Pub Med etc.

Fraudulent or knowingly inaccurate statements constitute unethical behavior and are unacceptable. Review and professional publication articles should also be accurate and objective, and editorial 'opinion' works should be clearly identified as such. Submission of a certificate by all MS submitting authors in this regard is mandatory in the form of the Copy Right Form and Plagiarism Check Report of SSN Journal of Management and Technology Research Communications.

Link of copy right form and Plagiarism Check Statement

iii). Duties and Responsibilities of Reviewers and Editors

Any manuscript received for review must be treated as a confidential document. Privileged information or ideas obtained through peer review must be kept confidential and not used for personal advantage. Reviews should be conducted objectively, and observations should be formulated clearly with supporting arguments, so that authors can use them for improving the paper. Any selected referee who feels unqualified to review the research reported in a manuscript or knows that its prompt review will be not be possible, should notify the editor and excuse himself from the review process.

Reviewers should not consider manuscripts in which they have conflicts of interest resulting from competitive, collaborative, or other relationships or connections with any of the authors, companies, or institutions connected to the papers. They must not put their own references in the revised MS, as citations for their benefit.

Editors of SSN Journal of Management ad Technology Research Communications will evaluate manuscripts exclusively on the basis of their academic merit and scientific rigor. An editor must not use unpublished information in the editor's own research without the express written consent of the author. Editors should take reasonable responsive measures when ethical complaints have been presented concerning a submitted manuscript or published paper.

iv) Plagiarism, it's check, tools used and Actions thereof

The authors of SSN Journal of Management and Technology Research Communications should strictly ensure that they have written and submitted entirely original manuscripts to the journal, strictly following all norms of academic quality. If the authors have used the work and /or words of others, it has been appropriately cited or quoted as per standard ethics and norms of publication.

Plagiarism takes many forms, from 'passing off' another's paper as the author's own paper, to copying or paraphrasing substantial parts of another's paper (without attribution), to claiming results from research conducted by others. Plagiarism in all its forms constitutes unethical in SSN Journal of Management and Technology Research Communications.

If any manuscript is found published with plagiarized material at any stage in SSN Journal of Management and Technology Research Communications, it will be immediately retracted with information to authors. Also, authors who fail to comply with the reviewer's comments in revising their manuscripts, particularly in reducing the accidental plagiarism will be informed about dropping their manuscripts from publication in SSN Journal of Management and Technology Research Communications, and they will be returned their APC after standard deductions.

Instructions are given to all authors who propose to submit their contribution to SSN Journal of Management and Technology Research Communications to kindly check their MS very minutely for plagiarism and similarity levels of their text matter of the manuscripts under submission using Ithenticate / Turnitin software.They have to certify in the Copy right form about this statement.

Link of copy right form and Plagiarism Check Statement

www.mntrc.in copy right and anti-plagiarism form

MS having less than 15 % of similarity levels using standard worldwide accepted soft wares will only be considered for publication in SSN Journal of SSN Journal of SSN Journal of Management and Technology Research Communications.

1. Malpractice and Ethical Statements

SSN Journal of Management and Technology Research Communications Publication Ethics and Publication Malpractice Statement is based, in large part, on the guidelines and standards developed by the Committee on Publication Ethics (COPE). The relevant duties and expectations of authors, reviewers, and editors of the journal are set out below.

Publication Ethics and Publication Malpractice Statement

SSN Journal of Management and Technology Research Communications follows the COPE Code of Conduct and Best Practice Guidelines for Journal Editors and the Code of Conduct for Journal Publishers. In addition, as a journal that follows the ICMJE's Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals, it is expected of authors, reviewers and editors that they follow the best-practice guidelines on ethical behaviour contained therein. A selection of key points is included below, but always refer to the three documents listed above for full details of Publication Ethics and Publication Malpractices.

Link of copy right form and Plagiarism Check Statement

Duties of Editors

Fair play and editorial independence

Editors evaluate submitted manuscripts exclusively on the basis of their scientific rigor and academic merit (importance, originality, study's validity, clarity) and its relevance to the journal's scope, without regard to the authors' race, gender, sexual orientation, ethnic origin, citizenship, religious belief, political philosophy or institutional affiliation. Decisions to edit and publish are not determined by the policies of governments or any other agencies outside of the journal itself. The Editor-in-Chief has full authority over the entire editorial content of the journal and the timing of publication of that content.

Confidentiality

Editors and editorial staff will not disclose any information about a submitted manuscript to anyone other than the corresponding author, reviewers, potential reviewers, other editorial advisers, and the publisher, as appropriate.

Disclosure and conflicts of interest

Editors and editorial board members will not use unpublished information disclosed in a submitted manuscript for their own research purposes without the authors' explicit written consent. Privileged information or ideas obtained by editors as a result of handling the manuscript will be kept confidential and not used for their personal advantage. Editors will recuse themselves from considering manuscripts in which they have conflicts of interest resulting from competitive, collaborative, or other relationships/connections with any of the authors, companies or institutions connected to the papers; instead, they will ask another member of the editorial board to handle the manuscript.

Publication decisions

The editors ensure that all submitted manuscripts being considered for publication undergo strict anonymized peer-review by at least two reviewers who are expert in the field. The Editor is responsible for deciding which of the manuscripts submitted to the journal will be published, based on the validation of the work in question, its importance to researchers and readers, the reviewers' comments and levels of academic quality. The Editor may confer with other editors or reviewers in making this decision.

Involvement and cooperation in investigations

Editors (in conjunction with the publisher and/or society) will take responsive measures when ethical concerns are raised with regard to a submitted manuscript or published paper. Every reported act of unethical publishing behavior will be looked into, even if it is discovered years after publication. If, on investigation, the ethical concern is well-founded, a correction, retraction, expression of concern or other note as may be relevant, will be published in the journal.

Duties of Reviewers

Contribution to editorial decisions

Peer review assists editors in making editorial decisions and, through editorial communications with authors, may assist authors in improving their manuscripts. Peer review is an essential component of formal scholarly communication and lies at the heart of scientific endeavor. The journal shares the view of many that all scholars who wish to contribute to the scientific process have an obligation to do a fair share of reviewing, maintaining all standards of academic quality, particularly the scientific rigor.

Promptness

Any invited referee who feels unqualified to review the research reported in a manuscript or knows that its prompt review will be impossible should immediately notify the editors and decline the invitation to review so that alternative reviewers can be contacted.

Confidentiality

Any manuscripts received for review are confidential documents and must be treated as such; they must not be shown to or discussed with others except if authorized by the Editor-in-Chief (who would only do so under exceptional and specific circumstances). This applies also to invited reviewers who decline the review invitation.

Standards of objectivity

Reviews should be conducted objectively and observations formulated clearly with supporting arguments so that authors can use them for improving the manuscript. Personal criticism of the authors is inappropriate.

Acknowledgement of sources

Reviewers should identify relevant published work that has not been cited by the authors. Any statement that is an observation, derivation or argument that has been reported in previous publications should be accompanied by the relevant citation. A reviewer should also notify the editors of any substantial similarity or overlap between the manuscript under consideration and any other manuscript (published or unpublished) of which they have personal knowledge.

Disclosure and conflicts of interest

Any invited referee who has conflicts of interest resulting from competitive, collaborative, or other relationships or connections with any of the authors, companies or institutions connected to the manuscript and the work described therein should immediately notify the editors to declare their conflicts of interest and decline the invitation to review so that alternative reviewers can be contacted. Unpublished material disclosed in a submitted manuscript must not be used in a reviewer's own research without the express written consent of the authors. Privileged information or ideas obtained through peer review must be kept confidential and not used for the reviewer's personal advantage. This applies also to invited reviewers who decline the review invitation.

Data access and retention

Authors may be asked to provide the raw data of their study together with the manuscript for editorial review and should be prepared to make the data publicly available if practicable. In any event, authors should ensure accessibility of such data to other competent professionals for at least 10 years after publication (preferably via an institutional or subject-based data repository or other data centre), provided that the confidentiality of the participants can be protected and legal rights concerning proprietary data do not preclude their release.

Supplementary data or information (SI) which are important for scientific progress help in reproducibility, being one of the golden standards of the scientific method. This can be shared as per submission guidelines of SSN Journal of Management and Technology Research Communications Authors must ensure that all submitted manuscripts have been prepared following academic quality writing, consisting of quality contents. All supplementary information like large data files, tables etc that are not practical to include in the manuscript itself, must be made readily available for the readers, reviewers as files uploaded when required. We encourage the authors to share their supplementary data which can make their articles more discoverable, giving people alternative ways to find their valuable research work.

Originality and plagiarism

The authors of SSN Journal of Management and Technology Research Communications should strictly ensure that they have written and submitted entirely original manuscripts to the journal, strictly following all norms of academic quality. If the authors have used the work and /or words of others, it has been appropriately cited or quoted as per standard ethics and norms of quality publication. Plagiarism takes many forms, from 'passing off' another's paper as the author's own paper, to copying or paraphrasing substantial parts of another's paper (without attribution), to claiming results from research conducted by others. Plagiarism in all its forms constitutes unethical in SSN Journal of Management and Technology Research Communications.

If any manuscript is found published with plagiarized material at any stage in SSN Journal of Management and Technology Research Communications, it will be immediately retracted with information to authors. Also, authors who fail to comply with the reviewer's comments in revising their manuscripts, particularly in reducing the accidental plagiarism will be informed about dropping their manuscripts from publication in SSN Journal of Management and Technology Research Communications, and they will be returned their APC after standard deductions.

Instructions are given to all authors who propose to submit their contribution to SSN Journal of SSN Journal of Management and Technology Research Communications to kindly check their MS very minutely for any accidental plagiarism and similarity levels of their text matter of the manuscripts under submission using only Ithenticate / Turnitin software.They have to certify in the Copy right form about this statement.

Link of copy right form and Plagiarism Check Statement

www.mntrc.in copy right and anti-plagiarism form

MS having less than 15 % of similarity levels using standard worldwide accepted soft wares will only be considered for publication in SSN Journal of Management and Technology Research Communications

Multiple, duplicate, redundant or concurrent submission/publication

Papers describing essentially the same research should not be published in more than one journal or primary publication. Hence, authors should not submit for consideration a manuscript that has already been published in another journal. Submission of a manuscript concurrently to more than one journal is unethical publishing behaviour and unacceptable.

The publication of some kinds of articles (such as clinical guidelines, translations) in more than one journal is sometimes justifiable, provided that certain conditions are met. The authors and editors of the journals concerned must agree to the secondary publication, which must reflect the same data and interpretation of the primary document. The primary reference must be cited in the secondary publication.

Authorship of the manuscript

Only persons who meet these following authorship criteria should be listed as authors in the manuscript as they must be able to take public responsibility for the content: (i) made significant contributions to the conception, design, execution, data acquisition, or analysis/interpretation of the study; and (ii) drafted the manuscript or revised it critically for important intellectual content; and (iii) have seen and approved the final version of the paper and agreed to its submission for publication. All persons who made substantial contributions to the work reported in the manuscript (such as technical help, writing and editing assistance, general support) but who do not meet the criteria for authorship must not be listed as an author, but should be acknowledged in the "Acknowledgements" section after their written permission to be named as been obtained. The corresponding author should ensure that all appropriate co -authors (according to the above definition) and no inappropriate co-authors are included in the author list and verify that all co-authors have seen and approved the final version of the manuscript and agreed to its submission for publication.

Disclosure and conflicts of interest

Authors should—at the earliest stage possible (generally by submitting a disclosure form at the time of submission and including a statement in the manuscript)—disclose any conflicts of interest that might be construed to influence the results or their interpretation in the manuscript.

Examples of potential conflicts of interest that should be disclosed include financial ones such as honoraria, educational grants or other funding, participation in speakers' bureaus, membership, employment, consultancies, stock ownership, or other equity interest, and paid expert testimony or patent-licensing arrangements, as well as non-financial ones such as personal or professional relationships, affiliations, knowledge or beliefs in the subject matter or materials discussed in the manuscript. All sources of financial support for the work should be disclosed (including the grant number or other reference number if any).

Acknowledgement of sources

Authors should ensure that they have properly acknowledged the work of others, and should also cite publications that have been influential in determining the nature of the reported work. Information obtained privately (from conversation, correspondence or discussion with third parties) must not be used or reported without explicit, written permission from the source. Authors should not use information obtained in the course of providing confidential services, such as refereeing manuscripts or grant applications, unless they have obtained the explicit written permission of the author(s) of the work involved in these services.

Hazards and human or animal subjects

If the work involves chemicals, procedures or equipment that have any unusual hazards inherent in their use, the authors must clearly identify these in the manuscript. If the work involves the use of animals or human participants, the authors should ensure that all procedures were performed in compliance with relevant laws and institutional guidelines and that the appropriate institutional committee(s) has approved them; the manuscript should contain a statement to this effect. Authors should also include a statement in the manuscript that informed consent was obtained for experimentation with human participants. The privacy rights of human participants must always be observed.

Peer review

Authors are obliged to participate in the peer review process and cooperate fully by responding promptly to editors' requests for raw data, clarifications, and proof of ethics approval, patient consents and copyright permissions. In the case of a first decision of "revisions necessary", authors should respond to the reviewers' comments systematically, point by point, and in a timely manner, revising and re-submitting their manuscript to the journal by the deadline given.

Fundamental errors in published works

When authors discover significant errors or inaccuracies in their own published work, it is their obligation to promptly notify the journal's editors or publisher and cooperate with them to either correct the paper in the form of an erratum or to retract the paper. If the editors or publisher learns from a third party that a published work contains a significant error or inaccuracy, then it is the authors' obligation to promptly correct or retract the paper or provide evidence to the journal editors of the correctness of the paper. For guidelines on retracting or correcting articles, please contact the editor at www.mntrc.in

Duties of the Publisher

Handling of unethical publishing behavior

In cases of alleged or proven scientific misconduct, fraudulent publication or plagiarism, the publisher, in close collaboration with the editors, will take all appropriate measures to clarify the situation and to amend the article in question. This includes the prompt publication of an erratum, clarification or, in the most severe case, the retraction of the affected work. The publisher, together with the editors, shall take reasonable steps to identify and prevent the publication of papers where research misconduct has occurred, and under no circumstances encourage such misconduct or knowingly allow such misconduct to take place.

Access to journal content

The publisher is committed to the permanent availability and preservation of scholarly research and ensures accessibility by partnering with organizations and maintaining our own digital archive as well as in international repositories like Portico, JStor/Ithaka and others. For details on SSN Journal of Management and Technology Research Communications archiving policy, please click www.mntrc.in.

Plagiarism and Ethics Statement

According to Oxford University Dictionary, plagiarism is defined as using some ones else's ideas, words, data, or other material produced by them without acknowledgement. It is the unauthorized use or close imitation of the language and thoughts of another author and representing them as one's own original work and SSN Journal of Management and Technology Research Communications condemns all forms of plagiarism, following a very strict and vigilant policy of removing this malady. Within the academia, it is considered dishonesty or fraud and offenders are subject to academic censure.

Plagiarism can be unintentional or intentional, reproducing academic material without appropriate credit to the original authors (Citations / References). Similarly self -plagiarism is the re-use of significant, identical or near identical portions of one's own work without citing the original work. This is also known as recycling fraud. Worst form of plagiarism is to steal the whole article from some journal and publish it under one's own name in another journal.

Plagiarism, fabrication, unethical or redundant publication grossly violates the editorial policies of SSN Journal of Management and Technology Research Communications. which follows best practice guidelines given by the International Committee of Medical Journal Editors (ICMJE) and Committee on Publication Ethics (COPE), as mentioned in the Instructions for Authors of SSN Journal of Management and Technology Research Communications. All authors submitting their MS to SSN Journal of Management and Technology Research Communications must complete and sign the ethical statement form and append the Plagiarism Check Certificate of their MS along with copy-right form (www.mntrc.in) failing which, their MS will not be processed further.

The Editorial Committee of SSN Journal of Management and Technology Research Communications will take appropriate action against any author found to be guilty of intentional plagiarism or exceeding the standard limits of plagiarism / similarity levels of the text matter in their MS. The name of author(s) committing plagiarism or using similar text without appropriate citations will also be disseminated to concerned authorities. We do not tolerate plagiarism in any of our publications, and we reserve the right to check all submissions through appropriate plagiarism checking tools. Submissions containing suspected plagiarism, in whole or part, will be rejected. If plagiarism is discovered post publication, we will follow our guidance outlined in the Retractions, Corrections and Expressions of Concern section of these guidelines. We expect our readers, reviewers and editors to raise any suspicions of plagiarism, either by contacting the relevant editor or by emailing at editor@mntrc.in

Plagiarism and Ethics Statement
According to Oxford University Dictionary, plagiarism is defined as using some ones else's ideas, words, data, or other material produced by them without acknowledgement. It is the unauthorized use or close imitation of the language and thoughts of another author and representing them as one's own original work and SSN Journal of Management and Technology Research Communications condemns all forms of plagiarism, following a very strict and vigilant policy of removing this malady. Within the academia, it is considered dishonesty or fraud and offenders are subject to academic censure.

Plagiarism can be unintentional or intentional, reproducing academic material without appropriate credit to the original authors (Citations / References). Similarly self -plagiarism is the re-use of significant, identical or near identical portions of one's own work without citing the original work. This is also known as recycling fraud. Worst form of plagiarism is to steal the whole article from some journal and publish it under one's own name in another journal.

Plagiarism, fabrication, unethical or redundant publication grossly violates the editorial policies of SSN Journal of Management and Technology Research Communications. which follows best practice guidelines given by the International Committee of Medical Journal Editors (ICMJE) and Committee on Publication Ethics (COPE), as mentioned in the Instructions for Authors of SSN Journal of Management and Technology Research Communications.

All authors submitting their MS to SSN Journal of Management and Technology Research Communications must complete and sign the ethical statement form and append the Plagiarism Check Certificate of their MS along with copy-right form (www.mntrc.in) failing which, their MS will not be processed further.

The Editorial Committee of SSN Journal of Management and Technology Research Communications will take appropriate action against any author found to be guilty of intentional plagiarism or exceeding the standard limits of plagiarism / similarity levels of the text matter in their MS. The name of author(s) committing plagiarism or using similar text without appropriate citations will also be disseminated to concerned authorities.

We do not tolerate plagiarism in any of our publications, and we reserve the right to check all submissions through appropriate plagiarism checking tools. Submissions containing suspected plagiarism, in whole or part, will be rejected. If plagiarism is discovered post publication, we will follow our guidance outlined in the Retractions, Corrections and Expressions of Concern section of these guidelines. We expect our readers, reviewers and editors to raise any suspicions of plagiarism, either by contacting the relevant editor or by emailing at editor@mntrc.in.

Ethical Issues

On Ethical Issues:
Animal and Human Studies

Ethical declarations in research form an integral part during the submission process of a manuscript to a journal. SSN Journal of Management and Technology Research Communications, requires that the experimental conditions under which animal and human assays and tests are performed are as per standard protocols used worldwide.

Authors must make it clear in writing that the procedures they used were as humane as possible and have been compiled with the guidelines for animal care of their institutions or with national / international guidelines. Studies on animals must comply with the prevailing standards of animal welfare according to Indian Council of Medical Research Guidelines or Committee for the Purpose of Control & Supervision of Experiments on Animals (CPCSEA) in India, and likewise following similar conditions elsewhere, (Ethical Approval Committees/ Institutional Review Board with Approval Number is necessary).For details of animal studies please see : ARRIVE and Guide for the Care and Use of Laboratory Animals.

Studies involving human subjects / patients / and also if the manuscript includes case reports / case series, authors need to provide the following: Name of the Ethical Committees /Institutional review Board, they have obtained consent from along with approval number /ID. Authors should specifically mention that the study was in accordance with the Helsinki Declaration of 1975 (Human Research: Helsinki Declaration as revised in 2013, SCARE criteria etc).

Case Reports: Case Reports should be followed as per the guidelines of SCARE criteria
Informed consent should be obtained from all patients for being included in the study." If any identifying information about participants is included in the article, the following sentence should also be included: "Additional informed consent was obtained from all individuals for whom identifying information is included in this article." If you have not included or cannot include this statement in your manuscript, please provide the reason or an alternative statement here and in the manuscript.

2. Disclosure of Interest
Authors must provide details of any financial or personal relationships that might bias the work being submitted. In a section of text preceding the References, please provide relevant information for each author(s) with regard to any conflicts of interest. All submissions must include disclosure of all relationships that could be viewed as presenting a potential conflict of interest.

3. Acknowledgement of sources:
Proper acknowledgement of the work of others must always be given. Funding acknowledgement must be properly made with grant details, number etc.

Data access and retention: Authors may be asked to provide the raw data in connection with a paper for editorial review, and should be prepared to provide public access to such data.

Peer Review Policy
Unbiased, independent, critical assessment is an intrinsic part of all scholarly work, including the scientific process. Peer review is the critical assessment of manuscripts submitted to journals by experts who are not part of the editorial staff, and is, therefore, an important extension of the scientific process. Each article submitted to SSN Journal of Management and Technology Research Communications for publication is reviewed by at least two specialist reviewers of the concerned area. The dual review process is strictly followed and in certain controversial cases, the opinion of a 3rd reviewer can also be sought.

Manuscript Processing

Upon on-line submission of the manuscript, the author will be acknowledged with a MS number, via e-mail. Initially an article will be reviewed by the Editorial team to judge the academic quality, scientific rigor and format of the manuscript, in particular its relevance to the scope of the journal, compliance with instructions to authors check list and levels of similarity / accidental plagiarism. Article submissions must consist of academic material that is unique and original, meaning that articles must engage cited material through critical thought. Articles must follow conventions of the English language in regard to proper grammar, punctuation, and typical writing practices. All factual statements must be supported by cited sources or research evidence. Authors must ensure the accuracy of citations, quotations, diagrams, tables, and maps.

Articles written in poor English language with confusing or illogical statements, or not conforming to instructions to authors of SSN Journal of Management and Technology Research Communications will either be rejected or returned to the authors for reformatting. Manuscripts deemed proper only will be forwarded to at least two subject experts to work as anonymized reviewers in a time bound frame of 4 to 5 weeks, to provide their unbiased input on the overall quality of the reviewed manuscript as per standard international norms.

Acceptable manuscripts will be checked for data analysis and verification of references before the author is notified about the status of the paper with any suggestions for modifications strictly as reviewers comments and revisions asked. Editors will check at every step for full compliance and revision of all such articles in press. Finally accepted articles will then be forwarded for typesetting and formatting, and the galley proof will be sent to the authors for proof reading, before final publication in a time bound period. For detailed process of manuscript, please see the flow chart of MS processing in SSN Journal of Management and Technology Research Communications.

Guidelines for Reviewers

An unpublished manuscript is a privileged document. Please protect it from any form of exploitation. Don't cite a manuscript or refer to the work it describes before it has been published and don't use the information that it contains for the advancement of your own research or in discussions with colleagues. Adopt a positive, impartial attitude toward the manuscript under review, with the aim of promoting effective and constructive scientific communication.

If you believe that you cannot judge a given article impartially, please return it immediately to the editor. Reviews must be completed within 4 to 5 weeks. If you know that you cannot finish the review within that time, immediately return the manuscript to the editor. In your review, consider the following aspects of the manuscript: –Adherence to style of the MS as set forth in Instructions to Authors of SSN Journal of Management and Technology Research Communications.

Guidelines for Reviewers

An unpublished manuscript is a privileged document. Please protect it from any form of exploitation. Don't cite a manuscript or refer to the work it describes before it has been published and don't use the information that it contains for the advancement of your own research or in discussions with colleagues. Adopt a positive, impartial attitude toward the manuscript under review, with the aim of promoting effective and constructive scientific communication.

If you believe that you cannot judge a given article impartially, please return it immediately to the editor. Reviews must be completed within 4 to 5 weeks. If you know that you cannot finish the review within that time, immediately return the manuscript to the editor.
In your review, consider the following aspects of the manuscript: –Adherence to style of the MS as set forth in Instructions to Authors of SSN Journal of Management and Technology Research Communications.

- Adequacy of title, abstract and its contents. Explicit language and clear expression of findings in the manuscript.
- Significance of objectives, questions or subjects studied, with a clear justification or rationale.
- Originality of work: It should be checked through standard plagiarism software only.
- Appropriateness of approach or methodology and adequacy of experimental techniques with citations, so that the work can be easily replicated.
- Appropriateness of clear images, figures and or tables and length of article, word count etc..
- Experimental data its lucid presentation and critical interpretation.
- Soundness of conclusion based on data, and interpretation and relevance of discussion of the manuscript.
- Appropriate literature citations as per Harvard Style of References with updated references.
- All sources must be cited in the reference list and in the main text. References with non-English titles must include a translation. All in-text citations must be cited in the reference list and all sources in the reference list must be cited within the article. Sources accessed online must include a DOI or URL.

If you wish to mark the text of the manuscript, use a pencil or make a photocopy, mark it, and return it together with the original. You can be particularly helpful in pointing out unnecessary illustrations and data that are presented in both tabular (and graphic) form and in detail in the text. Such redundancies are a waste of space and readers time.

A significant number of authors have not learnt how to organize data and will be benefit from your guidance. Do not discuss the paper with its authors. In your comments intended for transmission to the author, do not make any specific statement about the acceptability of a paper. Suggested revision should be stated as such and not expressed as conditions of acceptance. Present criticism dispassionately and avoid offensive remarks.

Organize your review so that an introductory paragraph summarizes the major findings of the article, gives your overall impression of the paper and highlights the major shortcomings. This paragraph should be followed by specific numbered comments which if appropriate may be subdivided into major and minor points. Confidential remarks directed to the editor should be typed (or handwritten) on a separate sheet, not on the review form. You might want to distinguish between revisions considered essential and those judged merely desirable.

Your criticisms, arguments and suggestions concerning the paper will be most useful to the editor and to the author if they are carefully documented. Do not make dogmatic, dismissive statements, particularly about the novelty of work. Substantiate your statements.

Reviewer's recommendations are gratefully received by the editor. However, since editorial decisions are usually based on evaluations derived from several sources, reviewers should not expect the editor to honor every recommendation.

Data Sharing and Availability Policy

SSN Journal of SSN Journal of SSN Journal of Management & Technology Research Communications is committed to a more open research landscape, facilitating faster and more effective research discovery by enabling reproducibility and verification of data, methodology and reporting standards. We encourage authors of articles published in our journal to share their research data including, but not limited to: raw data, processed data, software, algorithms, protocols, methods, materials. These can be submitted as supplementary data or can be shared as per submission guidelines of SSN Journal of SSN Journal of SSN Journal of Management & Technology Research Communications.

Authors will have to certify that the database generated and/or analysed during their current study incorporated in their manuscripts are not publicly available due to privacy and confidentiality agreements as well as other restrictions, but are available from the corresponding author on reasonable request, as per standard guidelines of ethical publication.

Retractions/ Corrections / Withdrawal

Authors submitting their work to SSN Journal of Management and Technology Research Communications. must carefully ensure that their submitted articles follow standard conventions of scientific reporting, originality of the work, explicit and correct English language used with regard to best writing practices. All factual statements must be supported by cited sources or research evidence. Authors must ensure the accuracy of citations, quotations, diagrams, tables, and maps. Despite the mandate of clear instructions on the journals website, SSN Journal of Management and Technology Research Communications. will consider retractions, corrections or expressions of concern in line with COPE's Retraction Guidelines, if an author is found to have made a justifiable error, the journal will issue a corrigendum. If the journal is found to have made an error, we will issue an erratum.

Retractions are usually reserved for articles that are seriously flawed that their findings or conclusions should not be relied upon, or that contain substantial plagiarism or life-endangering content. SSN Journal of Management and Technology Research Communications. that publishes accepted manuscripts, may make minor changes such as those which would likely occur during copyediting, typesetting or proofreading, but any substantive corrections will be carried out in line with COPE's Retraction Guidelines. Accepted articles in final stages of publication, if are withdrawn, will entail withdrawal fees. The request will be processed by the editorial board and only serious genuine reasons will be considered for retraction if possible. The decision of the editorial board will be final and not negotiable. Unethical withdrawal or no response from the authors to editorial board communication will be subjected to sanction a ban to all authors, and their institute will also be notified.

Infringements of professional ethical codes, such as multiple submission, bogus claims of authorship, plagiarism, fraudulent use of data or the like. Occasionally a retraction will be used to correct errors in submission or publication.The retraction of an article by its authors or the editor under the advice of members of the scholarly community has long been an occasional feature of the learned world.Standards for dealing with retractions have been developed by a number of library and scholarly bodies, and this best practice is adopted for article retraction by us.

A retraction note titled "Retraction: [article title]" signed by the authors and/or the editor is published in the paginated part of a subsequent issue of the journal and listed in the contents list.In the electronic version, a link is made to the original article.The online article is preceded by a screen containing the retraction note. It is to this screen that the link resolves; the reader can then proceed to the article itself. The original article is retained unchanged save for a watermark on the .pdf indicating on each page that it is "retracted."The HTML version of the document is removed.

Acknowledgements/ Funding

Acknowledgement of sources

Proper acknowledgement of the work of others must always be given. Funding acknowledgement must be properly made with grant details, number etc.

Disclosure of Interest

Authors must provide details of any financial or personal relationships that might bias the work being submitted. In a section of text preceding the References, please provide relevant information for each author(s) with regard to any conflicts of interest. All submissions must include disclosure of all relationships that could be viewed as presenting a potential conflict of interest.

Data access and retention: Authors may be asked to provide the raw data in connection with a paper for editorial review, and should be prepared to provide public access to such data.

Archiving and Repository Policies of SSN Journal of Management and Technology Research Communications

Our publication policies help our authors achieve a high level of openness with their research and support them in meeting the open access (OA) requirements of their research funders and institutions. All OA articles published by SSN Journal of Management and Technology Research Communications are archived in journals website as well as in the repositories of Portico / JSTOR, Google Scholar, Sementic Scholar and others using individual journal identifiers, DOIs of Cross Reference USA.

SSN Journal of Management and Technology Research Communications allows self as well as repository archiving of accepted and published papers through open access policy before and after the publication. Authors retain the copyright of their scholarly work and can archive publisher's version / PDF to personal or institutional repositories or libraries anytime without requiring permission from the journal or publisher.

Authors can also make their published article publicly available immediately after publication without requiring any permission to different repositories, libraries or personal websites provided that they also deposit the URL of their published article, in addition to the PDF version by correctly citing the journal name / publisher, along with other citation details. Contents published by SSN Journal of Management and Technology Research Communications with digital identifier objects (DOIs) are submitted to Cross Reference, Portico and other repositories for digital archiving for long term digital preservation. This information can be found on: https://www.portico.org/

Furthermore, we also submit our journal's meta-data to Web of Science and other institutional repositories. This is to make sure that the published scholarly content by SSN Journal of Management and Technology Research Communications remains available to the community despite discontinuation of the journal or any accidental loss of journals data in its personal archival records.

Informed Consent Policy

All individuals have individual rights that are not to be infringed. Individual participants in studies have, for example, the right to decide what happens to the (identifiable) personal data gathered, to what they have said during a study or an interview, as well as to any photograph that was taken. This is especially true concerning images of vulnerable people (e.g. minors, patients, refugees, etc) or the use of images in sensitive contexts. In many instances authors will need to secure written consent before including images or hide the identities as per international publication ethics and best practices.

Identifying details (names, dates of birth, identity numbers, biometrical characteristics (such as facial features, fingerprint, writing style, voice pattern, DNA or other distinguishing characteristic) and other information) of the participants that were studied should not be published in written descriptions, photographs, and genetic profiles unless the information is essential for scholarly purposes and the participant (or parent/guardian if the participant is a minor or incapable or legal representative) gave written informed consent for publication. Complete anonymity is difficult to achieve in some cases. Detailed descriptions of individual participants, whether of their whole bodies or of body sections, may lead to disclosure of their identity. Under certain circumstances consent is not required as long as information is anonymized and the submission does not include images that may identify the person.

For studies involving human subjects and volunteers, please indicate in the manuscript, in a section preceding the References, the following statement or an analogous statement that applies to your situation: "All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975 Human research: Helsinki Declaration as revised in 2013.

Informed consent should be obtained from all patients for being included in the study." If any identifying information about participants is included in the article, the following sentence should also be included: "Additional informed consent was obtained from all individuals for whom identifying information is included in this article." If you have not included or cannot include this statement in your manuscript, please provide the reason or an alternative statement here and in the manuscript.

SSN Journal of Management and Technology Research Communications

Peer Reviewed Refereed Open Access Journal

Contact Us

Editor
SSN Journal of Management and Technology Research Communications

Prof Dr Ayesha S Ali PhD FSSN CSIR Fellow

Department of Bioscience and Biotechnology

Saifia College Barkatullah University Bhopal India

Email: editor@mntrc.in

Mobile : 9755104244

Publisher:

Dr Ayesha S Ali

On Behalf of Society for Science and Nature SSN Bhopal

Publishers Address: C- 52 Housing Board Colony Kohe Fiza Bhopal 462001 MP India

Editor's Official Address

Prof Dr Ayesha S Ali PhD FSSN CSIR Fellow

Department of Bioscience and Biotechnology

Saifia College Barkatullah University Bhopal India

Email: editor@mntrc.in

Editorial Office

Executive Editor– editor@mntrc.in

Managing Editor- mntrc.in.info@gmail.com

SSN Journal of Management and Technology Research Communications

C- 52 Housing Board Colony Kohe Fiza Bhopal 462001 MP India

Mobile : 9893015818

Society for Science And Nature SSN Bhopal

Website –http://ssnb.org.in

Journal Website: https://mntrc.in/

Publishers Email: publishers@ssnb.org.in

SSN JOURNAL OF
MANAGEMENT & TECHNOLOGY RESEARCH COMMUNICATIONS

Volume 2 (1) Jan-Feb-Mar-Apr 2025

Online ISSN : 3049-0014

CONTENTS

ISSN 3049-0014

Editor
SSN JOURNAL OF MANAGEMENT AND TECHNOLOGY RESEARCH COMMUNICATIONS
Office: C-52, Housing Board Colony, Koh-e-Fiza, Bhopal - 462 001 (INDIA)
E-mail: editor@mntrc.in, profayeshaali@gmail.com

SSN Journal **of M**anagement & **T**echnology **R**esearch **C**ommunications
Vol 2 No (1) Jan-Feb-Mar 2025
Society for Science and Nature

E-ISSN: 3049-0014
CrossRef DOI: https://dx.doi.org/10.21786/mntrc

Editorial Communication

SSN Journal of Management and Technology Research Communications has successfully published its second issue, Volume 2, No 1, Jan-Feb-March 2025, with high-quality research articles in the intertwining and merging areas of management and technology. Please visit the journal's website to view the newly published issue of the SSN Journal of Management and Technology, https://mntrc.in/current issue.

Interesting articles have been published in the SSN Journal of Management and Technology during the last six months in the areas of management and technology, with contributions from authors from different countries, including the United States of America, Poland, Nigeria, Thailand, the United Kingdom, Saudi Arabia, and India. Dr Jan W. Dobrowolski, Distinguished Professor of AGH-University of Science and Technology, Kraków, Poland, contributed with his lifelong education experiences on Sustainable and Green Economy: Adopting Innovative Technologies for Better Health and Quality of Life.

Similarly, we were fortunate enough to have the views of Prof Belsare, PhD, DSc FNASc, Professor Emeritus, India, to provide our journal with his views in the form of a lucid article on Circular Bioeconomy for Sustainable Development. Jasim et al of The University of Alabama at Birmingham, Birmingham, Alabama, United States, communicated their views on Healthcare Cybersecurity, Recent Incidents, and Preventive Strategies.

Prof Pooja Jain of Management Studies, Amity University India, examined the concept of Blockchain Adoption and Usage concerning the Behavior in Private Banks in India, a highly informative article on Management Technology. Prof Subramani Senthil Kumar and colleagues from the Department of Management, Skyline University Nigeria, Kano, Nigeria, enlightened our readers with their article on Outsourcing Healthcare Services and its Impact on Strategic Goals of Patient Care in Nigerian Private Hospitals.

Authors Zhang and Phakdeephirot have presented their detailed findings on the Factors Influencing Consumers' Behavior to Purchase New Energy Vehicles: Evidence from Zhengzhou City, China, followed by another study by their colleagues on Factors Influencing Job Satisfaction Among IT Industry Employees in Chengdu, China: Enhancing Herzberg's Two-Factor Theory with Commute Distance. Indeed, it was a great experience with Prof Pulock Bhattacharjee, Vice President, Business Development, Skilling, Training & Placement, Bombay Stock Exchange Institute Limited, New Delhi, India, to share his views on the Health Insurance Sector in India. *SSN Journal of Management and Technology* is thankful to its young author, Prof Shaima Miraj of Saudi Electronic University, Riyadh, for sharing her views on the reforms in the health care sector from aspects of its management, opportunities, and challenges in India, dating from the past to the present.

An interesting communication by another young researcher, Dr Ahmad of Coventry, United Kingdom, appeared, where the problems of the indigenous population and their food security have been discussed. highlighting the importance of such studies, which reflect upon the hidden problems of the tribal population of India and their climate-related afflictions. It throws light on the question of the rigid dichotomy often made between nature and culture. It also emphasises why indigenous peoples' data collection and their authenticity are important for the conservation of nature. On behalf of the journal, I take great privilege and honour to thank our distinguished authors for their valued contributions, making our every issue worthy of quality reading. We do hope the trend will continue, and our authors, readers, and well-wishers will come forward to make the journal and its quality publication a great success.

Prof Ayesha Ali, PhD FSSN
Editor-in-Chief
SSN Journal of Management And Technology Research Communications
editor@mntrc.in
profayeshaali@gmail.com
www.mntrc.in

SSN Journal of Management & Technology Research Communications
Society for Science and Nature

E-ISSN: 3049-0014
CrossRef DOI: https://dx.doi.org/10.21786/mntrc
Vol 2 No (1) Jan-Feb-Mar-Apr 2025

Factors Influencing Consumers' Behavior to Purchase New Energy Vehicles: Evidence from Zhengzhou city, China

Zhikai Zhang[1] & Nutteera Phakdeephirot[2]*

[1]Rattanakosin International College of Creative Entrepreneurship, Rajamangala University of Technology Rattanakosin, Nakhon Pathom, 73101, Thailand.

[2*]Rattanakosin International College of Creative Entrepreneurship, Rajamangala University of Technology Rattanakosin, Nakhon Pathom, 73101, Thailand.

ABSTRACT

New Energy Vehicles (NEVs) are essential for reducing carbon emissions and promoting sustainable energy transitions. This study investigates NEV purchase behavior in Zhengzhou using a random sampling method, collecting 344 valid responses through offline and online surveys over two months. Structural Equation Modeling (SEM) is applied to analyze key determinants. The results indicate that economic value, functional value, social value, environmental friendliness, brand reputation, and emotional resonance significantly influence NEV purchase decisions, while emotional value and functional attributes are not statistically significant. These findings suggest that besides economic and functional considerations, social recognition and brand perception play critical roles in consumer decisions.

KEY WORDS: New Energy Vehicles (NEVs), Consumer Behavior, Perceived Value, Brand Image, Structural Equation Modeling (SEM).

INTRODUCTION

The promotion of New Energy Vehicles (NEVs) has become a pivotal strategy in addressing climate change and advancing sustainable development. With the escalating severity of environmental issues, including air pollution and greenhouse gas emissions, governments worldwide have implemented policies aimed at fostering the adoption of NEVs. These vehicles not only contribute to emission reduction but also enhance energy efficiency and reduce dependence on fossil fuels, thereby facilitating the transition towards a low-carbon transportation system [1]. The United Nations' Sustainable Development Goals (SDGs) encourage measures to lower carbon emissions, promote energy efficiency, and drive innovation in clean energy technologies [2]. The rapid development of the NEV industry in recent years has been driven by a combination of policy support, technological advancements, and increasing market demand [3]. Global NEV sales have surpassed 10 million units, with their share in the automotive market continuously rising. The European Union's Green Deal has set a goal of phasing out internal combustion engine vehicles by 2035 [4], while the United States has introduced the Inflation Reduction Act, which provides tax incentives for electric vehicle buyers [5]. In Asia, China has emerged as the global leader in NEV development, driven by comprehensive policy frameworks, financial incentives, and large-scale infrastructure investments [6].

China's dominance in the NEV sector is primarily attributed to sustained government support. Since the introduction of the Energy-Saving and New Energy Vehicle Industry Development Plan (2012–2020) in 2009, the Chinese government has implemented a series of measures to accelerate NEV adoption [7]. Under the nation's Dual Carbon strategy, NEVs have been positioned as a key solution to achieving carbon neutrality. Recent policies, including the New Energy Vehicle Industry Development

Article Information: *Corresponding Author: nutteera.pha@rmutr.ac.th
Received 10/02/2025 Accepted after revision 03/03/2025
Publication Date: 30th April 2025 Page No- 01-15

Available at: https://mntrc.in/
DOI: http://dx.doi.org/10.21786/mntrc/2.1.1

Plan (2021–2035), set ambitious targets, aiming for NEVs to account for 20% of total vehicle sales by 2025 [8]. Additionally, local governments have introduced targeted policies such as purchase subsidies, tax exemptions, and preferential traffic regulations to encourage NEV adoption [9]. Cities like Beijing and Shanghai have lifted purchase restrictions for NEVs while implementing incentives such as toll exemptions and dedicated parking spaces [10]. Furthermore, significant advancements have been made in charging infrastructure. By the end of 2023, China had installed over 6.5 million public charging stations, significantly improving charging accessibility and alleviating consumer concerns about range anxiety [11].

As a central transportation hub in China, Zhengzhou has made significant progress in promoting NEV adoption. The municipal government has aligned its development strategy with national policies by formulating the Zhengzhou New Energy Vehicle Industry Development Action Plan (2021–2025), which aims to reach 800,000 NEVs in operation and over 100,000 public charging stations by 2025 [12]. To facilitate NEV adoption, Zhengzhou has implemented a series of incentives, including direct purchase subsidies and funding support for charging infrastructure construction [13]. The city has also prioritized the electrification of public transportation and urban logistics. By the end of 2023, approximately 85% of Zhengzhou's public buses were electric, and over 20,000 NEVs were in operation as ride-hailing vehicles, contributing to the expansion of the city's green mobility network [14].

Market data further illustrate the rapid expansion of Zhengzhou's NEV sector. In 2023, the city recorded NEV sales of 380,000 units, marking a 30% year-on-year increase, with projections to reach 520,000 units in 2024. The development of charging infrastructure has also accelerated, with over 8,000 public charging stations established by the end of 2023 [15]. Zhengzhou's government aims to develop a one-kilometer charging network in core urban areas by 2025 to reduce consumer costs and improve charging convenience. In terms of brand competition, Zhengzhou's NEV market is dominated by major players such as BYD, Tesla, Li Auto, and XPeng [16]. BYD maintains a strong position due to its localized production and cost-effective models, while Tesla attracts premium consumers with its technological innovations and brand prestige [17]. Emerging brands like Li Auto and XPeng have gained traction among younger consumers by offering intelligent in-car systems and extended-range battery technologies, contributing to an increasingly competitive and diversified market landscape [18].

Beyond environmental benefits, the widespread adoption of NEVs has significant economic and social implications. The NEV industry drives advancements in key technological sectors such as battery innovation, smart mobility, and lightweight materials, fostering industrial upgrading and job creation [19]. The rapid development of Zhengzhou's NEV industry has stimulated upstream and downstream sectors, including component manufacturing and after-sales services, thereby facilitating regional economic transformation [20]. Additionally, increasing NEV adoption enhances public awareness of sustainable mobility, encouraging low-carbon lifestyles. In consumer decision-making, perceived value and brand image are among the most critical determinants of NEV purchase behavior [21]. Perceived value encompasses multiple dimensions, including functional value (e.g., driving range and charging convenience), emotional value (e.g., environmental consciousness), social value (e.g., green travel identity), and economic value (e.g., purchase subsidies and cost savings) [22]. Meanwhile, brand image influences consumer trust and preference, encompassing attributes such as brand reputation, product quality, technological innovation, and corporate social responsibility [23]. Brand image not only strengthens consumer confidence but also plays a decisive role in market competitiveness [24]. Therefore, this study sets out two primary objectives:

1. To determine the role of perceived value in consumers' decision-making behavior regarding the purchase of new energy vehicles.
2. To explain the influence of brand image on consumers' decision-making behavior when purchasing new energy vehicles.

Literature review

Perceived Value Theory explains consumer choices as a balance between benefits and costs, encompassing functional, emotional, social, and economic value [24]. In the NEV context, functional value reflects driving range, charging convenience, and performance, while emotional value is linked to environmental consciousness and personal fulfillment [21]. Social value is derived from NEVs being perceived as sustainable and socially responsible choices, and economic value includes factors such as purchase subsidies and operational cost savings [21]. Understanding the role of these value dimensions provides insight into how consumers evaluate NEVs and their purchase intentions. Additionally, Brand Image Theory emphasizes the importance of brand perception in consumer trust and decision-making [25]. Given the complexity and long product lifecycle of NEVs, a strong brand image—built through technological innovation, quality assurance, after-sales services, and corporate responsibility—reduces consumer uncertainty and enhances adoption. This study examines how these branding strategies influence purchasing behavior in a highly competitive NEV market.

Environmental Behavior Theory provides a broader context for policy incentives, infrastructure development, and societal norms that shape pro-environmental behaviors [26]. NEV adoption is significantly influenced by government support, tax incentives, charging infrastructure, and social acceptance of sustainable mobility solutions. These external factors reinforce perceived value and brand trust, strengthening consumer confidence in NEV purchases [27, 28]. By integrating these theoretical frameworks, this study constructs a comprehensive model to explain consumer behavior in the NEV market, offering insights into the interplay between individual perceptions, brand influence, and environmental factors.

Perceived value is a key determinant in consumer decision-making, particularly for high-involvement products such as New Energy Vehicles (NEVs). It represents a consumer's subjective assessment of the trade-off between the benefits obtained and the costs incurred, including financial, time, and effort-related considerations [29, 30]. Prior research has demonstrated that a higher perceived value generally enhances purchase intention, whereas a lower perceived value discourages adoption [31]. In the NEV market, perceived value encompasses not only the purchase price but also long-term costs such as maintenance, charging expenses, and government incentives, all of which influence consumer decision-making [29]. Although the impact of perceived value on consumer behavior has been widely validated in various market contexts, its role in Zhengzhou remains underexplored. Given that Zhengzhou consumers exhibit higher price sensitivity and the region's NEV infrastructure is still developing, the influence of perceived value on NEV purchase behavior in this specific context requires further investigation [32]. Based on this, the following hypothesis is proposed:

H1: Perceived value has a positive impact on Zhengzhou consumers' decisions to purchase new energy vehicles.

Functional value refers to consumers' assessment of an NEV's core performance attributes, including driving range, charging convenience, safety, power system, and intelligent technology. The continuous technological advancements in NEVs, such as extended driving ranges, faster charging speeds, and more reliable battery systems, have significantly improved functional value, enhancing consumer confidence while reducing uncertainties regarding NEV usability [33]. Functional value plays a critical role in NEV purchase decisions, with vehicle technical specifications, driving experience, and safety performance being key factors influencing consumer satisfaction and willingness to buy [34]. However, existing studies have mainly examined functional value's impact on NEV adoption in general, without focusing on its influence in Zhengzhou [35]. Therefore, the following hypothesis is proposed:

H1a: Functional value positively influences NEV purchase decision-making behavior.

Emotional value refers to the psychological satisfaction consumers derive from purchasing an NEV, which is often linked to brand image, environmental responsibility, and alignment with personal values [28]. When consumers perceive NEVs as a reflection of their environmental commitment, their purchase intentions significantly increase [36]. Furthermore, brands that emphasize sustainability and green innovation can foster a sense of emotional connection and consumer loyalty, strengthening the perceived value of their products [37]. Thus, the following hypothesis is proposed:

H1b: Emotional value positively influences NEV purchase decision-making behavior.

Social value refers to the degree to which consumers perceive NEV ownership as a means of gaining social recognition, status, and alignment with societal trends [28]. When NEVs become widely accepted and symbolically linked to sustainability and responsible consumption, consumers are more likely to be influenced by social norms, thereby increasing their willingness to buy [38]. In China, NEV adoption is driven not only by policy incentives but also by evolving social attitudes and public discourse [39]. NEVs are increasingly perceived as a status symbol that reflects environmental consciousness and social responsibility, influencing consumer choices [34]. Based on this, the following hypothesis is proposed:

H1c: Social value positively influences NEV purchase decision-making behavior.

Economic value represents consumers' assessment of an NEV's financial benefits, including its purchase price, operational costs, and long-term cost savings [40]. Economic considerations are particularly influential for price-sensitive consumers, who evaluate NEV affordability based on government subsidies, fuel cost savings, and maintenance expenses [41]. Since the initial acquisition cost of NEVs is relatively high, many consumers rely on long-term financial calculations to determine whether the investment is worthwhile [42]. However, consumer sensitivity to economic value varies across different markets [43]. Therefore, the following hypothesis is proposed:

H1d: Economic value positively influences NEV purchase decision-making behavior.

Brand image plays a crucial role in shaping consumer purchase decisions, as it encompasses perceptions of product reliability, quality, emotional appeal, and corporate reputation. A strong brand image enhances consumer trust, reduces perceived risk, and increases product desirability, particularly in high-involvement purchases such as new energy vehicles [44]. In the market for new energy vehicles, brand image is especially significant due to the technological complexity of these automobiles and lingering consumer concerns regarding performance, battery longevity, and resale value [45]. A well-established brand image positively affects consumer confidence and increases the likelihood of adopting emerging technologies [46]. However, while the relationship between brand image and purchase behavior has been extensively examined in mature automotive markets, its specific impact on consumer decision-making in the new energy vehicle market in Zhengzhou remains insufficiently explored [47]. Based on this, the following hypothesis is proposed:

H2: Brand image positively influences the purchase decision-making behavior of new energy vehicles.

Functional attributes refer to the core characteristics of a product that define its performance, quality, and usability, particularly in technology-intensive industries such as the new energy vehicle sector [48]. Key functional attributes, including battery efficiency, driving range, and charging speed, are critical determinants of consumer evaluations and purchase decisions [49]. Brands that deliver superior functional performance are perceived as more trustworthy

and technologically advanced, thereby reinforcing consumer confidence and increasing the likelihood of purchase [50]. In the context of the new energy vehicle industry, manufacturers that consistently introduce innovations in vehicle safety, energy efficiency, and autonomous driving technology strengthen their competitive positioning and foster consumer preference [35]. Therefore, the following hypothesis is proposed:

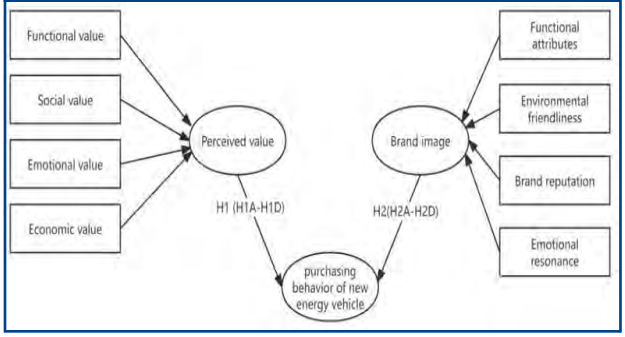
H2a: Functional attributes positively influence the purchase decision-making behavior of new energy vehicles.

Brand reputation encompasses consumer perceptions of corporate reliability, ethical business practices, and long-term credibility, all of which significantly shape consumer trust and purchase behavior [56]. A strong brand reputation enhances consumer confidence in product quality and encourages greater willingness to adopt innovative technologies such as new energy vehicles [38]. Companies that emphasize corporate social responsibility, sustainable business practices, and high-quality manufacturing standards tend to cultivate a favorable market reputation, thereby strengthening consumer trust [57]. Furthermore, a positive brand reputation helps mitigate consumer uncertainty, particularly in emerging industries where potential buyers seek reassurance regarding product reliability and long-term value [58]. Therefore, the following hypothesis is proposed:

H2c: Brand reputation positively influences the purchase decision-making behavior of new energy vehicles.

Emotional resonance refers to the connection consumers develop with a brand through shared values, identity alignment, and personal attachment. Bbrands capable of fostering emotional engagement generate stronger consumer loyalty and long-term brand advocacy [59]. In the context of the new energy vehicle industry, brands that effectively communicate sustainability values, corporate social responsibility, and technological innovation enhance emotional resonance, which in turn strengthens consumer commitment and increases the likelihood of purchase [60]. Emotional branding deepens consumer relationships with a brand, making it more appealing to environmentally conscious buyers who seek meaning and identity in their purchasing decisions [61]. Based on this, the following hypothesis is proposed:

Figure 1: Empirical model



H2d: Emotional resonance positively influences the purchase decision-making behavior of new energy vehicles.

Hence, this study develops figure 1.

METHOD

This study employs a quantitative research methodology to systematically analyze the key factors influencing consumer decisions to purchase new energy vehicles in Zhengzhou. As a central economic hub in China, Zhengzhou has a well-established new energy vehicle market, supported by favorable policies and infrastructure development, making it an ideal region for studying consumer behavior in this sector. Data collection for this study was conducted using a structured questionnaire survey over a period of two months, ensuring comprehensive coverage of consumer decision-making behaviors across different time frames and enhancing the representativeness of the dataset.

To ensure a representative sample, this study adopted a random sampling method, targeting consumers from diverse age groups, occupations, and income levels. During data collection, questionnaires were distributed offline at key locations such as new energy vehicle 4S stores, auto exhibitions, and charging stations to capture feedback from consumers actively engaged in the car-buying process. Additionally, the study employed online questionnaire distribution through social media platforms and forums related to new energy vehicles to expand the sample reach. Ultimately, a total of 344 valid questionnaires were collected, ensuring broad coverage and diversity within the dataset.

The survey instrument consisted of three primary sections, each designed to comprehensively assess the factors influencing new energy vehicle purchase behavior. The first section gathered demographic information, including gender, age, education level, income, vehicle ownership history, brand preference, and purchase price range, to examine how different consumer groups vary in their attitudes toward new energy vehicles. The second section measured perceived value, which includes four dimensions: functional value, emotional value, social value, and economic value. The measurement items in this section were adapted from the Perceived Value Scale (PERVAL) developed by Gallarza, Maubisson [62] and revised to align with the characteristics of the new energy vehicle market. The third section evaluated brand image and purchase behavior, examining how consumer perceptions of brand reliability, environmental responsibility, and emotional appeal influence their purchase decisions. The measurement items in this section were developed based on the brand image models proposed by Aaker [63] and Keller [64], with modifications tailored to the new energy vehicle market. All constructs in the questionnaire were measured using a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) to ensure precision and comparability in data analysis.

Before the main survey, a pretest was conducted to assess the reliability and validity of the questionnaire and refine

its design. A total of 30 valid responses were collected from new energy vehicle consumers in Zhengzhou, ensuring diverse representation across different age groups, occupations, and income levels. After data screening, a reliability and validity analysis was performed. The reliability analysis was conducted using Cronbach's α coefficient to assess the internal consistency of the measurement items, with all Cronbach's α values exceeding 0.7, indicating high reliability [65]. Specifically, constructs such as environmental friendliness (0.923), social value (0.906), and economic value (0.902) demonstrated strong internal consistency, reflecting high correlation among measurement items. Additionally, emotional resonance (0.878) and functional value (0.881) also exhibited high reliability, further validating the stability and robustness of the questionnaire.

RESULTS

Sample information

Table 1 provides an overview of the demographic composition and purchasing behavior of respondents. The demographic composition and purchasing behavior of respondents present a balanced gender distribution, with 49.7% male and 50.3% female participants. Most respondents fall within their prime earning years (21-50 years old), accounting for 83.5% of the sample, while younger individuals (below 20, 2.6%) and older consumers (above 51, 14.0%) make up smaller proportions. Regarding education, bachelor's degree holders constitute the largest group (29.9%), ollowed by high school graduates (27.0%) and vocational college attendees (25.3%), while advanced degree holders (master's 8.4%, Ph.D. 9.3%) form a smaller but highly educated segment.In terms of brand preference, Tesla and Li Auto are the most popular choices (16.9% each), followed by Wuling (11.3%), BYD (10.5%), and NIO (8.7%), with other brands also holding notable market shares. Most respondents purchased mid-to-upper-priced NEVs, with 26.5% spending 300,001–400,000 CNY and 25.3% selecting vehicles priced between 100,000–200,000 CNY. The key purchase drivers include owner discount policies (18.0%), brand preference (16.3%), vehicle performance (12.8%), charging convenience (12.5%), and environmental benefits (9.0%), while 20.3% cited additional motivations. These insights highlight the complex interplay of financial incentives, brand reputation, and functional considerations in shaping NEV purchase behavior.

Descriptive statistics

The descriptive statistics provide an overview of the central tendencies and distributions of key variables, reflecting respondents' perceptions of new energy vehicles (NEVs). The mean values range from 3.40 to 3.56, suggesting a moderate level of agreement among respondents regarding functional value, social value, emotional value, economic value, brand image, and purchasing behavior. The highest mean values are observed for purchasing behavior (3.56) and emotional resonance (3.55), indicating that respondents demonstrate a strong inclination toward recommending and purchasing NEVs. In contrast, economic value (3.44) and environmental friendliness (3.44) received the lowest scores, suggesting that financial and ecological benefits are perceived as less influential in the decision-making process.

The standard deviations range from 1.02 to 1.12, indicating moderate response variability. Higher variability is observed for functional attributes (1.12) and economic value (1.09), suggesting diverse opinions on these aspects, while functional value (1.03) and environmental friendliness (1.02) exhibit lower standard deviations, reflecting more consistent responses. The skewness values are all negative, ranging from -0.737 to -0.481, indicating that respondents tend to rate variables above the mean, reflecting an overall positive perception. Additionally, kurtosis values remain below zero, signifying a flat distribution, where responses are more spread out rather than concentrated around a specific rating. These findings highlight the importance of brand reputation and emotional connections in shaping consumer attitudes toward NEVs, alongside functional and economic considerations.

Data availability analysis

Reliability analysis evaluates the internal consistency of measurement constructs, ensuring that the questionnaire items accurately reflect the intended dimensions of each variable. Table 3 presents Cronbach's α values for all study variables, a widely used reliability coefficient that measures how well the items within each construct are correlated. A Cronbach's α value above 0.7 is generally considered acceptable, indicating a reliable measurement scale.The results confirm that all study variables meet or exceed this threshold, demonstrating high internal consistency. The highest reliability scores are observed for Brand Reputation (0.879), Environmental Friendliness (0.870), and Emotional Resonance (0.865), indicating that these constructs exhibit particularly strong alignment among their respective items. Similarly, Social Value (0.863) and Economic Value (0.860) display robust internal consistency, supporting their validity in capturing consumer perceptions related to social and financial considerations.Other constructs, including Functional Value (0.822) and Emotional Value (0.815), also demonstrate satisfactory reliability, suggesting that respondents provided consistent responses when evaluating these dimensions. Additionally, the Purchasing Behavior of New Energy Vehicles (0.836) shows strong internal consistency, reinforcing the reliability of this key outcome variable.

Factor analysis requires an evaluation of the dataset's suitability to ensure that variables exhibit sufficient intercorrelation for meaningful extraction of latent constructs. Table 4 presents the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity, two key statistical tests that assess the appropriateness of the data for factor analysis.The KMO value is 0.919, which exceeds the commonly accepted threshold of 0.7, indicating a high degree of sampling adequacy. A KMO value above 0.9 is considered excellent, suggesting that the dataset contains substantial shared variance among variables, making it well-suited for factor extraction and multivariate statistical analysis.

This high value underscores the robustness of the dataset for subsequent analyses.Bartlett's Test of Sphericity further validates the dataset's suitability, yielding a Chi-Square value of 6126.972, with 528 degrees of freedom (df) and a significance level (Sig. = 0.000). The significant result confirms that the correlation matrix is not an identity matrix, indicating the presence of meaningful relationships among variables. This supports the appropriateness of conducting factor analysis, as the dataset exhibits strong inter-item correlations necessary for the identification of latent constructs.

Measurement model and fit metrics

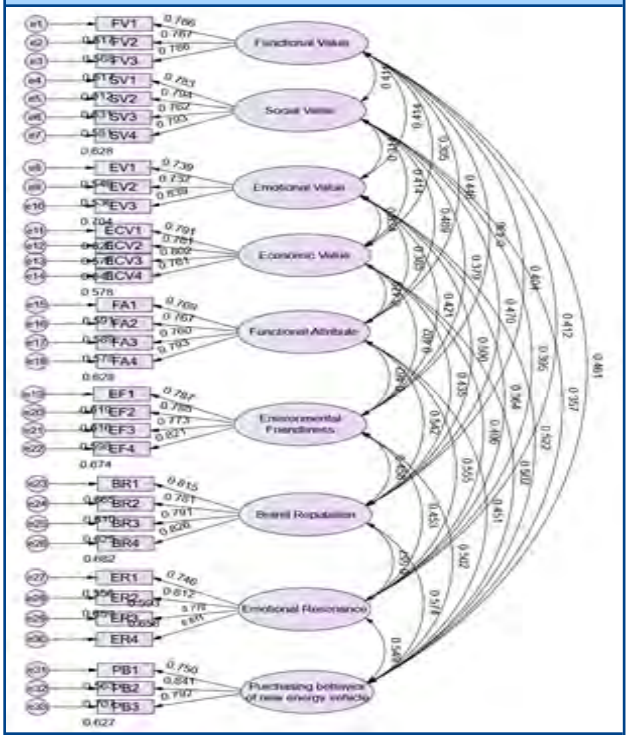
Figure 2 illustrates a measurement model within the confirmatory factor analyisis framework.

Table 5 presents the fit indices used to evaluate how well the measurement model aligns with the observed data. These indices assess the model's overall goodness-of-fit, ensuring that it accurately represents the relationships among the study variables.

Table 1. Sample Information

Information and options		Frequency	Percent
Gender	Male	171	49.7
	Frmale	173	50.3
Age	Below 20	9	2.6
	21-30	102	29.7
	31-40	87	25.3
	41-50	98	28.5
	51 and above	48	14.0
Educational Level	High school or below	93	27.0
	Vocational college	87	25.3
	Bachelor's Degree	103	29.9
	Master's Degree	29	8.4
	Ph.D. or above	32	9.3
Brands of new energy vehicles you have purchased	Tesla	58	16.9
	BYD	36	10.5
	Li Auto	58	16.9
	Xpeng	29	8.4
	NIO	30	8.7
	GAC Aion	26	7.6
	Changan	31	9.0
	Wuling	39	11.3
	Others	37	10.8
Price range of the new energy vehicle you purchased	Below 100,000 CNY	52	15.1
	100,000-200,000 CNY	87	25.3
	200,001-300,000 CNY	68	19.8
	300,001-400,000 CNY	91	26.5
	Above 400,000 CNY	46	13.4
How often do you use AI chatbots?	Energy-saving and environmental protection	31	9.0
	Car purchase subsidy	38	11.0
	Convenient charging	43	12.5
	Vehicle performance	44	12.8
	Owner discount policies	62	18.0
	Brand preference	56	16.3
	Others	70	20.3

Figure 2. Measurement model



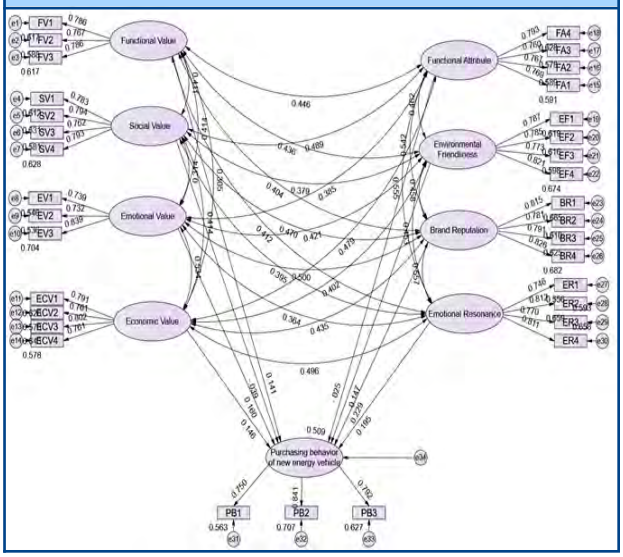
The chi-square to degrees of freedom ratio (χ^2/df) is 1.082, which is well below the reference standard of 3, indicating an excellent model fit. A lower value suggests that the discrepancy between the proposed model and the actual data is minimal, reinforcing the validity of the model's structure.The Root Mean Square Error of Approximation (RMSEA) is 0.015, significantly below the commonly accepted threshold of 0.08. This result indicates that the model has very low approximation errors, suggesting a close fit between the observed data and the hypothesized structure.

Several additional goodness-of-fit indices further confirm the robustness of the measurement model. The Goodness-of-Fit Index (GFI = 0.922) and the Adjusted Goodness-of-Fit Index (AGFI = 0.905) both exceed the 0.9 benchmark, demonstrating that the model sufficiently explains the data variance. The Normed Fit Index (NFI = 0.922), Tucker-Lewis Index (TLI = 0.993), and Comparative Fit Index (CFI = 0.994) all surpass the 0.9 threshold, indicating strong relative fit and alignment with the theoretical framework.

Convergent validity

Table 6 evaluates convergent validity through Confirmatory Factor Analysis (CFA), using factor loadings, Composite Reliability (CR), and Average Variance Extracted (AVE) to assess measurement consistency. All factor loadings exceed 0.7, confirming strong associations between observed variables and latent constructs. The highest loading is EV3 (0.839) under Emotional Value, while the lowest is EV2 (0.732), both within acceptable limits.CR values range from 0.815 to 0.876, surpassing the 0.7 threshold, indicating high internal reliability.

Figure 3. Structural model



Environmental Friendliness (0.876), Brand Reputation (0.866), and Emotional Resonance (0.870) exhibit the highest consistency. AVE values range from 0.595 to 0.638, exceeding the 0.5 benchmark, ensuring that each construct explains more than half of the variance in its indicators. Environmental Friendliness (0.638) and Brand Reputation (0.619) demonstrate the strongest explanatory power. These results validate the robustness of the measurement model, confirming that all constructs are reliably captured.

Discriminant validity

Table 7 evaluates discriminant validity, ensuring each latent variable is distinct and captures unique theoretical aspects. The diagonal values represent the square root of Average Variance Extracted (AVE) and should exceed the off-diagonal correlation coefficients. The results confirm that all constructs share more variance with their respective indicators than with others, validating their distinctiveness. Correlation coefficients range from 0.305 to 0.574, indicating moderate interrelationships while maintaining construct independence. Notably, Purchasing Behavior of New Energy Vehicles shows moderate correlations with Brand Reputation (0.574) and Emotional Value (0.522), suggesting that brand perception and emotional attachment influence purchase decisions. These findings confirm the robustness of the measurement model, ensuring its reliability for structural equation modeling and hypothesis testing.

Structural model fit metrics for the structural model

Figure 3 illustrates the structural equation model and path analysis diagram

Table 8 presents the model fit indices, confirming the structural model's robustness. The chi-square to degrees of freedom ratio (χ^2/df) = 1.082, well below the threshold of 3, indicates minimal discrepancy between the observed and expected covariance structures. The Root Mean Square Error of Approximation (RMSEA) = 0.015, significantly below 0.08, further validates the model's fit.Additional

indices, including GFI (0.922), AGFI (0.905), NFI (0.922), TLI (0.993), and CFI (0.994), all exceed the 0.9 benchmark, confirming a strong alignment with theoretical expectations. These results affirm that the model effectively explains NEV purchasing behavior, supporting the proposed relationships among key variables.

Table 2. Descriptive Statistics Results

Study variables	Items	Mean	S.D.	Skewness		Kurtosis	
				Value	S.E.	Value	S.E.
Functional Value	FV1	3.490	1.061	-0.574	0.131	-0.682	0.262
	FV2	3.460	1.103	-0.544	0.131	-0.743	0.262
	FV3	3.470	1.038	-0.646	0.131	-0.516	0.262
Social Value	SV1	3.490	1.047	-0.590	0.131	-0.617	0.262
	SV2	3.510	1.036	-0.617	0.131	-0.576	0.262
	SV3	3.510	1.077	-0.550	0.131	-0.667	0.262
	SV4	3.490	1.004	-0.514	0.131	-0.807	0.262
Emotional Value	EV1	3.470	1.033	-0.681	0.131	-0.466	0.262
	EV2	3.460	1.060	-0.594	0.131	-0.632	0.262
	EV3	3.490	1.052	-0.611	0.131	-0.587	0.262
Economic Value	ECV1	3.480	1.093	-0.708	0.131	-0.514	0.262
	ECV2	3.440	1.076	-0.492	0.131	-0.891	0.262
	ECV3	3.460	1.057	-0.607	0.131	-0.676	0.262
	ECV4	3.520	1.033	-0.630	0.131	-0.596	0.262
Functional Attribute	FA1	3.480	1.122	-0.610	0.131	-0.644	0.262
	FA2	3.420	1.041	-0.601	0.131	-0.782	0.262
	FA3	3.490	1.024	-0.532	0.131	-0.619	0.262
	FA4	3.490	1.047	-0.667	0.131	-0.606	0.262
Environmental Friendliness	EF1	3.480	1.024	-0.535	0.131	-0.721	0.262
	EF2	3.450	1.092	-0.481	0.131	-0.893	0.262
	EF3	3.470	1.021	-0.616	0.131	-0.549	0.262
	EF4	3.440	1.068	-0.658	0.131	-0.617	0.262
Brand Reputation	BR1	3.490	1.050	-0.600	0.131	-0.697	0.262
	BR2	3.480	1.096	-0.536	0.131	-0.711	0.262
	BR3	3.410	1.054	-0.737	0.131	-0.439	0.262
	BR4	3.510	1.052	-0.665	0.131	-0.523	0.262
Emotional Resonance	ER1	3.550	1.071	-0.523	0.131	-0.726	0.262
	ER2	3.450	1.032	-0.604	0.131	-0.640	0.262
	ER3	3.490	1.055	-0.554	0.131	-0.701	0.262
	ER4	3.500	1.058	-0.602	0.131	-0.644	0.262
Purchasing behavior of new energy vehicle	PB1	3.470	1.027	-0.556	0.131	-0.634	0.262
	PB2	3.560	1.056	-0.699	0.131	-0.477	0.262
	PB3	3.490	1.072	-0.606	0.131	-0.673	0.262

Path analysis for direct effects

Table 9 presents the direct path effects within the structural model, evaluating the influence of perceived value and brand image dimensions on NEV purchasing behavior. Significant positive effects are observed for functional value ($\beta = 0.141$, $p = 0.034$), social value ($\beta = 0.160$, $p = 0.027$), economic value ($\beta = 0.146$, $p = 0.041$), environmental friendliness ($\beta = 0.147$, $p = 0.022$), brand reputation ($\beta = 0.229$, $p = 0.002$), and emotional resonance ($\beta = 0.195$, $p = 0.007$), highlighting the role of both product attributes and brand perceptions in influencing consumer decisions.Conversely, emotional value ($\beta = -0.039$, $p = 0.538$) and functional attribute ($\beta = -0.025$, $p = 0.732$) do not exhibit significant relationships, indicating that emotional attachment and specific functional attributes are not decisive factors for adoption. These findings reinforce that both economic and brand-related factors shape purchasing behavior, confirming the theoretical model's validity.

DISCUSSION AND CONCLUSION

Theoretical influence

This study examines the factors influencing NEV purchasing behavior, focusing on perceived value and brand image. Structural equation modeling results indicate that economic value, social value, brand reputation, and emotional resonance significantly impact purchasing behavior, while emotional value and functional attributes do not. Additionally, environmental friendliness strengthens brand trust, indirectly shaping consumer decision-making. These findings refine existing theories in consumer behavior, branding, and environmental psychology.

Table 3. Reliability Statistics

Study variables	Number of questions	Cronbach's α
Functional Value	3	0.822
Social Value	4	0.863
Emotional Value	3	0.815
Economic Value	4	0.860
Functional Attribute	4	0.855
Environmental Friendliness	4	0.870
Brand Reputation	4	0.879
Emotional Resonance	4	0.865
Purchasing behavior of new energy vehicle	3	0.836

Table 4. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.919
Bartlett's Test of Sphericity	Approx. Chi-Square	6126.972
	df	528
	Sig.	.000

Building on Perceived Value Theory, this study highlights social and economic value as primary drivers of NEV adoption, while emotional value plays a lesser role in markets where cost and infrastructure remain critical concerns. Unlike previous studies suggesting emotional value enhances green product adoption [66], this study finds it insignificant in NEV purchases. Additionally, while prior research emphasizes functional attributes like battery life and charging convenience, this study finds brand trust and social influence more decisive in consumer choices [67].

This study also extends Brand Image Theory by demonstrating that brand reputation, emotional resonance, and environmental friendliness strongly influence purchasing behavior. Prior research mainly highlights brand awareness and technological superiority [68], but these findings suggest that corporate social responsibility and sustainability messaging enhance brand trust and drive purchase intention. Additionally, brand reputation mitigates perceived risks, influencing consumer behavior independently of technological innovation [46, 69].

Further, this study refines the Consumer Behavior Model by revealing the importance of social recognition and brand trust in shaping consumer decisions. Prior studies primarily focus on economic and policy-driven incentives [70], while this study emphasizes that social value and branding significantly influence the evaluation stage of NEV adoption. This challenges traditional views of NEV adoption as purely rational economic behavior, highlighting the growing role of social influence and branding in sustainable consumption [61].

Additionally, this study contributes to Environmental Behavior Theory by demonstrating that environmental friendliness indirectly influences purchasing behavior via brand trust. While prior research debates whether regulatory incentives or intrinsic environmental concerns drive green consumption [71, 72], this study supports a hybrid model, where corporate sustainability efforts reinforce consumer trust and purchase intention. This aligns with findings that environmentally responsible branding enhances consumer loyalty but further demonstrates that brand trust mediates this effect [73].

In summary, this study refines Perceived Value Theory by emphasizing social and economic value over emotional and functional value, extends Brand Image Theory by highlighting brand reputation and emotional resonance, advances the Consumer Behavior Model by illustrating the role of branding and social value, and strengthens Environmental Behavior Theory by confirming the impact of environmental friendliness on brand trust and consumer commitment. These insights contribute to the literature on sustainable consumption and NEV adoption, providing a foundation for future research on consumer preferences in low-carbon mobility markets.

Practice influence

The findings have significant practical implications for policymakers, industry stakeholders, and consumers, providing actionable insights for the sustainable development of the new energy vehicle (NEV) market. Given the demonstrated influence of economic value on purchasing behavior, government policies should continue to refine financial incentives, extending beyond direct subsidies to include long-term benefits such as tax exemptions, reduced insurance premiums, and charging infrastructure subsidies.

These measures can enhance the perceived affordability and long-term cost efficiency of NEVs, mitigating consumers' financial concerns. Additionally, as environmental friendliness has been shown to influence consumer trust in NEV brands, regulatory authorities should implement stricter sustainability standards and encourage automakers to invest in eco-friendly production processes, such as battery recycling initiatives and carbon-neutral manufacturing. Concurrently, improvements in charging infrastructure remain crucial, particularly in second-tier

cities like Zhengzhou, where limited accessibility to charging stations may hinder adoption. Public-private partnerships should be leveraged to accelerate infrastructure development, integrating charging networks within residential, commercial, and highway sectors to enhance the functional value of NEVs and alleviate range anxiety among potential buyers.

Table 5. Measure model fit index

Fit index	χ2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9
Result	1.082	0.015	0.922	0.905	0.922	0.993	0.994

Table 6. Convergence Validity

Latent variables	Observation indicators	Factor loading	CR	AVE
Functional Value	FV1	0.786	0.823	0.608
	FV2	0.767		
	FV3	0.786		
Social Value	SV1	0.783	0.864	0.613
	SV2	0.794		
	SV3	0.762		
	SV4	0.793		
Emotional Value	EV1	0.739	0.815	0.595
	EV2	0.732		
	EV3	0.839		
Economic Value	ECV1	0.791	0.861	0.607
	ECV2	0.761		
	ECV3	0.802		
	ECV4	0.761		
Functional Attribute	FA1	0.767	0.859	0.604
	FA2	0.760		
	FA3	0.793		
	FA4	0.787		
Environmental Friendliness	EF1	0.785	0.876	0.638
	EF2	0.773		
	EF3	0.821		
	EF4	0.815		
Brand Reputation	BR1	0.781	0.866	0.619
	BR2	0.791		
	BR3	0.826		
	BR4	0.746		
Emotional Resonance	ER1	0.812	0.870	0.625
	ER2	0.770		
	ER3	0.811		
	ER4	0.769		
Purchasing behavior of new energy vehicle	PB1	0.750	0.837	0.632
	PB2	0.841		
	PB3	0.792		

From a corporate perspective, the findings underscore the importance of brand reputation and emotional resonance in shaping consumer preferences. NEV manufacturers should focus on strategic brand positioning, emphasizing technological innovation, product reliability, and corporate social responsibility to build consumer trust.

Table 7. Discriminant Validity Test

Latent variables	FV	SV	EV	ECV	FA	EF	BR	ER	PB
Functional Value	0.780								
Social Value	0.411	0.783							
Emotional Value	0.414	0.314	0.771						
Economic Value	0.305	0.414	0.534	0.779					
Functional Attribute	0.446	0.489	0.385	0.479	0.777				
Environmental Friendliness	0.436	0.379	0.421	0.402	0.462	0.799			
Brand Reputation	0.404	0.470	0.500	0.435	0.542	0.458	0.787		
Emotional Resonance	0.412	0.395	0.364	0.496	0.555	0.453	0.557	0.791	
Purchasing behavior of new energy vehicle	0.461	0.357	0.522	0.502	0.451	0.502	0.574	0.549	0.795

Note: The diagonal is the square root of the corresponding variable's AVE.
FV: Functional Value; SV: Social Value; EV: Emotional Value; ECV: Economic Value; FA: Functional Attribute; EF: Environmental Friendliness; BR: Brand Reputation; ER: Emotional Resonance; PB: Purchasing behavior of new energy vehicle.

Table 8. Model fit index

Fit index	χ2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9
Results	1.082	0.015	0.922	0.905	0.922	0.993	0.994

Table 9. Direct path effects

Hypothesis	Path	Estimate	β	S.E.	C.R.	P	Results
H1	PV→PB	0.102	0.102	0.070	1.460	0.045	Supported
H1a	FV→PB	0.130	0.141	0.061	2.122	0.034	Supported
H1b	SV→PB	0.162	0.160	0.073	2.209	0.027	Supported
H1c	EV→PB	-0.037	-0.039	0.060	-0.616	0.538	Non-supported
H1d	ECV→PB	0.130	0.146	0.064	2.044	0.041	Supported
H2	BI→PB	0.137	0.137	0.080	1.710	0.035	Supported
H2a	FA→PB	-0.022	-0.025	0.065	-0.342	0.732	Non-supported
H2b	EF→PB	0.141	0.147	0.061	2.293	0.022	Supported
H2c	BR→PB	0.206	0.229	0.067	3.068	0.002	Supported
H2d	ER→PB	0.188	0.195	0.070	2.674	0.007	Supported

Note: The diagonal is the square root of the corresponding variable's AVE.
PV: Perceived Value; FV: Functional Value; SV: Social Value; EV: Emotional Value; ECV: Economic Value; BI: Brand Image; FA: Functional Attribute; EF: Environmental Friendliness; BR: Brand Reputation; ER: Emotional Resonance; PB: Purchasing behavior of new energy vehicle.

Marketing campaigns should leverage digital platforms and social media engagement to enhance consumer-brand interactions, fostering emotional connections that drive long-term brand loyalty. Furthermore, companies should optimize post-purchase support by offering extended battery warranties, resale value guarantees, and comprehensive after-sales services to reinforce consumer confidence.

Social influence also plays a critical role in consumer decision-making, suggesting that industry stakeholders should cultivate community-based marketing strategies, such as influencer partnerships and consumer advocacy programs, to enhance the social desirability of NEVs. Lastly, shared mobility solutions, such as NEV-based ride-hailing and car-sharing services, should be expanded to increase consumer exposure and familiarity with electric vehicles, thereby strengthening their perceived functional and economic value. By integrating these strategies, both policymakers and industry leaders can effectively accelerate the transition toward sustainable mobility and foster widespread adoption of NEVs in urban markets.

CONCLUSION

This study confirms that functional value, social value, economic value, environmental friendliness, brand reputation, and emotional resonance significantly influence purchase behavior, while emotional value and functional attributes do not. These results highlight the interplay between product-related factors and brand perception in shaping consumer decisions.

The study provides a holistic view of NEV adoption, emphasizing the role of social value and environmental consciousness in shaping consumer choices, particularly in emerging NEV markets. Practically, the findings offer insights for policymakers, industry stakeholders, and marketers. Governments should refine financial incentives and infrastructure policies to enhance perceived economic and functional value. Automakers should strengthen brand reputation through technological reliability, customer service, and corporate social responsibility. Marketing strategies should leverage social influence, engaging digital communities and sustainability advocates to promote NEVs as lifestyle choices. Additionally, charging infrastructure improvements and targeted promotions can accelerate market penetration.

Despite its contributions, this study has limitations. The focus on Zhengzhou limits generalizability; future research should conduct comparative city-level analyses. The cross-sectional design captures consumer perceptions at one point in time, necessitating longitudinal studies to track preference shifts due to policy and technological changes. Future research should also incorporate behavioral data (e.g., purchase records, charging patterns) to validate findings. Additionally, exploring risk perception and trust in autonomous driving technology could provide deeper insights into next-generation NEV adoption.In summary, this study advances the understanding of NEV consumer behavior, integrating perceived value, brand image, and environmental influences into a structured framework. Future research should explore emerging trends such as autonomous driving, vehicle-to-grid (V2G) integration, and circular economy practices to enhance insights into sustainable mobility adoption dynamics.

REFERENCE

1. Hossain, M.S., et al., Narrowing fossil fuel consumption in the Indian road transport sector towards reaching carbon neutrality. Energy Policy, 2023. 172: p. 113330.
2. Zakari, A., et al., Energy efficiency and sustainable development goals (SDGs). Energy, 2022. 239: p. 122365.
3. Hu, R., T. Cai, and W. Xu, Exploring the technology changes of new energy vehicles in China: Evolution and trends. Computers & Industrial Engineering, 2024. 191: p. 110178.
4. Möring-Martínez, G., M. Senzeybek, and P. Jochem, Clustering the European Union electric vehicle markets: A scenario analysis until 2035. Transportation Research Part D: Transport and Environment, 2024. 135: p. 104372.
5. Nam, S., Inflation Reduction Act's Clean Vehicle Provisions: Analysis of Potential International Trade Law Violations, in Revolutionary Approach to International Law: The Role of International Lawyer in Asia, E.Y.J. Lee, Editor. 2023, Springer Nature Singapore: Singapore. p. 177-195.
6. Liu, Z., S. Schindler, and W. Liu, Demystifying Chinese overseas investment in infrastructure: Port development, the Belt and Road Initiative and regional development. Journal of Transport Geography, 2020. 87: p. 102812.
7. Tian, J., P. Wang, and D. Zhu, Overview of Chinese new energy vehicle industry and policy development. Green Energy and Resources, 2024. 2(2): p. 100075.
8. Hao, X., et al., Toward Carbon Neutral Road Transport: Development Strategies and New R&D Organizational Paradigms. Automotive Innovation, 2024. 7(2): p. 209-224.
9. Liu, X., et al., Do policy incentives drive electric vehicle adoption? Evidence from China. Transportation Research Part A: Policy and Practice, 2021. 150: p. 49-62.
10. Xiao, G., et al., Which factors affect user satisfaction with ETC? Evidence from Shanghai and Beijing. Journal of Advanced Transportation, 2022. 2022(1): p. 3102249.
11. Fu, Z., et al., Orderly solar charging of electric vehicles and its impact on charging behavior: A year-round field experiment. Applied Energy, 2025. 381: p. 125211.
12. Chu, Y., et al., Assessment of Leading New Energy Vehicle City Markets in China and Policy Lessons. Электронный ресурс].—Режим доступа: https://theicct.org/wp-content/uploads/2022/09/China-EV-citymarkets_final. pdf, 2022. 1.
13. Zhao, X., et al., Policy incentives and electric vehicle adoption in China: From a perspective of policy mixes. Transportation Research Part A: Policy and Practice, 2024. 190: p. 104235.

14. Ma, J., et al., Electrification of Integrated Stereoscopic Transportation: A Perspective on the Electric Ride-Hailing, Transit, and Electric Vertical Takeoff and Landing Market in Jiangsu Province. World Electric Vehicle Journal, 2025. 16(3): p. 165.
15. Linjuan, Z., et al., Site selection and capacity determination of charging stations considering the uncertainty of users' dynamic charging demands. Frontiers in Energy Research, 2024. 11: p. 1295043.
16. Shou, S. and Y. Li, Exploring the collaborative innovation operational model of government-industry-education synergy: a case study of BYD in China. Asian Journal of Technology Innovation, 2024: p. 1-36.
17. Palmié, M., et al., Valuation entrepreneurship through product-design and blame-avoidance strategies: How Tesla managed to change the public perception of sustainable innovations. Journal of Product Innovation Management, 2024. 41(3): p. 644-676.
18. Figenbaum, E. and M. Kolbenstvedt, Competitive electric town transport. Main results from COMPETT–an Electromobility+ project. TØI report, 2015. 1422: p. 2015.
19. Hu, S., et al., The status quo and future trends of new energy vehicle power batteries in China — Analysis from policy perspective. Energy Reports, 2022. 8: p. 63-80.
20. Zhang, Z., et al., Does digital global value chain participation reduce energy resilience? Evidence from 49 countries worldwide. Technological Forecasting and Social Change, 2024. 208: p. 123712.
21. He, Z., et al., The impact of motivation, intention, and contextual factors on green purchasing behavior: New energy vehicles as an example. Business Strategy and the Environment, 2021. 30(2): p. 1249-1269.
22. Laukkanen, M. and N. Tura, Sustainable value propositions and customer perceived value: Clothing library case. Journal of Cleaner Production, 2022. 378: p. 134321.
23. Lin, W.L., The role of corporate social responsibility and corporate social irresponsibility in shaping corporate reputation: An analysis of competitive action and innovation strategies. Corporate Social Responsibility and Environmental Management, 2024. 31(2): p. 1451-1468.
24. Shams, R., S. Chatterjee, and R. Chaudhuri, Developing brand identity and sales strategy in the digital era: Moderating role of consumer belief in brand. Journal of Business Research, 2024. 179: p. 114689.
25. Kankam, G. and I.T. Charnor, Emotional intelligence and consumer decision-making styles: the mediating role of brand trust and brand loyalty. Future Business Journal, 2023. 9(1): p. 57.
26. Saulītis, A., V. Silkāne, and G.A. Gaile, Nudging pro-environmental behaviour in a subsidized waste recycling system: A field experimental study. Journal of Environmental Psychology, 2024. 99: p. 102416.
27. Abdul Qadir, S., et al., Navigating the complex realities of electric vehicle adoption: A comprehensive study of government strategies, policies, and incentives. Energy Strategy Reviews, 2024. 53: p. 101379.
28. Lv, Z., et al., Impact of perceived value, positive emotion, product coolness and Mianzi on new energy vehicle purchase intention. Journal of Retailing and Consumer Services, 2024. 76: p. 103564.
29. Zhao, H., et al., Consumers' purchase intention toward electric vehicles from the perspective of perceived green value: An empirical survey from china. World Electric Vehicle Journal, 2024. 15(6): p. 267.
30. Vo-Thanh, T., et al., The service digitalization in fine-dining restaurants: a cost-benefit perspective. International Journal of Contemporary Hospitality Management, 2022. 34(9): p. 3502-3524.
31. Srivastava, A., et al., Impact of perceived value on the online purchase intention of base of the pyramid consumers. International Journal of Consumer Studies, 2023. 47(4): p. 1291-1314.
32. Li, P. and Z. Zhang, The effects of new energy vehicle subsidies on air quality: Evidence from China. Energy Economics, 2023. 120: p. 106624.
33. He, H., et al., China's battery electric vehicles lead the world: achievements in technology system architecture and technological breakthroughs. Green Energy and Intelligent Transportation, 2022. 1(1): p. 100020.
34. Hu, X., R.N.R. Yusof, and Z.D. Mansor, Consumers' Purchase Intentions Towards New Energy Vehicles Based on the Theory of Planned Behaviour on Perceived Value: An Empirical Survey of China. World Electric Vehicle Journal, 2025. 16(3): p. 120.
35. Zhao, X., et al., Assessment of the effects of China's new energy vehicle industry policies: from the perspective of moderating effect of consumer characteristics. Environment, Development and Sustainability, 2025. 27(2): p. 4319-4340.
36. Moon, S.-J., Effect of consumer environmental propensity and innovative propensity on intention to purchase electric vehicles: Applying an extended theory of planned behavior. International Journal of Sustainable Transportation, 2021. 16(11): p. 1032-1046.
37. Yuan, J., et al., Sustainable development in brand loyalty: Exploring the dynamics of corporate social responsibility, customer attitudes, and emotional contagion. Corporate Social Responsibility and Environmental Management, 2024. 31(2): p. 1042-1051.
38. Lin, B. and L. Shi, Do environmental quality and policy changes affect the evolution of consumers' intentions to buy new energy vehicles. Applied Energy, 2022. 310: p. 118582.
39. Wu, Z., et al., Public attitudes and sentiments towards new energy vehicles in China: A text mining approach. Renewable and Sustainable Energy Reviews, 2023. 178: p. 113242.

40. Liang, T.-P., Y.-L. Lin, and H.-C. Hou, What drives consumers to adopt a sharing platform: An integrated model of value-based and transaction cost theories. Information & Management, 2021. 58(4): p. 103471.
41. Bhutto, M.H., et al., Predicting consumer purchase intention toward hybrid vehicles: testing the moderating role of price sensitivity. European Business Review, 2022. 34(1): p. 62-84.
42. Schlecht, I., C. Maurer, and L. Hirth, Financial contracts for differences: The problems with conventional CfDs in electricity markets and how forward contracts can help solve them. Energy Policy, 2024. 186: p. 113981.
43. Zhang, C., et al., Customer-driven value creation in the digital economy: Determining the role of customer firms' digital transformation on supplier performance in China. Omega, 2024. 128: p. 103132.
44. Zhao, H., F. Furuoka, and R. Rasiah, The Influence of Psychological Factors on Consumer Purchase Intention for Electric Vehicles: Case Study from China: Integrating the Necessary Condition Analysis Methodology from the Perspective of Self-Determination Theory. World Electric Vehicle Journal, 2024. 15(8): p. 331.
45. Cao, J., et al., Electric vehicle industry sustainable development with a stakeholder engagement system. Technology in Society, 2021. 67: p. 101771.
46. Featherman, M., et al., The impact of new technologies on consumers beliefs: Reducing the perceived risks of electric vehicle adoption. Technological Forecasting and Social Change, 2021. 169: p. 120847.
47. Fang, Z., et al., Estimating optimal substitution scale of urban gasoline taxis by electric taxis in the era of green energy: a case study of Zhengzhou City. Geo-spatial Information Science, 2023. 26(3): p. 514-539.
48. Lv, Z., H. Lv, and M. Fridenfalk, Digital twins in the marine industry. Electronics, 2023. 12(9): p. 2025.
49. Song, Y., et al., A decision support model for buying battery electric vehicles considering consumer learning and psychological behavior. Journal of Retailing and Consumer Services, 2023. 73: p. 103303.
50. Pappas, A., et al., More than Machines: The Role of the Future Retail Salesperson in Enhancing the Customer Experience. Journal of Retailing, 2023. 99(4): p. 518-531.
51. Zahoor, A., et al., A systematic study involving patent analysis and theoretical modeling of eco-friendly technologies for electric vehicles and power batteries to ease carbon emission from the transportation industry. Energy Conversion and Management, 2024. 321: p. 118996.
52. Chen, C.-W., Utilizing a hybrid approach to identify the importance of factors that influence consumer decision-making behavior in purchasing sustainable products. Sustainability, 2024. 16(11): p. 4432.
53. Lavuri, R., D. Roubaud, and O. Grebinevych, Sustainable consumption behaviour: Mediating role of pro-environment self-identity, attitude, and moderation role of environmental protection emotion. Journal of Environmental Management, 2023. 347: p. 119106.
54. Marvi, R., D. Zha, and P. Foroudi, Elevating B2B branding in a global context: Integrating existing literature and proposing a forward-thinking conceptual framework. Industrial Marketing Management, 2024. 120: p. 247-272.
55. Cheng, X., et al., How social interaction shapes habitual and occasional low-carbon consumption behaviors: Evidence from ten cities in China. Renewable and Sustainable Energy Reviews, 2023. 182: p. 113387.
56. Parray, Z.A., J. Iqbal, and R. Mushtaq, Customer perception of corporate social responsibility and its impact on customer engagement: critical significance of corporate reputation. Corporate Communications: An International Journal, 2024. 29(4): p. 592-606.
57. Le, T.T., Corporate social responsibility and SMEs' performance: mediating role of corporate image, corporate reputation and customer loyalty. International Journal of Emerging Markets, 2023. 18(10): p. 4565-4590.
58. Van Nguyen, M., K.D. Ha, and C.T. Phan, Sustainable development during economic uncertainty: What drives large construction firms to perform corporate social responsibility? Corporate Social Responsibility and Environmental Management, 2024. 31(4): p. 2838-2851.
59. Malik, G. and D. Pradhan, How does gameful experience foster customer engagement and brand advocacy? Consumer insights into branding in e-tail. Journal of Consumer Marketing, 2025. 42(2): p. 205-222.
60. Al-Issa, N. and M. Thanasi, Mapping the Future of Tech-Infused Luxury: A Roadmap and Research Directions. International Journal of Consumer Studies, 2024. 48(6): p. e13103.
61. Yadav, M., R. Gupta, and K. Nair, Time for sustainable marketing to build a green conscience in consumers: Evidence from a hybrid review. Journal of Cleaner Production, 2024. 443: p. 141188.
62. Gallarza, M.G., L. Maubisson, and A. Rivière, Replicating consumer value scales: A comparative study of EVS and PERVAL at a cultural heritage site. Journal of Business Research, 2021. 126: p. 614-623.
63. Aaker, D.A., Measuring brand equity across products and markets. California management review, 1996. 38(3).
64. Keller, K.L., Conceptualizing, Measuring, and Managing Customer-Based Brand Equity. Journal of Marketing, 1993. 57(1): p. 1-22.
65. Taber, K.S., The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Research in Science Education, 2018. 48(6): p. 1273-1296.
66. Joshi, Y., D.P. Uniyal, and D. Sangroya, Investigating consumers' green purchase intention: Examining the role of economic value, emotional value and perceived marketplace influence. Journal of Cleaner Production, 2021. 328: p.

129638.
67. Zhu, X., et al., Social and technological factors influencing consumer satisfaction with electric vehicles: An assimilation-contrast effect perspective. Research in Transportation Business & Management, 2024. 57: p. 101218.
68. Zhu, J., et al., Using blockchain or not? A focal firm's blockchain strategy in the context of carbon emission reduction technology innovation. Business Strategy and the Environment, 2024. 33(4): p. 3505-3531.
69. Hasan, R., R. Shams, and M. Rahman, Consumer trust and perceived risk for voice-controlled artificial intelligence: The case of Siri. Journal of Business Research, 2021. 131: p. 591-597.
70. Ahmad, E., et al., The influence of grid connectivity, electricity pricing, policy-driven power incentives, and carbon emissions on renewable energy adoption: Exploring key factors. Renewable Energy, 2024. 232: p. 121108.
71. Liu, F. and G.R. Madni, Moderating role of policy incentive and perceived cost in relationship of environmental awareness and green consumption behavior. Plos one, 2024. 19(2): p. e0296632.
72. Ng, P.M., et al., Green consumption and sustainable development: The effects of perceived values and motivation types on green purchase intention. Business Strategy and the Environment, 2024. 33(2): p. 1024-1039.
73. Tran, N.K.H., Enhancing green brand equity through environmental reputation: The important of green brand image, green brand trust, and green brand loyalty. Business Strategy & Development, 2023. 6(4): p. 1006-1017.

SSN Journal **of M**anagement & **T**echnology **R**esearch **C**ommunications
Vol 2 No (1) Jan-Feb-Mar-Apr 2025
Society for Science and Nature

E-ISSN: 3049-0014
CrossRef DOI: https://dx.doi.org/10.21786/mntrc

Public Health Care and its Management in India: Challenges and Opportunities

Shaima A Miraj

Department of Public Health, College of Health Sciences, Saudi Electronic University, Riyadh 11673, Saudi Arabia.

ABSTRACT

The Indian healthcare sector is growing at a brisk pace due to its strengthening coverage and services and increasing expenditure by public and private players. It has undergone significant transformations over the last 75 years, but still faces several challenges. The Indian healthcare market, which was valued at US$ 110 billion in 2016, is now projected to reach US$ 638 billion by 2025. It is noteworthy that much progress has been made in the country's healthcare management since independence. Life expectancy is greater than 67 years, and the India of 2025 is a thriving democracy with a diversified production base, a large scientific community, and an impressive information technology sector. This review article discusses the past and present of the Indian healthcare system and its management concerning the problems and challenges it has faced over the last many decades. Healthcare has become one of India's largest sectors, both in terms of revenue and employment, as it comprises hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance, and medical equipment. The Indian healthcare sector is growing at a brisk pace due to its strengthening coverage, services, and increasing expenditure by public as well as private players. India's competitive advantage lies in its large pool of well-trained medical professionals. India is also cost-competitive compared to its peers in Asia and Western countries. Moreover, India has emerged as a hub for R&D activities for international players due to its relatively low cost of clinical research. The telemedicine market is also expected to reach US$ 6 billion by 2025, driven by increased demand for remote healthcare solutions and advancements in technology.

KEY WORDS: PUBLIC HEALTH, MANAGEMENT IN INDIA, PAST AND THE PRESENT.

INTRODUCTION

Background of health and the health care system: Healthcare has become one of India's largest sectors, both in terms of revenue and employment. It comprises hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance, and medical equipment. The Indian healthcare sector is growing at a brisk pace due to its strengthening coverage and services and increasing expenditure by public and private players. It has undergone significant transformations over the years, but still faces several challenges.

India's healthcare delivery system is categorized into two major components - public and private, offering medical services and infrastructure to the 1.4 billion people living in India. The government, i.e., the public healthcare system, comprises limited secondary and tertiary care institutions in key cities and focuses on providing basic healthcare facilities in the form of Primary Healthcare Centers (PHCs) in rural areas. The private sector provides the majority of secondary, tertiary, and quaternary care institutions with a major concentration in metros, tier-I, and tier-II cities. India's competitive advantage lies in its large pool of well-trained medical professionals.

India is also cost-competitive compared to its peers in Asia and Western countries. The cost of surgery in India

Article Information: *Corresponding Author: shaima.ali.miraj@gmail.com
Received 01/02/2025 Accepted after revision 25/03/2025
Publication Date: 30th April 2025 PG No- 16-22

Available at: https://mntrc.in/
DOI: http://dx.doi.org/10.21786/mntrc/2.1.2

is about one-tenth of that in the US or Western Europe. The low cost of medical services has resulted in a rise in the country's medical tourism, attracting patients from across the world. Moreover, India has emerged as a hub for R&D activities for international players due to its relatively low cost of clinical research.

Primary healthcare services are the individual's first point of contact and are provided through primary health centers, community health centers, and sub-centers. Secondary care focuses on acute and specialist services provided by district hospitals. Tertiary care refers to advanced medical services, including specialty and super-specialty services provided by medical colleges. The private sector consists of individual practitioners, nursing homes, clinics, and corporate hospitals [1,2].

Health has been assumed as a gigantically growing industry, and the potential is tremendous as India's spending on health is dismal, far below the 2017 National Health Policy average of 2.5 %. As a result, there has been a sudden rise in private hospitals and their successful blooming. Hospitals in major cities in India in many cases are run by business houses, using corporate business strategies and high-tech specializations, which create demand and attract high-profile patients as the facilities in some of these hospitals are world-class [3,4].

The Indian healthcare market, which was valued at US$ 110 billion in 2016, is now projected to reach US$ 638 billion by 2025. The healthcare sector, as of 2024, is one of India's largest employers, employing a total of 7.5 million people [5]. India has supported the ideal of health for all since it became an independent nation more than 75 years ago. The Bhore Committee report in 1946 recommended a national health system for the delivery of comprehensive preventive and curative allopathic services through a rural-focused multilevel public system, financed by the government, through which all citizens would receive care irrespective of their ability to pay [6,7].

The health care system in India received a setback in its development over the last many years because of severe unavoidable circumstances, for example, the memories of the Bengal famine of 1943, which killed 2-3 million people are still haunting us, the fact that health services were concentrated in urban areas, and health indicators were universally poor with a life expectancy at birth of 37 years during the country's bloody partition and independence in 1947, [7].

However, much progress has been made since then. Life expectancy is greater than 67 years, and the India of 2025 is a thriving democracy with a diversified production base, a large scientific community, and an impressive information technology sector. During the same period, however, India's record in expanding social opportunities has been uneven. The health and nutritional status of children and women remains poor, and India is routinely ranked among countries performing weakly on overall health performance (8). But there is good reason for hope. The country has withstood the recent global economic crisis and quickly returned to economic growth.

Concerning India's public health care system it is still pathetic. India has one of the most fragmented and commercialized healthcare systems in the world, where world-class care is greatly outweighed by unregulated, poor-quality health services for the general people. Because public spending on health has remained low, private out-of-pocket (OOP) expenditures on health are still among the highest in the world [9].

Recent data show that there has been a considerable increase in government expenditure, decreasing the OOP from a high of 62.6% in 2014 to a low of 39,4%. Between 2014-15 and 2021-22, the government's share of health expenditure grew from 1.13% to 1.84% of GDP, allowing for enhanced public healthcare facilities and services. This increase makes healthcare more accessible and affordable, reducing individuals' need to pay out of pocket [10].

Health care, far from helping people rise out of poverty, has become an important cause of household impoverishment and debt. The average national health indicators, though showing improvements in recent decades, hide vast regional and social disparities. Although some privileged individuals enjoy excellent health outcomes, while others experience the worst imaginable conditions [11]. Health disparities are being exacerbated by unequal economic growth, growing commercialization of health care, and poor regulation of costs and quality of care [9]. As citizens of India, we have witnessed these injustices not professionally, but through our experiences of sickness in our families.

Healthcare paints a dire picture where India is short by a staggering 2.4 million hospital beds, leaving millions without access to proper medical treatment. India, which is meant to be utilizing its demographic advantage, seems to be overlooking its most valuable asset, people [12].

Healthcare in the new budget allocation has increased from Rs 33,150 crores in 2015 -16 to Rs 95,957 crores, a more than 100 percent jump. despite the increase, Indian hospital bed availability remains critically low, with just 1.4 beds per 1000 people, far below the WHO recommendation of 3.5 beds per 1,000. Between 2014-15 and 2021-22, the government's share of health expenditure grew from 1.13% to 1.84% of the GDP, allowing for enhanced public healthcare facilities and services. This increase makes healthcare more accessible and affordable, reducing individuals' need to pay out of pocket [10]. Worse, for 1000 people, government hospitals have an even more alarming ratio of 0.79 beds per 1000, meaning the country is short by 2.4 million beds. The doctor-to-patient ratio stands at 1:1,511, again failing to meet the WHO-recommended 1:1000

Definition of health: As per the definition, health does not simply refer to the absence of disease, but to a state of well-being, wholeness, harmony, equilibrium and

quality or fullness of life, [13]. The healthcare system in India is characterized by multiple systems of medicine, mixed ownership patterns, and different kinds of delivery structures. However, it is the primary duty of the constituent states and the government to look after the well-being of every individual. The constitution charges every state with raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties.

The health financing system in India is dependent on government budgetary allocations and private funding. The role of private financing has increased significantly in recent years. It is estimated that people spend about 4.9 % of the GDP on healthcare needs and this is about three-fourths of the healthcare expenditure [14]. Most of the health care funding is out-of-pocket private expenditure which has grown at the rate of 12.5% and for each 1% increase in the per capita income it has increased by 1.44%. Thus in the absence of effective regulation of private health services, healthcare costs are inevitably high, and it is the poor people of lower income groups who suffer most, [15].

Healthcare System and Its Importance: The health system in India is under severe strain, and one of the management experts even writes that naming what exists in a health care system may not be accurate because it largely concerns the management and treatment of sickness and disease, not vibrant good health. Longevity has not been accompanied by good health. This has been criticized as adding years to life without adding life to years, [16].

The private healthcare system in India has grown vastly over the years and is well-established and flourishing. At the time of Independence, the private health sector accounted for only 5 to 10 percent of total patient care. In 2004, the share of the private sector in total hospitalized treatment was estimated at 58.3 percent in rural areas and 61.8 percent in urban areas. In Haryana, a majority of chest symptomatic (75 percent of the male patients and 75 percent of the urban patients) obtained care from the private sector, for outpatient care, 77 percent went to private sources in Kerala [17].

Slum dwellers in Indore sought outpatient care predominantly from the private sector [18]. In Dehradun, only 25 per cent of the elderly went to a government source for medical care [19].A study of six states reported that the proportion of people who went to private health facilities was high, varying between 63 and 83 per cent in three North Indian states, [20] . It is a pleasant surprise that, India has developed an extensive network of healthcare infrastructure since independence. The system envisages availability and accessibility of publicly funded healthcare to all, regardless of their ability to pay. However over a period of time due to expansion in size and a shortfall in budgetary support, burdened due to a huge population, the public health care system has lagged behind in terms of its ability to meet the challenge of fulfilling the health needs of a large segment of the rapidly growing population.

Role of Private Health Care System: To meet this challenge partially, the private health care sector has grown in size and scope. Consequently, the present health care system is characterized by having providers belonging to ownership of both public and private facilities and providers practicing in different systems of medicine. Both public and private facilities provide health services, but the bulk of the curative services are skewed towards the urban areas and dominated by the private sector in India.

Private health expenditure is in nominal terms is growing very fast and with the proliferation of advanced medical technologies, new treatment protocols, equipment, the health care costs are increasing. To meet these increasing costs of treatment health insurance is highly justified. Though the need is quite high, the growth of health insurance is very slow, as compared to developed countries and even the developing countries. It is an established fact that, health care spending in India is very high, much more than the developing nations. Though India is one of the fastest growing economies with an expected growth rate in 2025-26 to between 6.5 to 6.8, despite its high growth rate, its rank is 134 on the Human Development Index [21].

Total public expenditure on health in the country as a percentage of GDP now stands at less than 2 %, however, health-related expenditures like clean drinking water, sanitation, and nutrition have a major bearing on health and if expenditure on these is counted, the total public health spending reaches around 1.5 percent of GDP. Even so, it is strongly felt that public expenditure on health needs to be increased. On the other hand, the country is gripped with communicable and non-communicable diseases resulting from changing lifestyles, while on the other hand, healthcare costs are escalating making access to quality healthcare difficult.

History of Healthcare in India: Historically, the art of health care in India can be traced back nearly 3500 years. From the early days of Indian history, the Ayurvedic tradition of medicine has been practiced. During the rule of Emperor Ashoka Maurya3rd Century BC, schools of learning in the healing arts were established. Many valuable herbs and medicinal combinations were discovered and created.

Even today many of these continue to be used. During his rein, there is evidence that Emperor Ashoka was the first leader in world history to attempt to give health care to all of his citizens, thus it was the India of antiquity which was the first state to give its citizens national health care. Modern medicine and health care were introduced in India during the colonial period. This was also a period that saw the gradual destruction of pre-capitalist modes of production in India. Under pre-capitalist mode of production institutionalised forms of health care delivery, as we understand them today, did not exist.

Practitioners who were not formally trained professionals but inheritors of a caste based occupational system provided health care within one's village. This does not mean that there was no attempt at evolving a

formal system. Charaka and Sushruta Samhitas, among other texts, is evidence of putting together a system of medicine. Universities like Takshashila, Nalanda and Kashi did provide formal training in Indian medicine. They were the Indian equivalent of Western alm-houses, monasteries and infirmaries which were provided with stocks of medicine and lodged the destitute, the crippled and the diseased who received every kind of help free and freely, [22,23,24,25,26,6,7].

Similarly, during the Mughal Sultanate, the rulers established such hospitals in large numbers in the cities of their kingdom, where all the facilities were provided to the patients free of charge. During the colonial period, hospitals and dispensaries were mostly state-owned or state-financed. The earliest literature available on medical practitioners is from the 1881 census, which records 108,751 male medical practitioners (female occupation data was not recorded!). Of these 12,620 were classified as physicians and surgeons (qualified doctors of modern medicine) and 60,678 as unqualified practitioners (which included Indian System Practitioners) [27].

The old concept of Piruvu (a collection) the forerunner of health insurance in India: Historically the concept of health insurance in India is not new, as social security for medical emergencies is not new to the Indian ethos. It is a common practice for villagers to take a 'piruvu' (a collection) to support a household with a sick patient. However, health insurance, as we know it today, was introduced only in 1912 when the first Insurance Act was passed followed by The Insurance Act of 1938, [28].

In Alma Ata (1978) (in old USSR), a global initiative towards health-related research and action was held in 1978. All the participants, including India, affirmed to ensure health for all by the year 2000, with primary health care as their top priority. But India perhaps understood it differently what Plato said "Attention to health is the greatest hindrance in life". The Indian health insurance sector is still an immature baby, the victim of the 'no common sense' of the government.

The primary health care system in India is managed mainly by the shallow structure of government health-care facilities and other public- health care systems in a traditional model of health funding and provision. But, it is unable to justify the demand for health security for 300 million Indian health insurable population mainly due to service costs being out of the reach of many people, absence of good and effective number of physicians, low rate of education programs, less number of hospitals, poor medical equipment and over all, the poor budget of government towards the health program.

Therefore, the health insurance policies in India in the beginning years of independence were nothing less than a burden of inefficiency of a government-run system. Moreover, the uncontrolled and non-innovative attitude of the Indian bureaucracy always argued against the private players in the health insurance sector in India, which is still one of the problems in making insurance affordable for the middle-income group, which constitutes the majority of the most needy.

Health care was in a dismal condition before 1947, when the IA Act ushered in health insurance in India, [29], but we have made considerable progress in improving the health status of our country and health insurance is a significant emerging financial tool in meeting the health care needs of the people of India. Thus, a favorable demand, significant market potential, coupled with supportive infrastructure and the regulatory environment, started a boom in the Indian Health Insurance scene.

The current version of the Insurance Act was introduced in 1938. Since then there was little change till 1956 and 1972 when the Life Insurance industry and General Insurance Industry were nationalized and 107 private insurance companies were brought under the umbrella of the General Insurance Corporation (GIC). Private and foreign entrepreneurs were allowed to enter the market with the enactment of the Insurance Regulatory and Development Act (IRDA) in 1999, [30].

Development and growth of health insurance in Modern India: Seventy years before Indian population was grim. Memories of the Bengal famine of 1943, which killed 2—3 million people, have haunted us our healthservices were concentrated in urban areas, and health indicators were universally poor with a life expectancy at birth of 37 years [31]. Considerable progress has been made since then, particularly in the highly impressive information technology sector.

Since independence, the health care system in India has been expanded and modernized considerably, with dramatic improvements in life expectancy and the availability of modern health care facilities and better training of medical personnel. At the same time, however, much remains to be done. Most of the discussions on health care financing in India have centred on the financial constraints of the public sector and the efficiency of resource allocation by the government. 'Health for all' has been seen as the central assumption of the health sector debate, thus making the government the central player. While we admit that the 'health system appears somewhat unrealistic – particularly in view of the fact that health spending in India is mostly private.

But still, poverty is the real context of India, as three-fourths of the population live below or at subsistence levels. The health and nutritional status of children and women remains poor, and India is routinely ranked among countries performing weakly on overall health performance. Recently, it has been reported that about 234 million people of India's population are poor across 124 countries as measured by the Multidimensional Poverty Index [32]. The five countries with the largest number of people living in poverty are India, 234 million; Pakistan, 93 million; Ethiopia 86 million; Nigeria, 74 million; and the Democratic Republic of the Congo, 66 million.

However, health-related expenditure like clean drinking water, sanitation, and nutrition has a major bearing on health and if expenditure on these is counted the total public health spending reaches around 2.5 percent of GDP, [33] .This means 70-90 per cent of their incomes go towards food and related consumption. In such a context social security support for health, education, housing etc. becomes critical. Ironically, India has one of the largest private health sectors in the world with over 80 per cent of ambulatory care being supported through out-of-pocket expenses, [34,35].

India has one of the most fragmented and commercialised health-care systems in the world, where world-class care is greatly outweighed by unregulated poor-quality health services. Because public spending on health has remained low, private out-of-pocket expenditures on health are among the highest in the world. Health care, far from helping people rise out of poverty, has become an important cause of household impoverishment and debt, [9].

Growth of Health expenditure in India in terms of GDP: Data showing expenditure on health in % of GDP from 1950 to 2025 based on a Report by Times Insight Group in association with J.P. Morgan. The average national health indicators, though showing improvements in recent decades, hide vast regional and social disparities. Although some privileged individuals enjoy excellent health outcomes, others experience the worst imaginable conditions, [36,11].

Health disparities are being exacerbated by unequal economic growth, growing commercialisation of health care, and poor regulation of costs and quality of care In India, despite improvements in access to health care, inequalities are related to socioeconomic status, geography, and gender, and are compounded by high out-of-pocket expenditures, with more than three-quarters of the increasing financial burden of health care being met by households. Health-care expenditures exacerbate poverty, with about 39 million additional people falling into poverty every year as a result of such expenditures, [36, 9].

Penetration of health insurance as an industry in India: The penetration of health insurance in India has been low. It is estimated that only about 3% to 5% of Indians are covered under any form of health insurance. In terms of the market share, the size of the commercial insurance is barely 1% of the total health spending in the country. The Indian health insurance scenario is a mix of mandatory social health insurance (SHI), voluntary private health insurance and community-based health insurance (CBHI). Health insurance is thus really a minor player in the health ecosystem. Thus, with escalating health care costs coupled with demand for health care services and lack of easy access for people from the low income group to quality health care, health insurance is emerging as an alternative mechanism for financing health care [8,37].

Health insurance is complex, and there are serious market-failure problems. In any market-driven system, what should be produced, how it should be produced, and for whom it should ne produced are determined by market forces. Competitive environments take care that resources are used efficiently (at the lowest cost) and effectively (with optimum outcomes). Insurance protects against risks or uncertain events and is based on the principle that what is highly in unpredictable to an individual is predictable to a group of individuals. Health insurance protects against the cost of illness, mobilizes funds for health services, increases the efficiency of mobilization of funds and provision of health services, and achieves certain equity objectives.

Problems of health care management and health financing in India: According to various health reports in India, public health services are very inadequate. The public curative and hospital services are mostly in the cities where only 25 percent of more than one billion population reside. Rural areas have mostly preventive and promotive services like family planning and immunization. The private sector has a virtual monopoly over ambulatory curative services in both rural and urban areas and over half of hospital care, [13, 8,37].

According to the Planning Commission's High Level Group headed by Dr. K.S Reddy who has recently said that India will take at least 17 more years before it can reach the WHO's recommended norm of 1 allopathic doctor per 1000 people i.e by 2028 this important landmark in health care will be achieved, (38).Further, a very large proportion of private providers are not qualified to provide modern health care because they are either trained in other systems of medicine traditional Indian systems like Ayurveda, Unani, Siddha, and Homoeopathy, (AYUSH) or worse, do not have any.

PERIOD	% GDP
1950 -1951	-0.22
1960- 1961	-0.63
1970-1971	-0.74
1980-1981	-0.91
1990-1991	-0.96
2000-2001	-0.90
2009-2010	-1.09
2012 -2013	-1.2 %
2024-2025	1.94%

The nation of India, with a population of 1.5 billion, experiences a vast inequity that exists in the healthcare industry, with barely 3 percent of the population covered by some form of health insurance, either social or private. The guiding principle of the Bhore Committee in 1946, that 'no individual should fail to secure adequate medical care because of inability to pay for it' looks unreachable still, after decades of Indian independence, [39].

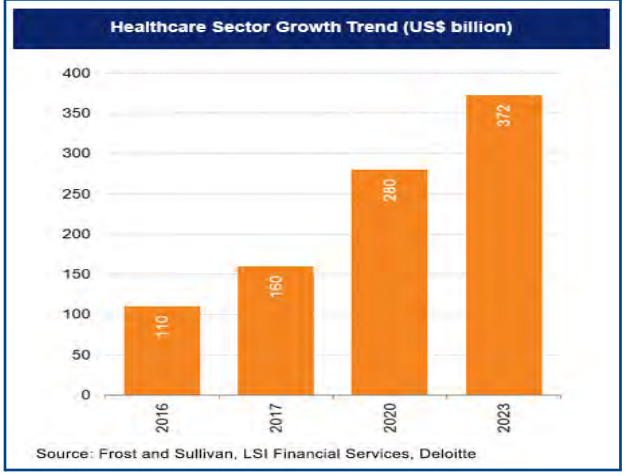
Albert Einstein surely sleeps happily in the grave after seeing the Indian government's practice of health management credo based on what he said fifty years back,

"Common sense is the collection of prejudices acquired by the age of eighteen". Unnecessary prejudice never allows our government to open the doors of health insurance to others. Indian(the government has never been sensible to understand that the opening of insurance sector in India will move individual health spending to collective spending backed by huge capital inflows into the health industry.

Future Perspectives: Healthcare has become one of India's largest sectors, both in terms of revenue and employment. Healthcare comprises hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance, and medical equipment. The Indian healthcare sector is growing at a brisk pace due to its strengthening coverage, services, and increasing expenditure by public as well as private players.

India's competitive advantage lies in its large pool of well-trained medical professionals. India is also cost-competitive compared to its peers in Asia and Western countries. The cost of surgery in India is about one-tenth of that in the US or Western Europe. The low cost of medical services has resulted in a rise in the country's medical tourism, attracting patients from across the world. Moreover, India has emerged as a hub for R&D activities for international players due to its relatively low cost of clinical research.

Figure 1: F



The telemedicine market is expected to reach US$ 5.4 billion by 2025, driven by increased demand for remote healthcare solutions and advancements in technology. In 2024, the Indian government established 60 new medical colleges, increasing MBBS seats by 6.3% to 1,15,812. This expansion has raised the total number of medical colleges to 766, up from 387 in 2013-14. Postgraduate seats also grew by 5.92% to 73,111.

In FY24 (Till February 2024), premiums underwritten by health insurance companies grew to Rs. 2,63,082 crore (US$ 31.84 billion). The health segment has a 33.33% share in the total gross written premiums earned in the country. The health-tech sector is set for significant expansion, with hiring projected to rise markedly. India's healthcare sector is extremely diversified and is full of opportunities in every segment, which includes providers, payers, and medical technology. With the increase in competition, businesses are looking to explore the latest dynamics and trends that will have a positive impact on their business. The hospital industry in India is forecast to increase to Rs. 8.6 lakh crore (US$ 132.84 billion) by FY22 from Rs. 4 lakh crore (US$ 61.79 billion) in FY17 at a CAGR of 16–17%. (40).

India is a land full of opportunities for players in the medical devices industry. The country has also become one of the leading destinations for high-end diagnostic services with tremendous capital investment for advanced diagnostic facilities, thus catering to a greater proportion of the population. Besides, Indian medical service consumers have become more conscious towards their healthcare upkeep. Rising income levels, an ageing population, growing health awareness and a changing attitude towards preventive healthcare are expected to boost healthcare services demand in the future. Greater penetration of health insurance aided the rise in healthcare spending, a trend likely to intensify in the coming decade.

CONCLUSION

According to various health reports in India, public health services are still inadequate. The public curative and hospital services are mostly in the cities where only 25 per cent of the more than one billion population reside. Rural areas have mostly preventive and promotive services like family planning and immunization. The private sector now has a virtual monopoly over ambulatory curative services in both rural and urban areas and over half of hospital care, better healthcare needs to be managed in a better way. As India is a land full of opportunities, players in the medical devices industry will have a bright future provided there is transparency of implementation of health benefit schemes both of the government and private players, particularly the corporate houses.

The country has also become one of the leading destinations for high-end diagnostic services with tremendous capital investment for advanced diagnostic facilities, thus catering to a greater proportion of the population. Besides, Indian medical service consumers have become more conscious of their healthcare upkeep. Rising income levels, an ageing population, growing health awareness and a changing attitude towards preventive healthcare are expected to boost healthcare service demands in the future. Greater penetration of affordable health insurance can aid the rise in healthcare spending, a trend likely to intensify in the coming decade.

Conflict of Interest: The author declares no conflict of interest.

Data Avail ability Statement: Data will be available from the corresponding author on a reasonable request.

Funding: Nil

REFERENCES

1. Kumar A The Transformation of The Indian Healthcare System Cureus. 2023 May 16;15(5) :e39079. doi: 10.7759/cureus.3907
2. Health System. Information May; 2023 ;https://www.statista.com/markets/412/topic/454/health-system/#overview 2023 3 [Google Scholar]
3. Wilson H Justice and the Social Determinants of Health: An Overview. Dr James Wilson - 2009 - Public Health Ethics 2 (3):210-213.
4. Health Information Systems Technological and Management Perspectives Third Edition 2020 Springer
5. India Brand Equity Foundation IBEF Jan 2025
6. Borkar, G. (1961): Health In Independent India,Revised Edition, New Delhi: Ministry of Health.
7. Rao KN The nation's health: Publications Division New Delhi 1966
8. WHO World Health Statistics (2012) WHO's annual compilation of health-related data for its 194 Countries
9. Kumar AKS, LC Chen, M. Chaudhary, S. Ganju, V. Mahajan, A. Sinha,
10. Sen (2011) Financing health care for all : Challenges and Opportunities, The Lancet, Volume 377, Issue 9766, Pp 668-679.
11. National Health Accounts (NHA) Estimates for India 2021-2022
12. Paul VK, Sachdev HS, Mavalankar D Reproductive health, and child health and nutrition in India: meeting the challenge. The Lancet 201110.1016/S0140-6736(10)61492-4. published online Jan 2012.
13. Mohan D Frontline The Hindu Feb 06 2025
14. WHO World Health Organisation Report: Reducing risks, promoting healthy life, WHO, Geneva 2002
15. Sengupta A. and S. Nundy The private health sector in India , British Medical Journal , 2005 331:1157-1158
16. Bhat R, Mavalankar D, Singh P, & Singh N Major causes and challenges in Health Insurance. Working paper 2007 No 2010 – 02-01-IIM, Ahmedabad
17. Vombatkere S.G. Health Association, Dec 2007,5-6.
18. Levesque, J. F., S. Haddad, D. Narayana, and P. Fournier. Outpatient are Utilization in Urban Kerala, India. Health Policy and Planning 2006 21 (4): 289–301.
19. Islam M., M. Montgomery, and S. Taneja Urban Health Care- seeking Behaviour: 2006 A Cases Study of Slums in India and the Phillipines. Bethesda, Maryland. The Partners for Health Reform Plus Project, Abt Associates Inc.
20. Kaushik, U. Elderly Perceived Health Needs: Assessment Survey in the States of Himachal Pradesh & Uttarakhand. March. 2009 Help Age India, New Delhi.
21. Rao, P.H. The Private Health Sector in India: A Framework for Improving the Quality of Care. ASCI Journal of Management 2012 41 (2): 14– 39.
22. HDI Human Development Index (HDI) UNDP 2025
23. Heber D.The useful plants of India in Medicine. (1873)
24. Friedrich KRA. Studies in the medicine of Ancient India. 1907
25. Siegerist Henry A History of Medicine, Vol I 1951 Oxford University Press, London.
26. Bhatia M, Susan B Primary Health Care, Now and Forever? A Case Study of a Paradigm Change Intl J of Social Determinants and Health Services 2009 Volume 43, Issue 3
27. Gokhale BV Swasth Hind 4 165 1961
28. Census Census of India 1881, vol. 3, Govt of India Delhi.
29. Bhat R, S Maheshwari, S Sahu (2005) Third Party administrators and health insurance in India : Perception of providers and policy holders, IIM, Ahmedabad.
30. IA : The Insurance Act As amended by Insurance (amendment) 1938 Act, [4 of 1938]
31. IRDA Insurance Regulatory and Development Authority Act, 1999 amendment of the Insurance Act, 1938, the Life Insurance Corporation Act, 1956 and the General Insurance Business (Nationalisation) Act, 1972, Republic of India
32. Famine Enquiry Commission Report 1945
33. MPI The Global Multidimensional Poverty Index (2024) UNDP
34. Kansara K & G Pathania A study of factor affecting the demand for health insurance in Punjab, Journal of Management & Science, 2012 Vol. 2 No 4 Page No 1- 9
35. World Development Report 2020 Trading for Development in the Age of Global Value Chain
36. UNDP Human Development Report 2022: The Next Frontier: Human Development and the Anthropocene
37. Balarajan Y, Selvaraj S, Subramanian SV .Health care and equity in India. The Lancet 2012-10. 1016/S0140-6736(10)61894-6.published online Jan 12.
38. WHO The World Health Report 2010: Health Systems Financing: the Path to Universal Coverage
39. HLG, Planning Commission Report, (2010-2013).
40. Banerjee, D Indian Journal of Medicine Education. Evolution Of The Existing Health Services Systems Of India March 1976
41. Healthcare sector growth trend (Source: Frost and Sullivan, LSI 2024 Financial Services, Deloitte, Aranca Research).

SSN Journal of Management & Technology Research Communications
Vol 2 No (1) Jan-Feb-Mar-Apr 2025
Society for Science and Nature

E-ISSN: 3049-0014
CrossRef DOI: https://dx.doi.org/10.21786/mntrc

Factors Influencing Job Satisfaction Among IT Industry Employees in Chengdu, China: Enhancing Herzberg's Two-Factor Theory with Commute Distance

Zhihao Qin[1] & Nutteera Phakdeephirot[2*]
Rattanakosin International College of Creative Entrepreneurship, Rajamangala University of Technology Rattanakosin, Nakhon Pathom 73170, Thailand

ABSTRACT

As China's digital economy rapidly expands, understanding job satisfaction among IT professionals is increasingly critical. This study examines the influence of hygiene factors, motivator factors, and commute distance on job satisfaction in Chengdu's IT sector, extending Herzberg's TwoFactor Theory by incorporating commuting as an external variable. A quantitative approach was employed using a structured questionnaire. Data were collected from 520 IT employees via convenience sampling, and analyzed using Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). The results indicate that both hygiene and motivator factors significantly enhance job satisfaction, while commute distance has a negative impact. These findings highlight the need for organizations and policymakers to address both internal workplace dynamics and external environmental stressors. The study contributes to theoretical development by integrating commuterelated variables into job satisfaction models and offers practical insights for HR strategies, urban planning, and sustainable workforce management in China's hightech industries.

KEY WORDS: DIGITAL ECONOMY; TWOFACTOR THEORY; IT EMPLOYEES; JOB SATISFACTION; SUSTAINABLE WORKFORCE MANAGEMENT.

INTRODUCTION

The Information Technology (IT) industry has emerged as a critical engine of global economic transformation, driving innovation across sectors through the adoption of advanced technologies such as artificial intelligence, cloud computing, big data analytics, and digital infrastructure. As the digital economy continues to reshape business operations and societal interactions, countries around the world, particularly China, have capitalized on this momentum to accelerate industrial upgrading and economic modernization [1, 2]. China has positioned itself as a global leader in digital innovation, leveraging its massive domestic market, technical talent, and strategic investments to become one of the world's largest IT markets [1, 3].

Chengdu, a key city in western China, has rapidly developed into a regional IT hub. The city's IT sector benefits from robust infrastructure, a deep talent pool supported by over 130 higher education institutions, and strong governmental support [4]. In 2024 alone, the sector employed more than 930,000 professionals and contributed over 671 billion RMB to Chengdu's GDP, reflecting its central role in regional economic development [5, 6]. However, the fastpaced expansion of the IT industry has brought with it new workplace challenges—particularly in terms of employee wellbeing and job satisfaction [7].

The modern IT work environment is often characterized by long working hours, high cognitive demands, frequent technological changes, and intense performance pressure. These factors have been linked to rising levels of stress, burnout, and job dissatisfaction among IT professionals. Moreover, the increasing complexity of urban living, particularly long commuting times, adds

Article Information: *Corresponding Author: nutteera.pha@rmutr.ac.th
Received 02/02/2025 Accepted after revision 18/03/2025
Publication Date: 30th April 2025 Pg No- 23- 34

Available at: https://mntrc.in/
DOI: http://dx.doi.org/10.21786/mntrc/2.1.3

another layer of stress for employees. In Chengdu, IT professionals spend an average of 70 minutes commuting daily—time that erodes worklife balance, reduces rest, and contributes to mental fatigue [8, 9].

Against this backdrop, employee wellbeing has emerged as a critical concern for both organizational leaders and policymakers. Studies have shown that higher levels of job satisfaction are associated with improved productivity, increased organizational commitment, and lower turnover rates [10, 11]. Addressing factors that influence job satisfaction—both internal (e.g., compensation, leadership, job design) and external (e.g., commute distance)—is essential to maintaining a healthy and sustainable IT workforce.

Herzberg's Two Factor Theory offers a valuable theoretical lens through which to examine job satisfaction. According to the theory, job satisfaction is driven by two sets of factors: motivators (e.g., achievement, recognition, and career advancement) and hygiene factors (e.g., salary, company policy, supervision) [12]. Motivators contribute positively to job satisfaction when present, while the absence of hygiene factors may lead to dissatisfaction but not necessarily to satisfaction when improved [13-15]. This dichotomy has been widely validated across various sectors, including manufacturing, healthcare, and IT.

However, Herzberg's model primarily focuses on workplacecentered factors and largely overlooks contextual or environmental variables, such as commuting. With urbanization on the rise and commute times lengthening, recent research has begun to emphasize the psychological and physical toll of commuting on employee wellbeing [16]. Commuting stress has been associated with increased fatigue, reduced productivity, and decreased job satisfaction, making it a salient yet underexplored determinant of workplace outcomes.

This study extends Herzberg's TwoFactor Theory by incorporating commute distance as an exogenous variable affecting job satisfaction. By analyzing data from 520 IT professionals in Chengdu, this research explores how traditional motivators and hygiene factors, as well as commuterelated stressors, jointly influence job satisfaction in one of China's fastestgrowing tech hubs. In doing so, the study addresses a critical gap in the literature and provides a more holistic framework for understanding job satisfaction in the modern digital workplace.

The significance of this research is twofold. Theoretically, it contributes to the evolving literature on workplace motivation by challenging the traditional boundary of Herzberg's model and integrating nonworkplacerelated factors into the analysis. Practically, it offers insights for human resource managers, policymakers, and urban planners seeking to improve job satisfaction and reduce turnover in the IT industry. As Chengdu continues to grow as a technology hub, understanding and addressing the full spectrum of factors affecting IT professionals' wellbeing is imperative for ensuring longterm industry sustainability.

Literature review:

Herzberg's TwoFactor Theory, also known as the motivationhygiene theory, provides one of the most enduring frameworks for understanding job satisfaction. The theory distinguishes between two categories of factors influencing employees' attitudes toward work: motivators and hygiene factors. Motivators refer to intrinsic elements such as achievement, recognition, responsibility, and opportunities for advancement, which enhance satisfaction when present [12, 17, 18]. Hygiene factors, such as salary, supervision, organizational policies, and working conditions, do not inherently improve satisfaction but can cause dissatisfaction if absent or inadequate [13]. This dual structure has been validated across sectors including healthcare, education, and technology, reinforcing its relevance in analyzing workplace wellbeing in complex organizational environments.

While Herzberg's theory has remained a foundational framework, modern workplace dynamics necessitate theoretical refinements. Contemporary research has expanded the application of the TwoFactor Theory to account for external contextual variables that were not originally considered. For instance, He, Fu [19] integrated the theory with performance pressure to examine how excessive workload could undermine motivation. Similarly, in digital and remote working environments, factors such as technology access, schedule flexibility, and employee autonomy now play a role in shaping satisfaction [20]. These adaptations underscore the evolving nature of work and highlight the need to include both internal organizational factors and external environmental variables in modern job satisfaction models—particularly in fast changing industries such as IT.

The IT industry presents unique challenges to employee satisfaction. Due to rapid innovation cycles, constant upskilling demands, and high project complexity, IT professionals often experience stress, burnout, and job instability. In this context, hygiene factors such as competitive salary, efficient supervision, and favorable working conditions are essential for mitigating dissatisfaction. Poor organizational support or rigid company policies can exacerbate turnover intentions, even among highly capable employees (Conroy & Morton, 2024) [21-23].

Conversely, motivator factors are crucial for longterm engagement in the IT workforce. Opportunities for advancement, recognition for innovation, intellectual challenge, and autonomy are vital for sustaining satisfaction [24]. Companies that offer mentorship programs, performancebased rewards, and meaningful work environments experience greater retention and commitment from their workforce [25]. Therefore, understanding how hygiene and motivator factors operate in tandem is essential for building an adaptive and competitive IT workforce, particularly in highgrowth technology cities like Chengdu.

Despite the robustness of Herzberg's framework, it largely omits variables outside the organizational setting,

particularly those associated with employee lifestyle and urban infrastructure. Commute distance—defined as the physical or temporal gap between an employee's home and workplace—has emerged as a significant determinant of job satisfaction, especially in urbanized regions [26, 27]. Research increasingly shows that longer commute times contribute to stress, fatigue, decreased productivity, and lower satisfaction [28, 29]. These effects are exacerbated when employees must navigate inefficient public transit or high traffic congestion, common in expanding metropolitan areas like Chengdu.

The inclusion of commute distance as a hygienelike external factor thus provides a more comprehensive model of job satisfaction. It acknowledges that daily stressors beyond the workplace can impact employees' perceptions of worklife balance, energy levels, and psychological wellbeing—thereby influencing job satisfaction even when internal organizational factors are wellmanaged.

Building on the extended conceptual framework, this study proposes an integrative model that positions commute distance alongside Herzberg's original motivator and hygiene factors. The goal is to analyze how these variables collectively shape job satisfaction among IT professionals in Chengdu.

Based on this theoretical development, the following hypotheses are proposed:

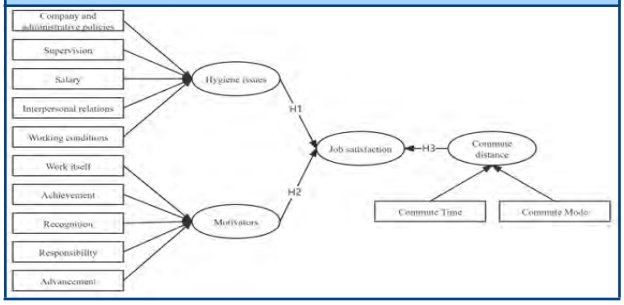
H1: Hygiene factors (e.g., salary, company policies, supervision) have a significant positive impact on job satisfaction.

H2: Motivator factors (e.g., achievement, recognition, advancement) significantly enhance job satisfaction.

H3: Commute distance has a significant negative impact on job satisfaction, acting as an external contextual stressor.

This extended framework not only strengthens the explanatory power of Herzberg's model but also reflects the complex realities of urban labor markets, particularly within China's rapidly expanding digital economy. Figure 1 shows the empirical model.

Figure 1: Theoretical Framework



METHODOLOGY

Sampling Strategy and Data Collection: This study adopts a quantitative research design to investigate the factors influencing job satisfaction among IT professionals in Chengdu, China. The target population comprises employees working in various ITrelated positions, including software development, cloud computing, data analysis, AI engineering, and IT support services. A convenience sampling method was employed to ensure accessibility and coverage of diverse employee profiles across the city's major IT zones. The survey was distributed through both online platforms (e.g., WeChat, Xiaohongshu) and physical channels (e.g., posters with QR codes in tech parks), allowing for participation from individuals working in multinational corporations, local enterprises, and startups.

A total of 520 valid responses were collected, aligning with the recommended rule of thumb for sample size estimation—10 times the number of items in the measurement instrument ([30]. This sample size is deemed statistically sufficient for conducting confirmatory factor analysis (CFA) and structural equation modeling (SEM). All participants had at least six months of experience in their current IT roles, ensuring familiarity with company policies, job responsibilities, and commuting experiences.

Measurement Instruments: The questionnaire design was grounded in established literature and adapted to the local context of Chengdu's IT industry. All constructs were measured using 5point Likert scales (1 = strongly disagree to 5 = strongly agree). The scale items were derived from validated instruments in previous studies and refined through a pilot test.

Hygiene Factors (25 items): Adapted from Adamopoulos and Syrou [31] and Ghimire, Dahal [32], the hygiene construct includes five dimensions—company policy, supervision, salary, interpersonal relationships, and working conditions. Items reflect employees' perceptions of policy fairness, managerial competence, compensation adequacy, team collaboration, and workplace infrastructure.

Motivator Factors (18 items): Based on Wang, Gan [33] and Herzberg's original theoretical components, this construct includes work meaning, achievement, recognition, responsibility, and advancement. Items assess employees' sense of purpose, career development opportunities, and professional recognition within Chengdu's tech sector.

Commute Distance (4 items): Derived from Emre and and De Spiegeleare [34], this external factor includes commute time and mode of transportation. The items assess how commuting affects worklife balance, productivity, and stress.

Job Satisfaction (3 items): Adapted from Wong [35], this construct measures overall satisfaction, career alignment, and engagement within the IT profession. Items reflect employee contentment with job roles, compensation, and future growth opportunities.

Each item was refined through a pilot study (n = 52) to ensure clarity, relevance, and internal consistency. Cronbach's alpha values exceeded 0.85 for all variables, indicating high reliability

Data Analysis Procedures: To analyze the collected data, the study employed a multistep statistical approach. First, descriptive statistics were used to summarize respondent demographics and variable distributions. Second, reliability analysis using Cronbach's alpha was conducted to test internal consistency. Third, Confirmatory Factor Analysis (CFA) was applied to evaluate the construct validity of the measurement model, ensuring acceptable model fit indicators (e.g., CFI, RMSEA, TLI).

Following validation, Structural Equation Modeling (SEM) was used to test the hypothesized relationships between hygiene factors, motivators, commute distance, and job satisfaction. SEM is particularly suitable for this study due to its ability to handle latent variables and simultaneously estimate multiple dependency relationships. Additionally, KaiserMeyerOlkin (KMO) and Bartlett's test of sphericity were conducted to verify the data's suitability for factor analysis. All statistical analyses were performed using SPSS and AMOS software, ensuring robust and replicable results.

Table 1. Sample Information

Information and options		Frequency	Percent
Gender	Male	363	69.8
	Female	157	30.2
Age	1828	192	36.9
	2939	196	37.7
	40 and above	132	25.4
Education Level	Bachelor's	188	36.2
	Master's	204	39.2
	Ph.D.	128	24.6
Annual Income	Below 100,000	212	40.8
	100,000 300,000	226	43.5
	Above 300,000	82	15.7

RESULTS

Descriptive analysis: Table 1 shows several key characteristics of IT professionals in Chengdu. Gender distribution indicates a significant male majority, with 69.8% male and 30.2% female, reflecting the traditionally maledominated nature of the IT industry. In terms of age, the largest proportion of participants falls within the 2939 age group (37.7%), followed closely by the 1828 age group (36.9%), suggesting that Chengdu's IT workforce is primarily composed of young and midcareer professionals. The 40 and above group (25.4%) is relatively smaller, indicating fewer senior professionals, possibly due to the dynamic and rapidly evolving nature of the industry, which may favor younger, more adaptable employees.

Regarding educational qualifications, 39.2% of participants hold a master's degree, making it the most common qualification, followed by 36.2% with a bachelor's degree and 24.6% with a Ph.D. This suggests that a significant portion of IT professionals in Chengdu have advanced education, reflecting the industry's demand for specialized skills and expertise. The annual income distribution further aligns with this, with the majority of participants earning ¥100,000 ¥300,000 (43.5%), followed by 40.8% earning below ¥100,000, and only 15.7% earning above ¥300,000. This indicates that while a substantial portion of the workforce earns moderate salaries, highincome roles are relatively limited, possibly restricted to senior positions or niche technical expertise. These findings provide insights into the demographic, educational, and economic structure of Chengdu's IT workforce, forming a solid foundation for further analysis of job satisfaction factors.

Table 2 provides the descriptive statistics for the study variables, presenting key measures such as mean, standard deviation (S.D.), skewness, and kurtosis for each of the items under the "Hygiene issues" and "Motivators" categories. The mean scores for most items fall between 3.50 and 3.62, suggesting that the respondents generally perceive the statements as moderately favorable. This indicates a relatively consistent response pattern across the variables, with participants' perceptions aligned towards a neutraltopositive outlook regarding both hygiene and motivational factors in their work environment. The standard deviations range from 0.974 to 1.076, reflecting moderate variability in responses.

The relatively high standard deviations suggest some diversity in individual perceptions, which is not unexpected in the context of subjective variables such as job satisfaction and motivators. The skewness values for all items are negative, indicating that the distribution of responses is slightly skewed to the left, with more respondents rating the items towards the higher end of the scale. The skewness values, ranging from 0.597 to 0.877, suggest that the data is moderately skewed, but not excessively so, indicating a generally balanced distribution of responses. Similarly, the kurtosis values are close to zero, ranging from 0.615 to 0.039, suggesting that the distribution of responses is approximately normal, without significant outliers. These results indicate that the items under both "Hygiene issues" and "Motivators" exhibit reasonable normality in their distribution, supporting the suitability of the data for further statistical analysis [36].

Reliability test: Table 3 presents the reliability statistics for the study variables, using Cronbach's α to assess the internal consistency of the measurement scales. Cronbach's α is a widely used statistic that quantifies the degree to which multiple items within a scale are interrelated and consistently measure the same underlying construct. A value above 0.7 is typically considered acceptable, indicating that the scale demonstrates sufficient reliability for further analysis. In the case of this study, the Cronbach's α values for all variables exceed the threshold of 0.7, confirming the internal consistency of the scales used [37]. Specifically, the "Hygiene issues" scale, with a Cronbach's α of 0.969, and the "Motivators" scale, with a value of 0.957, exhibit excellent reliability, suggesting a strong interrelationship among the items within these constructs.

Table 2. Descriptive Statistics Results

Study variables	Items	Mean	S.D.	Skewness		Kurtosis	
				Value	S.E.	Value	S.E.
Hygiene issues	HI1	3.560	1.024	0.736	0.107	0.266	0.214
	HI2	3.610	1.013	0.778	0.107	0.125	0.214
	HI3	3.600	1.030	0.765	0.107	0.247	0.214
	HI4	3.520	1.022	0.684	0.107	0.429	0.214
	HI5	3.510	1.076	0.763	0.107	0.285	0.214
	HI6	3.540	1.010	0.641	0.107	0.407	0.214
	HI7	3.590	1.045	0.726	0.107	0.293	0.214
	HI8	3.580	1.032	0.577	0.107	0.615	0.214
	HI9	3.560	1.019	0.680	0.107	0.318	0.214
	HI10	3.560	1.030	0.597	0.107	0.563	0.214
	HI11	3.610	1.024	0.699	0.107	0.399	0.214
	HI12	3.550	1.027	0.764	0.107	0.267	0.214
	HI13	3.530	1.029	0.739	0.107	0.373	0.214
	HI14	3.580	1.038	0.773	0.107	0.224	0.214
	HI15	3.520	0.974	0.665	0.107	0.405	0.214
	HI16	3.610	1.010	0.730	0.107	0.170	0.214
	HI17	3.590	1.018	0.688	0.107	0.318	0.214
	HI18	3.590	1.045	0.721	0.107	0.289	0.214
	HI19	3.570	1.037	0.729	0.107	0.288	0.214
	HI20	3.620	1.021	0.774	0.107	0.098	0.214
	HI21	3.560	1.043	0.877	0.107	0.039	0.214
	HI22	3.610	1.016	0.816	0.107	0.131	0.214
	HI23	3.580	0.979	0.651	0.107	0.455	0.214
	HI24	3.620	1.019	0.733	0.107	0.331	0.214
	HI25	3.590	1.050	0.758	0.107	0.191	0.214
Motivators	MO1	3.580	0.988	0.660	0.107	0.393	0.214
	MO2	3.560	0.974	0.772	0.107	0.227	0.214
	MO3	3.560	1.037	0.697	0.107	0.429	0.214
	MO4	3.540	1.072	0.781	0.107	0.213	0.214
	MO5	3.600	1.036	0.682	0.107	0.355	0.214
	MO6	3.580	1.021	0.745	0.107	0.210	0.214
	MO7	3.570	1.048	0.796	0.107	0.219	0.214
	MO8	3.590	0.999	0.746	0.107	0.236	0.214
	MO9	3.590	1.020	0.635	0.107	0.521	0.214
	MO10	3.540	1.025	0.551	0.107	0.660	0.214
	MO11	3.580	1.013	0.736	0.107	0.303	0.214
	MO12	3.540	1.027	0.775	0.107	0.287	0.214
	MO13	3.570	1.055	0.793	0.107	0.251	0.214
	MO14	3.550	1.033	0.647	0.107	0.460	0.214
	MO15	3.570	1.014	0.713	0.107	0.341	0.214
	MO16	3.560	1.034	0.703	0.107	0.305	0.214
	MO17	3.610	1.015	0.747	0.107	0.194	0.214
	MO18	3.530	1.001	0.822	0.107	0.254	0.214
Commute distance	CD1	3.650	1.026	0.640	0.107	0.408	0.214
	CD2	3.550	0.986	0.752	0.107	0.281	0.214
	CD3	3.560	1.011	0.670	0.107	0.484	0.214
	CD4	3.590	1.024	0.701	0.107	0.348	0.214
Job satisfaction	JS1	3.570	0.971	0.747	0.107	0.182	0.214
	JS2	3.620	1.025	0.697	0.107	0.300	0.214
	JS3	3.580	0.965	0.646	0.107	0.497	0.214

Additionally, the Cronbach's α values for "Commute distance" (0.846) and "Job satisfaction" (0.798) are also above the acceptable threshold, further supporting the reliability of these scales. Although these values are slightly lower than those for "Hygiene issues" and "Motivators," they still indicate a high level of consistency

among the items measuring these constructs. Taken together, the results presented in Table 4.5 provide strong evidence of the reliability of the measurement instruments, ensuring that the data collected is robust and suitable for subsequent analysis.

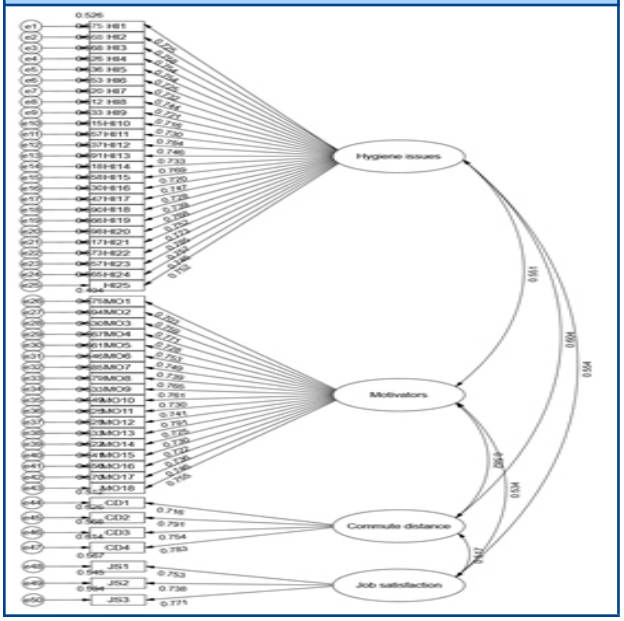
Table 3. Reliability Statistics

Study variables	Number of questions	Cronbach's α
Hygiene issues	25	0.969
Motivators	18	0.957
Commute distance	4	0.846
Job satisfaction	3	0.798

Table 4. KMO and Bartlett's Test

KaiserMeyerOlkin Measure of Sampling Adequacy.		**.987**
Bartlett's Test of Sphericity	ChiSquare Approx.	17458.787
	df	1225
	Sig.	.000

Figure 2 Measurement model



Validity test: Table 4 presents the results of the KaiserMeyerOlkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity, both of which are crucial for assessing the suitability of the data for factor analysis. The KMO statistic, with a value of 0.978, indicates an excellent level of sampling adequacy. KMO values above 0.7 are generally deemed acceptable, and values closer to 1.0 reflect stronger correlations among the variables, thereby supporting the validity of the factor analysis. A KMO value of 0.978 suggests that the data is highly suitable for factor analysis, with variables being sufficiently intercorrelated to uncover meaningful latent structures.

Bartlett's Test of Sphericity further confirms the appropriateness of the data for factor analysis. The test yields a ChiSquare value of 17,458.787 with 1,225 degrees of freedom and a pvalue of 0.000. The highly significant result ($p < 0.001$) rejects the null hypothesis that the correlation matrix is an identity matrix, indicating that there are significant correlations among the variables [37]. This provides strong evidence that the data can be factorized and that factor analysis will yield meaningful results.

Structural Equation Model: Figure 2 illustrates the measurement model for the study, displaying the relationships between the latent variables, observed variables, and error terms. The ovals represent the latent variables, which are unobservable constructs measured by multiple indicators (the squares). In this diagram, the latent variables include "Hygiene issues," "Motivators," "Commute distance," and "Job satisfaction," each of which is associated with a set of observed variables that serve as indicators of these constructs.

Table 5. Measure model fit index

Fit index	χ2/ df	RM SEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.85	>0.85	>0.85	>0.85	>0.85
Result	1.294	0.024	0.899	0.890	0.916	0.979	0.980

The error terms, represented by small circles, capture the variance in the observed variables that is not explained by the latent variables. The arrows connecting the observed variables to their corresponding latent variables indicate the directional relationships, illustrating how each indicator is linked to the underlying construct. The measurement model also demonstrates the correlations among the latent variables, which are represented by the bidirectional arrows between them, highlighting their interdependencies and the degree to which they share common variance.

Table 5 presents the fit indices for the measurement model, providing critical information on how well the proposed model fits the data. The first fit index, χ^2/df (Chisquare divided by degrees of freedom), yields a value of 1.294, which is well below the threshold of 3, indicating a good fit between the model and the data. A χ^2/df ratio under 3 suggests that the model is not overfitting and that the observed data adequately supports the hypothesized structure. The RMSEA (Root Mean Square Error of Approximation) value of 0.024 is also below the recommended cutoff of 0.08, signifying a good fit and suggesting minimal approximation error. A lower RMSEA indicates that the model provides a close fit to the population covariance matrix, thereby supporting the model's validity.

Additional fit indices include the GFI (Goodness of Fit Index) and AGFI (Adjusted Goodness of Fit Index), with values of 0.899 and 0.890, respectively. Both of these values exceed the benchmark of 0.85, reflecting a good fit. The NFI (Normed Fit Index), TLI (TuckerLewis Index), and CFI (Comparative Fit Index) all exceed the threshold of 0.85, with values of 0.916, 0.979, and 0.980, respectively, further confirming the model's strong fit [38]. These indices collectively indicate that the model is an adequate representation of the data, demonstrating that the measurement model adequately reflects the relationships between the latent and observed variables.

Table 6 presents the results of the convergent validity analysis for the study's latent variables. Convergent validity is assessed using two key metrics: the Composite Reliability (CR) and the Average Variance Extracted (AVE). CR reflects the internal consistency of the indicators that measure a particular latent variable, while AVE assesses the extent to which the indicators explain the variance in the latent variable. According to the guidelines for confirmatory factor analysis, convergence validity is considered satisfactory if the CR value is greater than 0.7 and the AVE value exceeds 0.50. In this table, the CR values for all latent variables, including "Hygiene issues" (0.969), "Motivators" (0.957), "Commute distance" (0.847), and "Job satisfaction" (0.798), all surpass the 0.7 threshold, demonstrating excellent internal consistency. Similarly, the AVE values for all variables—ranging from 0.555 for "Hygiene issues" to 0.580 for "Commute distance"—are above the recommended minimum of 0.50, indicating that the latent variables account for a substantial portion of the variance in their respective indicators.

The factor loadings for the observed indicators range from 0.703 to 0.791 across the latent variables, with the majority of loadings exceeding the commonly accepted threshold of 0.7. These high factor loadings suggest that each observed indicator contributes significantly to its respective latent variable, further supporting the validity of the measurement model. For instance, the factor loadings for "Hygiene issues" range from 0.716 (for HI9) to 0.785 (for HI22), and for "Motivators," they range from 0.703 (for MO1) to 0.791 (for MO12). These results collectively affirm the robustness of the measurement model and validate the constructs being measured [37].

Table 7 presents the results of the discriminant validity test, which is used to assess whether the latent variables in the study are distinct from one another. Discriminant validity ensures that a variable is not highly correlated with other variables in the model, thereby confirming that each latent construct represents a unique dimension of the theoretical framework. In this table, the diagonal values represent the square root of the Average Variance Extracted (AVE) for each latent variable, which serve as an indicator of the variable's ability to explain the variance of its indicators. For example, the diagonal value of 0.747 for "Hygiene issues" reflects the square root of its AVE, indicating a solid proportion of the variance explained by this construct.

Table 6 Convergence Validity

Latent variables	Observation indicators	Factor loading	CR	AVE
Hygiene issues	HI1	0.725	0.969	0.558
	HI2	0.758		
	HI3	0.754		
	HI4	0.754		
	HI5	0.725		
	HI6	0.732		
	HI7	0.744		
	HI8	0.721		
	HI9	0.716		
	HI10	0.730		
	HI11	0.784		
	HI12	0.746		
	HI13	0.733		
	HI14	0.769		
	HI15	0.720		
	HI16	0.747		
	HI17	0.728		
	HI18	0.739		
	HI19	0.768		
	HI20	0.752		
	HI21	0.773		
	HI22	0.785		
	HI23	0.757		
	HI24	0.746		
	HI25	0.752		
Motivators	MO1	0.703	0.957	0.555
	MO2	0.759		
	MO3	0.771		
	MO4	0.728		
	MO5	0.753		
	MO6	0.749		
	MO7	0.739		
	MO8	0.765		
	MO9	0.761		
	MO10	0.730		
	MO11	0.741		
	MO12	0.791		
	MO13	0.725		
	MO14	0.730		
	MO15	0.722		
	MO16	0.736		
	MO17	0.746		
	MO18	0.755		
Commute distance	CD1	0.716	0.847	0.580
	CD2	0.791		
	CD3	0.754		
	CD4	0.783		
Job satisfaction	JS1	0.753	0.798	0.569
	JS2	0.738		
	JS3	0.771		

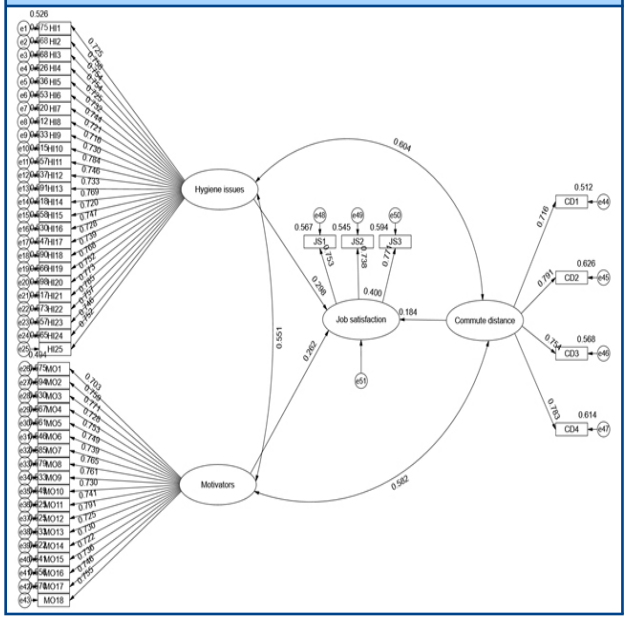
The corresponding offdiagonal values represent the correlations between the latent variables, with all correlations falling below the threshold of 0.85, which is typically considered an indication of acceptable discriminant validity.

Table 7. Discriminant validity test

Latent variables	Hygiene issues	Motivators	Commute distance	Job satisfaction
Hygiene issues	0.747			
Motivators	0.551	0.745		
Commute distance	0.604	0.582	0.762	
Job satisfaction	0.554	0.534	0.517	0.754

Note: The diagonal is the square root of the corresponding variable's AVE.

Figure 3: Structural model



The results from Table 4.9 suggest that each latent variable maintains sufficient distinctiveness from the others. For instance, the correlation between "Hygiene issues" and "Motivators" is 0.551, which is lower than the square root of their respective AVEs (0.747 and 0.745), indicating that the two constructs are sufficiently different from one another. Similarly, the correlations between "Commute distance" and the other latent variables, such as "Hygiene issues" (0.604) and "Motivators" (0.582), remain below the threshold of 0.85, supporting the idea that these constructs represent separate dimensions. The "Job satisfaction" variable shows similar patterns, with correlations of 0.554, 0.534, and 0.517 with the other latent variables, which further reinforces the discriminant validity of the measurement model [39].

Figure 3 illustrates the structural model in the context of the study, depicting the relationships among latent variables, observed variables, error terms, and path coefficients. The latent variables—"Hygiene issues," "Motivators," "Job satisfaction," and "Commute distance"—are represented by ovals, while the observed variables, or indicators, are shown as squares, with their corresponding factor loadings indicated on the arrows. The arrows connecting the latent variables signify the hypothesized directional relationships, where "Hygiene issues" and "Motivators" both influence "Job satisfaction," with path coefficients of 0.567 and 0.400, respectively.

Similarly, "Job satisfaction" affects "Commute distance," as indicated by the path coefficient of 0.184. The error terms, represented by small circles, account for the unexplained variance in the observed variables. The path coefficients provide insight into the strength and direction of the relationships between the variables, highlighting the structural dependencies in the model. This diagram effectively captures the theoretical framework, illustrating both the direct and indirect effects among the study's constructs and providing a clear representation of the model's structure.

Table 8 presents the model fit indices for the structural model, providing an assessment of how well the proposed model aligns with the observed data. The χ^2/df (Chisquare divided by degrees of freedom) ratio is 1.294, which is below the threshold of 3, indicating a good fit between the structural model and the data. This ratio suggests that the model does not suffer from overfitting, and the data supports the hypothesized relationships. The RMSEA (Root Mean Square Error of Approximation) value of 0.024 is well below the recommended cutoff of 0.08, indicating that the model approximates the true population covariance matrix with minimal error, further supporting the model's goodness of fit.

Additionally, the Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit Index (AGFI) are both above the 0.85 threshold, with values of 0.899 and 0.890, respectively, suggesting that the model explains a substantial proportion of the variance in the data. The Normed Fit Index (NFI), TuckerLewis Index (TLI), and Comparative Fit Index (CFI) all exceed the 0.85 threshold, with values of 0.916, 0.979, and 0.980, respectively [38]. These indices indicate a very strong fit, demonstrating that the structural model is an appropriate representation of the data.

Table 8. Model fit index

Fit index	χ2/ df	RM SEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.85	>0.85	>0.85	>0.85	>0.85
Result	1.294	0.024	0.899	0.890	0.916	0.979	0.980

Table 9. Direct path effects

Hypothesis	Path	Unstandardized d estimates	β	S.E.	C.R.	P	Results
H1	HI→JS	0.294	0.298	0.059	5.007		Supported
H2	MO→JS	0.276	0.262	0.061	4.509		Supported
H3	CD→JS	0.183	0.184	0.065	2.828	0.005	Supported

Note: HI: Hygiene issues; MO: Motivators; CD: Commute distance; JS: Job satisfaction. : P<0.001.

Table 9 presents the results of the direct path effects, offering a detailed analysis of the relationships between the study's latent variables. Each hypothesis tests the direct impact of one variable on another, with path coefficients (unstandardized estimates) representing the strength of these relationships. The unstandardized estimates provide the raw effect sizes, showing the magnitude of change in the dependent variable (Job satisfaction, JS) for a unit change in the independent variables (Hygiene issues, HI; Motivators, MO; Commute distance, CD). For instance, the path from Hygiene issues (HI) to Job satisfaction (JS) has an unstandardized estimate of 0.294, meaning that for each oneunit increase in Hygiene issues, Job satisfaction increases by 0.294 units. Similarly, the paths from Motivators (MO) to Job satisfaction (JS) and from Commute distance (CD) to Job satisfaction (JS) have unstandardized estimates of 0.276 and 0.183, respectively.

The table 9 also includes the standardized path coefficients (β), which provide a normalized measure of the strength of the relationships between the variables.

H1: Hygiene Issues (HI) → Job Satisfaction (JS)
Path coefficient (β = 0.298, p < 0.001)

Hypothesis H1 is supported, indicating that hygiene issues (HI) exert a significant positive effect on job satisfaction (JS).

Hygiene factors encompass company and administrative policies, supervision, salary, interpersonal relations, and working conditions.

According to Herzberg's TwoFactor Theory, these factors are classified as hygiene factors, which do not necessarily enhance job satisfaction but can prevent dissatisfaction when adequately addressed.

The path coefficient of 0.294 suggests that improvements in hygiene factors lead to a significant increase in job satisfaction, reinforcing the notion that maintaining a wellstructured work environment and fair compensation policies contributes to employees' overall job contentment.

H2: Motivators (MO) → Job Satisfaction (JS)

Path coefficient (β = 0.262, p < 0.001)

Hypothesis H2 is supported, demonstrating that motivators (MO) have a significant positive influence on job satisfaction (JS).

Motivators include the nature of the work itself, achievement, responsibility, advancement, and recognition.

In Herzberg's framework, these elements represent intrinsic motivators that drive employees' engagement and foster longterm job satisfaction.

The path coefficient of 0.276 indicates that an increase in intrinsic motivators—such as opportunities for professional growth, meaningful work, and recognition—leads to a higher level of job satisfaction, supporting the argument that organizations should cultivate an environment that promotes personal and professional development.

H3: Commute Distance (CD) → Job Satisfaction (JS)

Path coefficient (β = 0.184, p = 0.005)

Hypothesis H3 is supported, revealing that commute distance (CD) has a significant negative effect on job satisfaction (JS).

Commute distance is conceptualized through commute time and commute mode.

Prior research suggests that long commuting times and inconvenient commuting modes may contribute to increased stress and worklife imbalance, potentially reducing job satisfaction.

The path coefficient of 0.183, while lower than those of HI and MO, remains statistically significant ($p = 0.005$), suggesting that longer and more challenging commutes are associated with lower job satisfaction. This finding underscores the importance of considering employees' commuting conditions when designing workplace policies, such as flexible working arrangements or strategic office locations.

Overall Interpretation: Hygiene factors (H1) and motivators (H2) exert a stronger influence on job satisfaction, aligning with Herzberg's theory that hygiene factors mitigate dissatisfaction while motivators enhance satisfaction.

Commute distance (H3) demonstrates a weaker yet significant effect, implying that longer commutes can adversely impact employees' job satisfaction.

From a managerial perspective, organizations seeking to enhance job satisfaction should not only improve extrinsic work conditions (e.g., salary, policies, supervision) but also focus on intrinsic factors (e.g., career growth, recognition, meaningful work). Additionally, organizations should consider implementing policies that minimize employees' commuting burdens to sustain higher levels of job satisfaction.

DISCUSSION AND CONCLSION

Discussion of Findings: This study aimed to examine the factors influencing job satisfaction among IT professionals in Chengdu by extending Herzberg's TwoFactor Theory with an additional external factor—commute distance. The results of the structural equation modeling (SEM) confirm the theoretical assumptions and provide important empirical insights.

Firstly, the analysis supports Hypothesis 1, revealing that hygiene factors have a significant positive impact on job satisfaction. Consistent with Herzberg's original framework, employees' satisfaction is strongly influenced by tangible aspects such as salary competitiveness, clear company policies, and favorable working conditions. This finding echoes prior studies indicating that inadequate hygiene conditions can lead to dissatisfaction, particularly in highintensity sectors like IT [32,40].

Secondly, motivator factors are shown to exert a substantial and statistically significant influence on job satisfaction, confirming Hypothesis 2. Factors such as recognition, achievement, professional growth, and meaningful work were highly valued among Chengdu's IT professionals. This aligns with the intrinsic motivation literature, which posits that intellectual challenge, autonomy, and advancement opportunities are especially critical in knowledgebased industries [41].

Thirdly, and most notably, the results validate Hypothesis 3, demonstrating that commute distance negatively affects job satisfaction. Employees with longer commutes reported lower levels of satisfaction, primarily due to diminished worklife balance and increased stress. This supports recent findings on the psychological and physical burden of commuting [34,42] and underscores the need to consider commuterelated variables as part of a holistic job satisfaction model.

Collectively, these findings suggest that traditional workplace interventions—while necessary—are insufficient on their own. External contextual factors like commuting must also be addressed to foster sustainable employee wellbeing.

Theoretical Contributions: This research makes a meaningful theoretical contribution by extending Herzberg's TwoFactor Theory beyond the organizational boundary. By incorporating commute distance as an external factor, the study challenges the traditional binary classification of motivators and hygiene factors and proposes a more integrative model that better reflects modern urban work environments.

Furthermore, by applying this extended framework to the context of Chengdu's IT industry, the study offers a contextualized understanding of job satisfaction in highgrowth, knowledgeintensive economies. This localization helps bridge the gap between global organizational theories and China's unique urban and industrial dynamics.

Practical Implications: From a practical standpoint, the study offers actionable insights for HR managers, urban planners, and policymakers:

For IT firms: Investing in both hygiene and motivator systems—such as flexible working hours, clear promotion mechanisms, and supervisor training—can directly enhance job satisfaction and reduce turnover rates.

On commute management: Employers should explore hybrid work models, shuttle services, or office relocation strategies to minimize commuting burdens.

For policymakers: Urban development strategies should integrate housing affordability near tech zones, improve public transit accessibility, and support smart city innovations that reduce commuting pressure for tech workers.

In sum, improving employee satisfaction in the IT sector requires not only internal organizational adjustments but also systemic solutions addressing the urban ecosystem in which professionals operate.

Limitations and Future Research: Despite its contributions, this study is subject to several limitations. First, the use of convenience sampling may limit the generalizability of the results to the broader IT population in China or other countries. Second, the study adopts a crosssectional design, preventing causal inferences. Future research should consider longitudinal methods to track changes in job satisfaction over time and explore additional external variables such as housing affordability or remote work readiness.

Moreover, qualitative studies could complement this quantitative model by exploring the subjective experiences behind commuting stress or motivator perceptions in depth.

CONCLUSION

In conclusion, this study provides a nuanced understanding of job satisfaction among IT professionals in Chengdu by integrating Herzberg's TwoFactor Theory with commute distance as a contextual variable. The findings affirm the importance of both internal organizational factors and external living conditions in shaping employee wellbeing. As China's digital economy continues to evolve, attention to the comprehensive worklife experience of IT employees will be essential for building.

REFERENCE

1. Shi, Y. and F. Wei, Comparative Analysis of Digital Economy-Driven Innovation Development in China: An International Perspective. Journal of the Knowledge Economy, 2024: p. 1-43.
2. Li, W., W. Cui, and P. Yi, Digital economy evaluation, regional differences and spatio-temporal evolution: Case study of Yangtze River economic belt in China. Sustainable Cities and Society, 2024. 113: p. 105685.
3. Liu, G., et al., Understanding mechanisms of digital transformation in state-owned enterprises in China: An institutional perspective. Technological Forecasting and Social Change, 2024. 202: p. 123288.
4. Li, X., Z. Chen, and Y. Chen, The Impact of Digital Talent Inflow on the Co-Agglomeration of the Digital Economy Industry and Manufacturing. Systems, 2024. 12(8): p. 317.
5. Wu, Z., et al., Regional differences and dynamic evolution of high-quality development in service industry: A case study of the Chengdu-Chongqing economic circle. Plos one, 2024. 19(3): p. e0297755.
6. Wan, J., et al., A spatial econometric investigation into road traffic accessibility and economic growth: insights from the Chengdu-Chongqing twin-city economic circle. Humanities and Social Sciences Communications, 2024. 11(1): p. 183.
7. Sandhu, S., et al., Enhancing Job Satisfaction in a Tech-Driven Workplace. Sustainable Management Practices for Employee Retention and Recruitment, 2025: p. 151.
8. Pooladvand, S. and S. Hasanzadeh, Neurophysiological evaluation of workers' decision dynamics under time pressure and increased mental demand. Automation in Construction, 2022. 141: p. 104437.
9. Singh, P., et al., Enforced remote working: The impact of digital platform-induced stress and remote working experience on technology exhaustion and subjective wellbeing. Journal of Business Research, 2022. 151: p. 269-286.
10. Uslu Sahan, F. and F. Terzioglu, Transformational leadership practices of nurse managers: the effects on the organizational commitment and job satisfaction of staff nurses. Leadership in Health Services, 2022. 35(4): p. 494-505.
11. Hashmi, M.A., A. Al Ghaithi, and K. Sartawi, Impact of flexible work arrangements on employees' perceived productivity, organisational commitment and perceived work quality: a United Arab Emirates case-study. Competitiveness Review: An International Business Journal, 2023. 33(2): p. 332-363.
12. Thant, Z.M., Assessing the determinants of Myanmar government employees' job satisfaction through Herzberg's two-factor theory. Chinese Public Administration Review, 2023. 14(1): p. 27-38.
13. Pratama, R.A., et al., Effect of Extrinsic Job Satisfaction Hygiene Factors and Intrinsic Job Satisfaction Motivation on Turnover Intention. Bulletin of Counseling and Psychotherapy, 2023. 5(2): p. 148-158.
14. Kures, M. and S.C. Deller, Growth in commuting patterns and their impacts on rural workforce and economic development. Economic Development Quarterly, 2023. 37(1): p. 54-63.
15. Glazener, A., et al., Fourteen pathways between urban transportation and health: A conceptual model and literature review. Journal of Transport & Health, 2021. 21: p. 101070.
16. Conceição, M.A., et al., The effect of transport infrastructure, congestion and reliability on mental wellbeing: a systematic review of empirical studies. Transport reviews, 2023. 43(2): p. 264-302.
17. Ewen, R.B., P.C. Smith, and C.L. Hulin, An empirical test of the herzberg two-factor theory. Journal of applied psychology, 1966. 50(6): p. 544.
18. Van den Broeck, A., et al., Beyond intrinsic and extrinsic motivation: A meta-analysis on self-determination theory's multidimensional conceptualization of work motivation. Organizational Psychology Review, 2021. 11(3): p. 240-273.
19. He, Q., et al., "Thriving at work" or not? Research on the effects of performance pressure based on achievement motivation theory and two-factor theory. Journal of Managerial Psychology, 2024. 39(2): p. 146-161.
20. Seeber, I. and J. Erhardt, Working from Home with Flexible and Permeable Boundaries. Business & Information Systems Engineering, 2023. 65(3): p. 277-292.
21. Leka, S. and A. Jain, Conceptualising work-related psychosocial risks: Current state of the art and implications for research, policy and practice. Policy And Practice, 2024:

p. 254.
22. Sepiriti, S., Analysis of the Contributing Factors to Teachers' Job Dissatisfaction in Lesotho Secondary Schools and the Mitigating Strategies. European Journal of Educational Management, 2024. 7(4): p. 185-198.
23. Li, L., et al., Examining sustainable hospitality practices and employee turnover in Pakistan: The interplay of robotics awareness, mutual trust, and technical skills development in the age of artificial intelligence. Journal of Environmental Management, 2025. 373: p. 123922.
24. Ghobakhloo, M., et al., Industry 4.0, innovation, and sustainable development: A systematic review and a roadmap to sustainable innovation. Business Strategy and the Environment, 2021. 30(8): p. 4237-4257.
25. Subramaniam, S.H., et al., Key factors influencing long-term retention among Contact Centre employee in Malaysia: a Delphi method study. Cogent Business & Management, 2024. 11(1): p. 2370444.
26. Shen, Y., N. Ta, and Z. Liu, Job-housing distance, neighborhood environment, and mental health in suburban Shanghai: A gender difference perspective. Cities, 2021. 115: p. 103214.
27. Chen, L., M. Chen, and C. Fan, Age disparities and socioeconomic factors for commuting distance in Beijing by explainable machine learning. Cities, 2024. 155: p. 105493.
28. Kapitza, J., Commuting at night: How time of day affects commuter perceptions. Travel Behaviour and Society, 2024. 35: p. 100750.
29. Ma, L., et al., Impact of commuting time on self-reported work productivity: A quasi-longitudinal examination. Travel Behaviour and Society, 2024. 37: p. 100837.
30. Ogbanufe, O. and L. Ge, A comparative evaluation of behavioral security motives: Protection, intrinsic, and identity motivations. Computers & Security, 2023. 128: p. 103136.
31. Adamopoulos, I.P. and N.F. Syrou, Associations and correlations of job stress, job satisfaction and burn out in public health sector. European Journal of Environment and Public Health, 2022. 6(2): p. em0113.
32. Ghimire, B., et al., Motivators and Hygiene Factors Affecting Academics in Nepalese Higher Education Institutions: Applying Herzberg's Two-Factor Theory. Journal of Business and Social Sciences Research, 2024. 9(2): p. 1-16.
33. Wang, Q., et al., Public service motivation and public employees' turnover intention: the role of job satisfaction and career growth opportunity. Personnel Review, 2024. 53(1): p. 99-118.
34. Emre, O. and S. and De Spiegeleare, The role of work–life balance and autonomy in the relationship between commuting, employee commitment and well-being. The International Journal of Human Resource Management, 2021. 32(11): p. 2443-2467.
35. Wong, F.M.F., Job satisfaction in nursing: A qualitative inquiry into novice and experienced nurses' perspectives. Nurse Education in Practice, 2024. 78: p. 104018.
36. Wang, Y., C. Liu, and Y.-F. Tu, Factors affecting the adoption of AI-based applications in higher education. Educational Technology & Society, 2021. 24(3): p. 116-129.
37. Azarmehr, T., et al., Psychometric Properties of the Persian Version of the Principal Instructional Leadership Scale for High School Principals (PILS): Translation, Psychometric Properties, and Network Analysis. The Asia-Pacific Education Researcher, 2024: p. 1-12.
38. Zhang, M., et al., Multidimensional factors affecting care needs in daily living among community-dwelling older adults: A structural equation modelling approach. 2021. 29(5): p. 1207-1219.
39. Alshammari, M.M., Y.H. Al-Mamary, and A.A. Abubakar, Revolutionizing education: unleashing the power of social media in Saudi Arabian public universities. Humanities and Social Sciences Communications, 2024. 11(1): p. 808.
40. Conroy, S.A. and J.W. Morton, The Role of Human Resource Management in Surviving or Thriving: A Review of Compensation Systems and Low-Wage Work. Research in Personnel and Human Resources Management, 2024: p. 1-44.
41. Ajmal, M., Z. Sareet, and A. Islam, Unleashing innovation through employee voice behavior in the hotel industry: the impact of ambidextrous leadership on innovative work behavior. Journal of Hospitality and Tourism Insights, 2025. 8(2): p. 448-471.
42. Gerpott, F.H., W. Rivkin, and D. Unger, Autonomous or controlled self-regulation, that is the question: A self-determination perspective on the impact of commuting on employees' domain-specific functioning. Organizational Psychology Review, 2022. 13(1): p. 67-95.

SSN Journal **of M**anagement & **T**echnology **R**esearch **C**ommunications
Vol 2 No (1) Jan-Feb-Mar-Apr 2025
Society for Science and Nature

E-ISSN: 3049-0014
CrossRef DOI: https://dx.doi.org/10.21786/mntrc

Food Security Management for Tribal Communities of India: Problems and Strategies

Afifa Ahmad

Department of Public Health, The University of Birmingham

Edgbaston, Birmingham, B15 2TT, United Kingdom

Present address: Coventry City Council, Council House, Earl Street, CV1 5RR,

ABSTRACT

BIndia's tribal population or indigenous population (IP) faces significant food security challenges. This review article examines the problems, challenges, and solutions related to food security among certain tribal populations of India. It discusses the cultural significance of traditional food systems, the impact of urbanization and industrial agriculture, and the need for community-led initiatives to promote food sovereignty. This updated review also aims to understand the food security in the backdrop of recent environmental changes as indigenous people's livelihood and food security are weather-driven and have to be keenly observed for any change in the same. Ecological change and severe events may exacerbate the vulnerability of indigenous populations. It is worth mentioning that the main challenges which are already encountered by the poor IP include economic and political exclusion, abuse of human rights, unemployment, discrimination, and resource depletion. In the review, it was also observed that the residents of this specific community were further compelled to transfer and live in the areas where their ancestors had a site for thousands of years to minimise the detrimental effects. It affects their social capital, food security, water supply, sanitary conditions, mental health, and ability to fight off infectious diseases and injuries, and the availability of healthcare directly or indirectly. It can be concluded that as such ecological changes affect the food security of IP in India, reviving indigenous food systems and encouraging indigenous crops and farming practices can help communities become self-sufficient, economically free, and sustainable. Similarly, community-led initiatives like supporting indigenous-led food sovereignty can promote ecological and cultural sustainability. The government's actions involving documenting traditional knowledge and preserving and promoting indigenous foods can help address malnutrition and hunger in indigenous communities.

KEY WORDS: MANAGEMENT, FOOD SECURITY, TRIBAL POPULATION, INDIA.

INTRODUCTION

AsIndia is suffering from one of the largest numbers of undernourished people in the world, despite having one of world's largest farm outputs. There are various reasons behind the existence of this dichotomy. Challenges with Food Security in India have been a major cause of concern for the authorities over the past many years. The First Millennium Development Goal states the target of "Halving hunger by 2015". Sadly, the recent statistics for India present a very gloomy picture. India currently has the largest number of undernourished people in the world, although it has made substantial progress in health determinants over the past decades and ranks second worldwide in farm output. According to the World Food Programme, 195 million people in India are undernourished, 43% of children in India are chronically undernourished. India ranks 68th out of 113 major countries in the Global Food Security Index 2022 [1].

Article Information: *Corresponding Author: afifa.ahmad@coventry.gov.uk
Received 12/01/2025 Accepted after revision 20/02/2025
Publication Date: 30th April 2025 Pg No- 35- 43

Available at: https://mntrc.in/
DOI: http://dx.doi.org/10.21786/mntrc/2.1.4

Food insecurity is a condition in which a person or household has difficulty obtaining adequate, safe, culturally acceptable, and nutrient-dense food to fulfill dietary needs and preferences for a healthy life, owing to a lack of resources or climate change. The impacts of inadequate resource availability on food and health are reflected by a spectrum of unfavorable developmental consequences of varying severity [2]. Food insecurity per se, exists when all people, at all times, do not have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life [3].

Groups and communities identified and enumerated as tribes and indigenous people during British rule came to be reclassified as Scheduled Tribes after the adoption of the Indian Constitution in 1950. Indigenous people make up approximately 6% of the world's population, and they account for approximately 90% of the extremely poor [4].

According to the Census of India [5], the tribal population constitutes 8.6% of the country's population. National Family Health Survey data, 2015-2016, [6] shows 45.6 percent of indigenous members live in the lowest wealth bracket. It has been found that natural resources and land on which the IP depend are indistinguishably linked with their cultural livelihood identities along with their spiritual and physical well-being. It is worth mentioning that the main challenges encountered by the poor IP include economic and political exclusion, abuse of human rights, unemployment, discrimination, and resource depletion.

Reasons for food security in India: There are several reasons for the need for a robust food security system in India, some are stated as follows: Population Pressure: With over 1.5 billion people, India has a large and growing population. The increasing demand for food places significant pressure on agricultural production and food resources. Agricultural Productivity: India's agricultural sector is characterized by low productivity due to several factors, such as fragmented land holdings, inadequate irrigation facilities, lack of modern farming techniques, and limited access to credit and technology.

Climate Change and Natural Disasters: Erratic weather patterns, including droughts, floods, and extreme temperatures, affect crop yields and livestock productivity. Water Scarcity: Agriculture in India is heavily dependent on monsoon rains. However, rainfall patterns are increasingly unpredictable, leading to water scarcity in some regions. Degradation and Soil Health: Land degradation, caused by factors like erosion, overuse of chemical fertilizers, and improper land management practices, poses a threat to agricultural productivity. Storage and Distribution: Inefficient storage facilities and inadequate cold chain systems result in substantial food losses and wastage. Poverty and Inequality: Many people, particularly in rural areas and marginalized communities, struggle to afford and access nutritious food consistently.

Indigenous or Tribal People of India: The World Bank states, "Indigenous Peoples are distinct social and cultural groups that share collective ancestral ties to the lands and natural resources where they live, occupy or from which they have been displaced [7]. Estimates of the population of Indigenous peoples range from 250 million to 600 million [8]. There are some 5,000 distinct Indigenous peoples spread across every inhabited climate zone and inhabited continent of the world [9,10]. Most Indigenous peoples are in a minority in the state or traditional territory they inhabit and have experienced domination by other groups, especially non-Indigenous people, [11,12].

The International Labour Organization's (ILO) Indigenous and Tribal Peoples Convention, 1989 (ILO Convention No. 169) [13[states that the convention covers: peoples in independent countries who are regarded as indigenous on account of their descent from the populations which inhabited the country, or a geographical region to which the country belongs, at the time of conquest or colonisation or the establishment of present state boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions [14] .[24]

The convention also covers "tribal peoples" who are distinguished from Indigenous peoples and described as "tribal peoples in independent countries whose social, cultural and economic conditions distinguish them from other sections of the national community and whose status is regulated wholly or partially by their customs or traditions or by special laws or regulations, [15].

The term "Adivasi" refers to all the indigenous subcontinent tribes and is also known as the IP of India before the Indo Aryans and Dravidians. These people are known as the original inhabitants of the Indian subcontinent. In the context of India, it can be said that the local population, specifically those who live near the high-risk prone zones such as mountain regions and coastal areas, are expected to face high unpredictability due to food security impacted by weather changes. Henceforth, ensuring nutritional and food security is one of the primary tasks of the strategy makers and the government of India.

In India, there are 705 official and recognized ethnic groups, however, it is estimated that there are more ethnic groups that would qualify for the status of Scheduled Tribes but have not been officially recognized yet. It is estimated that many IPs keep a language distance from the original languages or languages of the region of the country in which they reside. However, many have either lost their native languages or are in danger of going extinct because of being uprooted from their homes and/or relocated to other areas. It has been estimated that the dietary habits of the tribal community in the Himalayan region are changing because of climate change. It is a new norm in the 21st century.

According to the findings of Upadhyay and Palanivel [16], the reasons for the existing food insecurity in India in rural and tribal areas are mainly due to lack of improvement in agricultural productivity owing to

inadequate resources and markets needed to obtain agricultural stability Climate change too, has an impact on the agricultural productivity, which affects the availability of food items and thus, food security. The major impact of weather-related changes is on rain-fed crops, other than rice and wheat. For the tribal communities, habitation in remote, difficult terrains and the practice of subsistence farming have led to significant economic backwardness.

Some studies have reported that in the urban population, the key issue that catalyzes the problem of food insecurity in urban areas and needs to be addressed is the large proportion of the informal workforce, resulting in the unplanned growth of slums that lack basic health and hygiene facilities. Rural-to-urban migration has shown a gradual increase, with its high share in total migration. These rural migrants form a large chunk of the population referred to as the 'informal sector'. The emergence of these rural origin pockets in the urban areas has resulted in several slum settlements characterized by inadequate water and sanitation facilities, insufficient housing, and increased food insecurity [16, 17].

Another important point that might promote food insecurity is the dependence of this labourer class on daily employment wages, which tends to be variable on different days of the month and thus food procurement and access fluctuate. A striking issue is that in India, all the privilege of the government schemes and programmes aimed at helping the urban slum people is enjoyed only by those slums that are notified. Ironically, around 50 % of the urban slums are not notified and thus are deprived of government schemes. People from these un-notified slums have to buy their food from the common market at a competitive price and are devoid of the subsidized food made available through the Public Distribution System,[18].

The main aim of food security is to ensure that people at all times have social, physical and economic access to safe, nutritious and sufficient food that meets their dietary needs and food preferences for a healthy and active life. In the context of the IP of India, they eat nuts, fruits, roots, seeds, vegetables, and grasses. While nutrition outcomes across India are poor, they are typically worse in tribal areas. Sixty percent of the burden of malnutrition occurs in seven states: Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, and Uttar Pradesh. These states lag in terms of per capita income and human development indicators and also possess significant proportions of Scheduled Castes (SCs) and Scheduled Tribes (STs). Traditionally Scheduled Castes have faced social segregation and discrimination, and Scheduled Tribes have been isolated and excluded physically and, hence, socially [19]. India's 'indigenous peoples' number about 104 million and account for 8.6 percent of the overall population.

Moreover, as per the observation of Patil [20], every step of their lives is impacted by disadvantages and prejudice regarding change in the climate. It is worth mentioning that the close relationship of IP with the natural environment and resources makes them highly sensitive to the effects of global warming [21]. In some cases, it has been identified that the existence of many people and tribal communities is threatened by climate change and by the fast-expanding production of biofuels, which are being promoted as a "solution" to the challenge.

Figure 1: Drought-prone areas in India

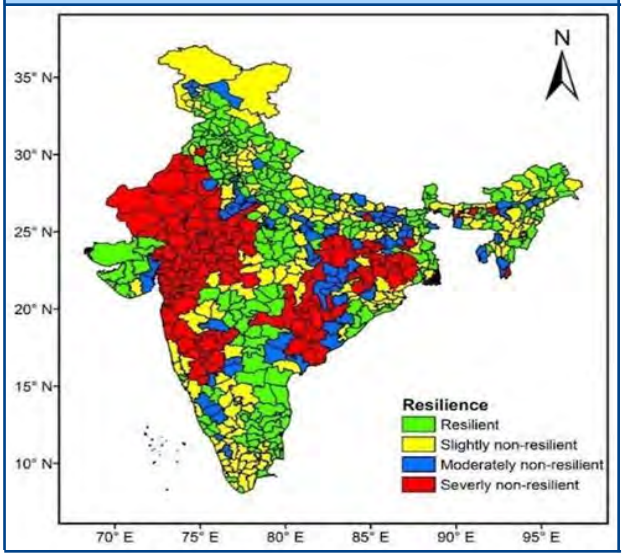
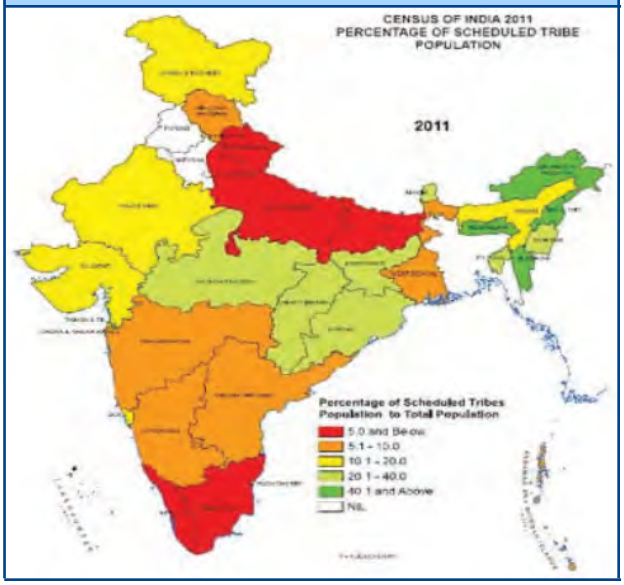


Figure 2 showing tribal states of India Cited From [22] Chandramouli, C. 2013. Release of Primary Census Abstract Data Highlights, Census of India 2011, Registrar General and Census Commissioner of India, Ministry of Home Affairs



It is worth mentioning that the capacity of indigenous people to assess and monitor their environment and make decisions, such as whether to plant crops, has also been hampered by the increasingly unpredictable weather. As per the observation of Etchart [23], they have grown increasingly interested in finding other ways to survive, such as assisting drug traffickers or letting loggers and gold

prospectors enter the jungle. The indigenous and peasant groups of India who live in forests are being negatively impacted by the biofuel crops.

It has been observed that biofuel crops are promoted as a part of the solution to climate change. The land rights, traditional ways of life, and even the survival of indigenous community people are threatened or destroyed. Biofuels, which include corn, oil palm, rapeseed, sugar cane, soy, and wheat, are liquid or gaseous fuels made from plant (or animal) materials. It has been found by this indigenous community of India that the water level and forest cover of Alirajpur and Madhya Pradesh Jhabua have been decreasing significantly over the past years.

However, if they do not conserve natural resources, then it can become a great challenge for the next generation. In response to the challenge, more than 10000 Bhil tribe people from around 300 villages have repaired 250 hand pumps and planted 11000 trees in the region. This initiative taken by this tribal community has increased the level of water over a certain period. This shows the effective support and collaborative work of this indigenous community of India against one of the major climate change challenges. It is worth mentioning that this step taken by the Bhil committee is one of the greatest examples of a positive view toward sustainable development [24].

Additionally, the associated problems related to climate change are increasing gradually, and calls for urgent action to be taken to allow enough time for building resilience in the food production system of India. As seen in the figure above, climate change poses a continuum of threats to agribusiness, agricultural productivity, and economic and social ramifications, including national food security. On the farm, the production of the field crop might rise or decline based on herbicides fighting for nutrients and water, as well as corrective farming measures.

Pests, as well as illnesses, are anticipated to spread because of changes in the weather patterns emerging in places that are less equipped for them, both biologically as well as procedurally, with possibly greater terrible impacts [25]. These increased hazards to farm productivity immediately result in increased threats to the food security of those who depend on traditional agriculture for food as well as a living. Thus, these individuals can influence faraway communities' food security as well as nutrition via price fluctuations, along with interrupting commerce.

Concern regarding ensuring food security, especially for the vulnerable communities, has grown as a result of the threat of global environmental changes such as land cover, change in availability of water, cycling, and altered availability of nitrogen. According to George and McKay [26] there is also growing worry that meeting the cost of food demand from a rise in population and shift of that reference would result in more environmental degradation, native vegetation loss, and agricultural intensification. This might also impact the food security and food system of the indigenous people. As per the observation of Zurayk [27], food security is not only concerned with the availability of food but also the accessibility and utilization of food. However, it has been found that climate change can impact food security and food availability. As indigenous people are the closest to the environment and nature, their food security is highly impacted by several factors.

In a detailed paper on addressing the food insecurity of India through agricultural traditional knowledge, Sharma [28] reported that, like other developing countries, food security in India is a complex issue that has been a concern for many years. Despite being one of the world's largest producers of food, millions of Indians still struggle to access enough nutritious food to meet their daily needs. One of the main reasons for food insecurity in India is poverty. According to the World Bank, [29] approximately 21.9% of the population in India lives below the poverty line.

This means that one in five Indians cannot afford to buy enough food to meet their daily needs. The seriousness of the matter can be assessed through other global research reports as well which have undertaken the task of studying the issues of food security and global hunger. Given the current population growth patterns, a report published by Food & Agriculture Organization [30] predicts that the total global population is likely to rise by 35% by the year 2050, and such an occurrence will mostly be in developing countries. As a result, enormous pressure will be placed on affected countries to expand their agricultural production capacity by nearly 70%. As a result of this, food will become a matter of national security in those regions.

According to this report of FAO, by 2050 the world's population will reach 9.1 billion, 34 percent higher than today. Nearly all of this population increase will occur in developing countries. Urbanization will continue at an accelerated pace, and about 70 percent of the world's population will be urban (compared to 49 percent today). Income levels will be many multiples of what they are now. In order to feed this larger, more urban and richer population, food production (net of food used for biofuels) must increase by 70 percent. Annual cereal production will need to rise to about 3 billion tonnes from 2.1 billion today, and annual meat production will need to rise by over 200 million tonnes to reach 470 million tonnes.

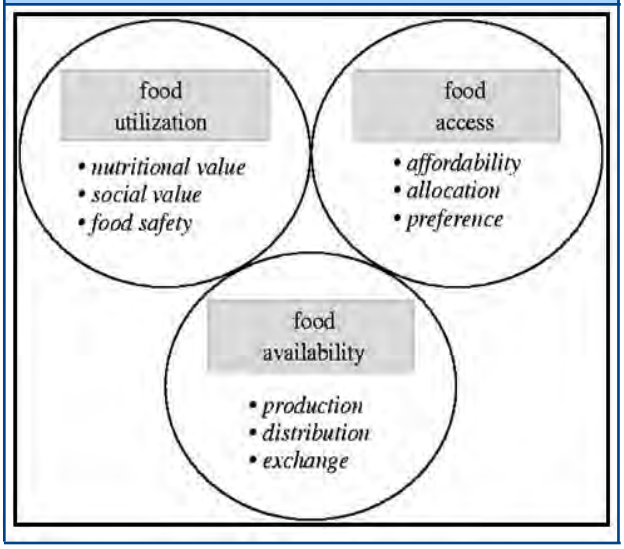
The International Food Policy Research Institute (IFPRI) further concretizes these findings. The study published by the IFPRI, under its 2022 Global Hunger Index (GHI) finds that current progress against hunger has mostly halted [31]. The situation has gotten worse in numerous nations and regions. One of the GHI's primary indicators, the prevalence of undernourishment, shows that the number of people who are not getting enough to eat is on the rise, and could reach 828 million by 2021 [32, 33].

The International Food Policy Research Institute (IFPRI) is in charge of making the index. The GHI gives each country a score out of 100. The best score is 0 (no hunger), and the worst is 100. A lower GHI score means that people are eating better and that the country is ranked higher. The GHI shows what worked and what didn't

work in reducing hunger and gives information about what causes hunger. To show how complex hunger is, the GHI combines three indicators with the same amount of weight: undernourishment, underweight children, and child mortality [32,33].

Hunger is on the rise, reaching around 800 million people in 2020, and about 2.4 billion people now suffer food insecurity [34]. India continues to bear a huge burden of food and nutrition insecurity, ranking 107 out of 121 countries on the 2022 Global Hunger Index [35]. The World Food Programme claims that India is home to a quarter of all undernourished people worldwide, making the country a key focus for tackling hunger on a global scale. Within India, it seems that sixty percent of the burden of malnutrition occurs in densely tribal populated states (SAFANSI, 2014:1), and NFHS-IV reports that more than 40% of tribal children in India are stunted and underweight and about 30% wasted, [36,37].

Figure 3: 32 Components of food security (Source: El Bilali et al., 2020 [38])]



It is worth mentioning that improving and supporting the adaptive capacity of the IP can only be successful and helpful if it is integrated with other strategies such as land use planning, nutritional plants, disaster preparation, and an environmental conservation plan for sustainable development. According to the observation of El Bilali et al. [38], adjusting to changing circumstances calls for more money and technology transfer and capacity building that most indigenous communities do not have. In addition, it has been found that short-term adaptation activities are underway, but capacity, constraints, and resources limit the implementation of long-term strategies.

It is important to note that some mitigation measures have unpleasant direct and indirect consequences for the IP community. For illustration, some initiatives for agriculture may reduce the emission of greenhouse gases but also lead to an increase in the plantation of monoculture crops and have been identified to be linked with the decline in food security and biodiversity. As per the views of Mukhopadhyay et al.,[39] it can be said that to prevent these plans from harming IP communities, it is essential that these groups fully and effectively participate in the development of the mitigation measures that the state develops.

On this note, it can be said that policies to protect and recognize the rights of the IP to their food security and land will benefit human society. Nalau et al. [40] found that IP plays an important role in many ecosystems as they stay active in their territories and land and thus help to enhance the resilience of these ecosystems. Due to the food insecurity, the IP was forced to choose to migrate away from their traditional and due to this, they often face double discrimination as indigenous people and migrants.

According to Agarwal [41] one of the biggest drawbacks of food insecurity is that indigenous people become more vulnerable to irregular migration such as due to abrupt displacement caused by a catastrophic change event, limited legal migration alternatives, and little opportunity to make educated decisions, people of this community are more susceptible to crimes like trafficking and smuggling. It has been observed that people who belong to the indigenous communities are being forced to move to cities for economic reasons by deforestation, particularly in emerging nations. These families frequently end up in urban slums. Earlier studies reveal that man-made activities such as overpopulation, pollution, burning fossil fuel, and deforestation have a high impact on the degradation of Himalayan areas, which makes the residents of that vertical area more susceptible to climate variations. This study also replied that a complete understanding of the local socio-cultural attitudes related to food choices is necessary for inclusive and responsive climate change initiatives [42].

It is worth mentioning that the food usage and dietary habits of the indigenous group change due to the variation made in the production system brought by the change in the climate. At the same time, long-term food security has also been found to be impacted by the impact of a changing climate on the stability of the food system and its resilience. Additionally, the pursuit of food security increases greenhouse gas emissions from deforestation and land use changes by increasing agricultural intensification and agricultural area expansion [38]. Because of the complex relationship between food security and climate change, there is a need for integrated policies that maximize co-benefits while resolving trade-offs.

This study by Bilali reveals that the indigenous people who live in such conditions have a high rate of poverty and hunger because of the adverse effects of the variation on food security. The author has also reflected that the degradation of in climate and the utilization of food have also impacted the nutritional status of the population, especially in the context of poor and Indigenous people [38]. The change in climate results in increasing temperature, reducing the quality of water, and affecting hygiene habits, especially in semi-arid and arid areas. It also increases the burden of diseases such as diarrhea among the children of the indigenous community. This qualitative research

has also stated that global warming is one of the causes of malnutrition because it negatively impacts the nutrition and food security of vulnerable groups such as children and women. According to another research, approximately 60% of the Indian population directly depends on agriculture and is found to be related to industries for their livelihoods [43].

Indian agriculture is particularly vulnerable to the dangers and shocks brought on by climate change. Due to their economic and social fragility, resource-poor families will face even greater problems because of climate change. A recent study by the George Institute for Global Health Report of India [44] found that while the tribal communities had traditional ecological knowledge about a variety of indigenous foods, the consumption of these foods among women and children in all communities was inadequate, with poor nutrient intake. Vitamin A and iron deficiency was observed among women of the Sauria Paharia and Santhal communities.

Among the Munda women, there was poor intake of all nutrients except protein and vitamin C, while the Ho community had inadequate intake of all nutrients except for Vitamin A, Vitamin C, thiamin, and niacin. A high prevalence of wasting, stunting, and low weight was observed in young children in all the tribes. It is possible to tackle undernutrition in these communities by implementing strategies such as agricultural extension programs that promote indigenous crop varieties and nutrition education sessions to increase dietary diversity using indigenous foods.

The team of researchers from the George Institute recommend that in addition to increasing the demand for locally produced foods, it is important to promote the creation of community seed banks for distributing indigenous seeds, educating indigenous communities on sustainable farming methods to preserve local landraces and drought-resistant varieties, and supporting communities in establishing home gardens. Nutrition education sessions that reinforce traditional ecological knowledge and raise awareness about the nutritional significance of indigenous foods should also be encouraged. These actions are essential for promoting resilient, nutritious, and sustainable food systems[44].

Qualitative discussions carried out by the George Institute Team in its report revealed that climate variability had a significant impact on the agroforestry systems, with reduced crop productivity, diversity and food availability from forests and waterbodies resulting in reduced consumption of indigenous foods. The easy availability of cheap ultra-processed foods in local markets was seen to create a shift in dietary patterns, and promotion of hybrid seeds by local agricultural organizations led to reduced production of indigenous varieties [44].

The research also analysed the value chains of finger millet and Koinaar leaves among some of the Indigenous communities. The study identified postharvest losses, laborious processes, and weather dependence as barriers towards the production and consumption of finger millet, while limited seasonal availability and lack of preservation techniques were associated with reduced production and processing of Koinaar leaves. Improving storage, processing machinery, preservation techniques, and market opportunities could enhance production and consumption of these nutrient-rich indigenous foods. This research has significance to India's program "International Year of Millets 2023" to encourage production and consumption of nutritious millets, (The George Institute Report 2023,[44].

In India, most IP are farmers, such as the Bhil Community and their livelihood and food security are negatively impacted by climate change. The rising temperatures, frequent droughts, and flood reduces the crop fertility and yield. It creates a challenge to the food security of IP. Some of its examples are an increase in drought, agricultural labor migration, unemployment, and high food insecurity. All these factors affect their social capital, food security, access to clean water and sanitation, mental health, the spread of infectious diseases and injuries, and their ability to receive healthcare in this community. To minimize the impact of the challenges faced by the IP of India, it can be recommended that the government of India should promote the health and well-being of the tribal communities in India. It has been identified that many of the people of this community live far from the modern world and the reach of technology.

However, the government should take effective steps to ensure their health and safety. As the variation in climate directly impacts their food security, the government should take steps such as providing health and minimum living requirements to them, such as food, clothing, and shelter. It is important to note that this systematic study reveals that most times, the indigenous group are forced to leave their ancestral land in search of food; in this context, the government should provide them with constant food and accommodation because they are living below the poverty line.

The economic condition of India and the neglect by the policy makers is the challenge of this recommendation. Women and children of this community suffer from hunger and malnutrition because of the unavailability of food. On this note, the government should provide appropriate Healthcare services and medical camps in such areas to provide them healthcare treatment for free.

It has been found that factorial changes directly impact the agriculture and food security of IP in India. It results in poverty, starvation, hunger, and malnutrition. This escalates the economic distress and mental health of these vulnerable sections of society.

Malnutrition is one of India's most serious and persistent problems. As of 2007, an estimated 43 percent of children under five are underweight, a rate more than double that of Sub-Saharan Africa, and five times greater than that of China. Approximately 48 percent of Indians are stunted, 20 percent are wasted, 70 percent are anemic,

and 57 percent are vitamin A deficient [45]. Despite the targeted efforts of national programs, progress has been slow. A more recent study from 2011, conducted across 100 districts, observed that the percentage of children under five who are underweight is 42 percent, representing only a 1 percent decrease since 2007. Indeed, the stunting figure among children under five also increased to 59 percent.

The South Asia Food and Nutrition Security Initiative [46] states that tribal communities lag in every major area important for nutrition, including year-round access to food, delivery of optimal care and feeding practices, and access to health, water, sanitation, and other basic services. Additionally there is low consumption and lack of dietary diversity, derailing nutrition improvements. High poverty levels and low levels of income contribute to lower levels of food security, as well. Various government programs exist to address nutrition, but implementation issues such as supply-side, service delivery and utilization challenges, often at the community level, constrain and reduce effectiveness.

Research and several surveys help understand the significant challenges of food security of such people, aligned with public health issues directly faced by the IP of India. It has been found that the variation in climate results in nutritional insecurity, malnourishment, and wasting amongst indigenous people. As most of the people in this community are farmers, the change impacts their food production. For example, an increase in temperature, drought, flood, and lack of rain damages the food crop, resulting in starvation.

Accordingly, an important area that needs to be explored is 'crop diversification'. Higher profitability and stability in production highlight the importance of crop diversification, e.g. legumes alternative to rice and wheat. Growing of non-cereal crops such as oilseeds, fruits and vegetables etc need to be encouraged. The creation of decentralized food grain banks in each village or block of the district, from which people may get subsidized food grains against food coupons, will be a good option. This concept will improve the delivery of food grains and eliminate corruption [16].

One of the ways to ensure direct access to good quality food that can be easily grown and prepared could be the concept of home gardening. One excellent example of household gardening can be seen in Bangladesh, where, as part of its global effort to eliminate vitamin A deficiency and nutritional blindness, the NGO Helen Keller International implemented a home gardening and nutrition education project [47].

The concept worked upon was that promotion of low-cost vegetable gardens amalgamated with nutrition education could prove to be instrumental for improving the nutritional status, particularly women and young children. As a result of this intervention, the average household income increased and also the nutritional intake. Using community leaders through a group approach will indirectly ensure community participation and will add to the success of the concept.

The major challenge faced by the IP is that their traditional food and wild varieties of food are being eliminated from natural habitat, causing high risk to food stability and security. Also been found that the accessibility or availability of food decreases because of the detrimental effect of variation in climate and weather on prices and availability of food in rural livelihoods.

Public Distribution Systems (PDS) in India play a crucial role in ensuring food security for its population. With the help of targeted Identification, PDS provides subsidized food grains. It supplies essential commodities such as rice, wheat, and sugar. It maintains a buffer stock of food grains to meet emergency requirements, such as natural disasters. It also has an extensive distribution network spread across the country. Fair Price Shops act as the primary distribution points to reach the most vulnerable populations.

Creation of community seed banks for indigenous seeds distribution, education on sustainable farming methods for conservation of local landraces as well as drought-resistant varieties, supporting communities for establishing home gardens, and conducting nutrition education sessions that reinforce TEK and raise interest about IFs and their nutritional significance should be encouraged.

Indigenous people, despite their vast knowledge of the world's territories and guardianship of 80% of global species diversity, are nutritionally vulnerable and experience significant disparities in health outcomes, grounded in poverty and marginalization [48]. This contributes to their inability to realize the potential of their traditional food systems in providing sustainable solutions to the existing nutrition insecurity within the population [49]. Factors like declining traditional knowledge, opportunity cost in access, displacement of traditional crop species by a few major crops, and shifting diets and food cultures have substantially influenced their food systems [50] and led to underutilization of many diverse indigenous food resources [51,52].

CONCLUSION

Food security among indigenous populations in India requires a multifaceted approach that addresses cultural, ecological, and economic challenges. By promoting indigenous food systems, supporting community-led initiatives, and preserving traditional knowledge, we can help ensure the food security and sovereignty of India's indigenous populations. An important area that needs to be explored is crop diversification. Higher profitability and the stability in production highlight the importance of crop diversification, e.g., legumes as an alternative with rice and wheat. Growing of non-cereal crops such as oilseeds, fruits and vegetables etc need to be encouraged. The creation of decentralized food grain banks in each village or block of the district, from which people may get subsidized

food grains against food coupons, will be a good option. This concept will improve the delivery of food grains and eliminate corruption. The primary source of the poor tribal people is their land, therefore, the government must protect the tribes' agricultural land to ensure their food security. As food security is associated with the wider aspect of public health and can influence the mental health and wellbeing of the IP, it is suggested that the government should provide them with basic hygienic food products for survival.

Data Availability: All data are available from the corresponding author and can be shared upon a reasonable request

Conflict of Interest: The author declares no conflict of interest.

Funding: Nil

REFERENCES

1. Global Food Security Index 2022. (1) 23-45
2. Wright, A.L., Gabel, C., Ballantyne, M., Jack, S.M. and Wahoush, O. Using two-eyed seeing in research with indigenous people: an integrative review. International Journal of Qualitative Methods, 2019 18, p.1609406919869695.
3. (Food and Agriculture Organisation, FAO, (3). http://www.fao.org/docrep/005/y4671e/y4671e06.htm, accessed on 22 nd Feb 2025.
4. Worldbank.org, (2022).
5. Census of India (2011)
6. National Health Survey Data (2016)
7. The Indigenous People The World Bank Retrieved April 2024
8. Muckle, Robert J. (2012). Indigenous Peoples of North America: A Concise Anthropological Overview. University of Toronto Press. p. 18. ISBN 978-1-4426-0416-2.
9. "Indigenous Peoples and the United Nations Human Rights System" (PDF). United Nations. p. 2. Retrieved 21 May 2023.
10. Acharya, Deepak and Shrivastava Anshu: Indigenous Herbal Medicines: Tribal Formulations and Traditional Herbal Practices, Aavishkar Publishers Distributor, Jaipur, India. 2008 ISBN 978-81-7910-252-7. p. 440
11. UNHR Fact Sheet No. 9 2013, p. 3.
12. Taylor Saito, Natsu . "Unsettling Narratives". Settler Colonialism, Race, and the Law: Why Structural Racism Persist (eBook). NYU Press. ISBN 978-0-8147-0802-6. Archived from the original on 15 March 2023
13. The International Labour Organization's (ILO) Indigenous and Tribal Peoples Convention, 1989 (ILO Convention No. 169),
14. Sanders, Douglas E. "Indigenous peoples: Issues of definition". International Journal of Cultural Property. 1999 8 (1): 4–13. doi:10.1017/s0940739199770591. ISSN 0940-7391. S2CID 154898887.
15. Secretariat of the Permanent Forum on Indigenous Issues 2009, p. 5.
16. Upadhyay RP and C Palanivel: Challenges in Achieving Food Security in India. Iran J Public Health 2011 Dec 31;40(4):31–36
17. Athreya VB, Rukmani R, Bhavani RV, Anuradha G, Gopinath R, Velan AS. Report on the state of food insecurity in urban India. 2010 Sep;:34. M S Swaminathan Research Foundation. [Google Scholar]
18. Identifying and addressing food insecurity among the urban poor. Summary of the FSN forum discussion No. 35. 27 April – 15 June, 2009. Retrieved from: http://km.fao.org/fileadmin/user_upload/fsn/docs/PROCEEDINGS_Food_Insecurity_Among_Urban_Poor.doc, accessed on 18.2.2021
19. World Bank Report World Development Report 1991 The Challenge of Development
20. Patil, P.D., (2019). Availability of Food: An Issue of Food Security Among Tribal Population In Satpuda Mountain Region of Jalgoan District (MS).
21. Kumar, P., Manjunatha, A.V. and Sourav, S.K. Contract Farming and Land Tenancy in Indian Agriculture. 2020 Sage Publications Pvt. Limited.
22. Chandramouli, C. Release of Primary Census Abstract Data Highlights, Census of India 2011, Registrar General and Census Commissioner of India, 2013 Ministry of Home Affairs
23. Etchart, L. Indigenous Peoples and International Law in the Ecuadorian Amazon. Laws, 2022 11 (4), p.55.
24. Hindustantimes.com, Bhil tribes revive old traditionsFood and to conserve forest and water. 2022 https://www.hindustantimes.com/indore/bhil-tribes-revive-old-tradition-to-conserve-forest-and-water/story-hAI84PTrx0MNF6bFXnuxaJ.html
25. Food and Agriculture Organization Rome FAO.org 2019
26. George, N.A. and McKay, F.H. The public distribution system and food security in India. International journal of environmental research and public health, 2019 16(17), p.3221.
27. Zurayk, R. Pandemic and food security: A view from the Global South. Journal of Agriculture, Food Systems, and Community Development, 2020 9(3), pp.17-21.
28. Sharma, I.P., Kanta, C., Dwivedi, T. and Rani, R.Indigenous agricultural practices: A supreme key to maintaining biodiversity. In Microbiological Advancements for Higher Altitude Agro-Ecosystems & Sustainability (pp. 91-112). 2020 Springer, Singapore.
29. World Bank Group, India's Poverty Profile, available at: https://www.worldbank.org/en/news/infographic/2016/05/27/india-s-poverty-profile (last visited on December 24, 2025) (29)
30. FAO Food and Agriculture Organization Rome FAO.org 2023
31. The International Food Policy Research Institute (IFPRI) further concretes these findings. The study published by the IFPRI, under its 2022 Global Hunger Index (GHI)

32. (Global Hunger Index available at: https://www.globalhungerindex.org/pdf/en/2022.pdf (Last visited on January 2025)
33. Sharma S (2023) Addressing the food insecurity of India through agricultural traditional knowledge, ILI Law Review Summer Issue 2023) – 33
34. United Nations Development Program UNDP (2022)
35. World Food Programme, 2024: (35).
36. Grover, Aakriti, Anju Singh, and R. B. Singh. Sustainable Health Through Food, Nutrition, and Lifestyle 2022 (Springer)
37. McKay, Fiona H., Alice Sims and Paige van der Pligt. "Measuring Food Insecurity in India: A Systematic Review of the Current Evidence", Current Nutrition Reports 2023 12:349–358.
38. El Bilali, H., Bassole, I.H.N., Dambo, L. and Berjan, S. Climate change and food security. Agriculture & Forestry 2020 /Poljoprivreda i Sumarstvo, 66(3).
39. Mukhopadhyay, R., Sarkar, B., Jat, H.S., Sharma, P.C. and Bolan, N.S. Soil salinity under climate change: Challenges for sustainable agriculture and food security. Journal of Environmental Management, 2021 280, p.111736.
40. Nalau, J., Becken, S., Schliephack, J., Parsons, M., Brown, C. and Mackey, B. The role of indigenous and traditional knowledge in ecosystem-based adaptation: A review of the literature and case studies from the Pacific Islands. 2018 Weather, Climate, and Society, 10(4), pp.851-865.
41. Agarwal, B.. Gender equality, food security and the sustainable development goals. Current opinion in environmental sustainability, 2018 34, pp.26-32.
42. Das, S. and Mishra, A.J. Dynamics of indigenous community's food and culture in the time of climate change in the Himalayan region. Journal of Ethnic Foods, 2022 9(1), pp.1-15.
43. Datt, R., Sohane, R.K. and Mahdi, S.S. Indigenous Technical Knowledge Under a Changing Climate. In Innovative Approaches for Sustainable Development 2022 (pp. 21-41). Springer
44. The George Institute for Global Health Report of India (2023) info@georgeinstitute.org
45. International Institute for Population Sciences (IIPS) and Macro International. 2007. National Family Health Survey (NFHS 3), 2005-6: India: Vol I: Mumbai, IIPS
46. SAFANSI (2014) The South Asia Food and Nutrition Security Initiative: A report
47. Talukder A, Kiess L, Huq N, de Pee S, Hill ID, Bloem MW. Increasing the production and consumption of vitamin A–rich fruits and vegetables: Lessons learned in taking the Bangladesh homestead gardening program to a national scale. Food and Nutrition Bulletin. 2000;21(2):165–172. [Google Scholar]
48. IUCN Director General's Statement on International Day of the World's Indigenous Peoples 2019. IUCN (2019) Available online at: https://www.iucn.org/news/secretariat/201908/iucn-director-generals-statement-international-day-worlds-indigenous-peoples-2019 (accessed November 12, 2024). Google Scholar
49. Indigenous Peoples. World Bank. Available online at: https://www.worldbank.org/en/topic/indigenouspeoples (accessed August 20, 2024).
50. Kattides MLM, Lima MGB. Changing food systems and implications for sustainable communities: Cyprus, Canada, and Brazil. Environ J. (2008) 36:45–59.
51. Shelef O, Weisberg PJ, Provenza FD. The value of native plants and local production in an era of global agriculture. Front Plant Sci. (2017) 8:2069. doi: 10.3389/fpls.2017.02069PubMed Abstract | CrossRef Full Text | Google Scholar
52. Tshering K, Thapa L, Matsushima K, Minami M, Nemoto K. Edible wild plants of Bhutan and their contribution to food and nutrition security. In: Durst, P, Bayasgalanbat N, editor. Promotion of Underutilized indigenous food resources for food security and nutrition in Asia and the Pacific. Bangkok: Food and Agriculture Organization (2014), 60–7.

SSN Journal of Management & Technology Research Communications
Vol 2 No (1) Jan-Feb-Mar-Apr 2025
Society for Science and Nature

E-ISSN: 3049-0014
CrossRef DOI: https://dx.doi.org/10.21786/mntrc

Development of Health Insurance in India: Strategic Analysis of the Past, Present, and Future

Pulock Bhattacharji

Vice President Business Development, Skilling, Training & Placement

Bombay Stock Exchange Institute Limited, New Delhi, India.

ABSTRACT

Health insurance in India has evolved significantly over the decades, transitioning from rudimentary government-funded schemes to a more diverse, technology-driven sector. This research paper examines the historical context, present dynamics, and future trajectory of health insurance in India. It explores the policy shifts, technological innovations, and market developments shaping the sector. The study also evaluates current challenges and likeable solutions, aiming to provide a comprehensive understanding of how health insurance can contribute to universal health coverage in India. In conclusion, India's health insurance landscape is at a critical juncture. While the country faces significant challenges, it also has a unique opportunity to leapfrog traditional systems by embracing digital innovation and regulatory reforms. By adopting global best practices, improving infrastructure, and putting customers at the center of operations, TPAs and insurers can transform into agile, tech-enabled, and trusted pillars of India's healthcare ecosystem.

KEY WORDS: HEALTH INSURANCE, INDIA, POLICY, UNIVERSAL HEALTH COVERAGE, AYUSHMAN BHARAT, IRDAI, DIGITAL HEALTH.

INTRODUCTION

AIndia's healthcare system is one of the most complex in the world, characterized by a mix of public and private service providers and a vast demographic landscape. The financial burden of healthcare on Indian households remains significant, with out-of-pocket expenditure constituting nearly 55–60% of the total health spending [1,2]. Health insurance is increasingly seen as a pivotal tool in bridging the accessibility and affordability gap. It contributes about 29% of the insurance industry's premium income and serves as a financial safety net for millions [3]. While still developing, the sector shows promise in delivering accessible healthcare solutions across socio-economic strata [4,5].

Article Information: *Corresponding Author: pulock.bhattacharji@sebiti.com
Received 16/02/2025 Accepted after revision 29/03/2025
Publication Date: 30th April 2025 Pg No- 44-49

Available at: https://mntrc.in/
DOI: http://dx.doi.org/10.21786/mntrc/2.1.5

India's journey in health insurance has evolved significantly from limited government employee coverage to ambitious goals of universal health coverage (UHC) by 2030 [3]. In the pre-1986 era, health coverage was primarily provided through schemes like the Employees' State Insurance (ESI) in 1952 and the Central Government Health Scheme (CGHS) in 1954 [6]. Between 1986 and 1999, the landscape began to change with the introduction of Mediclaim policies by the General Insurance Corporation (GIC). The period was also marked by the formation of the Insurance Regulatory and Development Authority of India (IRDAI) in 1999, a crucial step toward regulating and liberalizing the sector [3]. Post-2000, the sector witnessed accelerated growth. Private insurers entered the market, and public schemes like the Rashtriya Swasthya Bima Yojana (RSBY) were introduced in 2008 [7].

Coverage increased substantially, driven by competition and innovation. Products diversified into critical illness plans, family floaters, and senior citizen coverage. In the current scenario, the launch of Ayushman Bharat – Pradhan Mantri Jan Arogya Yojana (PMJAY) in 2018 has been transformative, aiming to cover over 50 crore beneficiaries from economically vulnerable groups

[8]. Today, around 30% of the Indian population has some form of health insurance, though rural penetration remains low [1]. There is now a wide variety of specialized plans including coverage for maternity, chronic diseases, and lifestyle-related conditions [9,10].

Literature review also suggests numerous challenges faced by the industry, including implementation inconsistencies, high out-of-pocket (OOP) expenses, coverage gaps, fragmentation in healthcare delivery, opaque billing practices as well as widespread fraud, etc. in the last 2 decades. Literature by Sengupta and Nundy (2005) points out that the lack of standardized treatment protocols and weak digital infrastructure significantly hampers the efficiency of claim management [6]. Moreover, empirical research shows that TPAs often face operational bottlenecks due to manual claim processing, limited interoperability with hospitals, and regulatory overload. These structural inefficiencies contribute to delayed settlements, poor customer satisfaction, and high loss ratios for insurers.

Internationally, comparative studies shed light on how countries like Germany, the United States, and Singapore have successfully integrated technology and regulation to create more resilient insurance ecosystems. For instance, the use of ICD and CPT codes in the U.S. [11], Germany's sickness fund model [12], and Singapore's NEHR-enabled MediShield framework [13] serve as benchmarks in reducing fraud, standardizing care, and improving transparency.

Literature from global agencies such as the World Health Organization [2] and the World Bank (2020) also advocates for digitization, public-private partnerships, and health system interoperability as key drivers of efficiency. Indian policy papers and industry whitepapers, including those by CII (2021) and NITI Aayog (2021), suggest that adopting such best practices—particularly through initiatives like the Ayushman Bharat Digital Mission (ABDM)—can help overcome many of the domestic challenges faced by insurers and TPAs [4,9].

This paper delves into the evolution of health insurance in India, from its nascent stages to its present form and anticipates future developments driven by technology, policy, and societal needs.

METHODOLOGY

This research employs a qualitative approach supplemented by quantitative data analysis. Sources include secondary data from IRDAI reports, National Health Accounts, WHO, and World Bank. Policy documents from the Ministry of Health and Family Welfare as well as academic journals, white papers, and industry reports.

The data was analyzed to trace historical trends, understand current dynamics, and forecast future developments. Thematic analysis was used to identify recurring patterns and challenges.

RESULTS AND DISCUSSION

The collective findings from multiple studies paint a nuanced picture of health insurance development in India. The evolution of health insurance in India, as outlined in the timeline, reveals a significant transformation from a limited, government-centric model to a more diversified and technology-enabled ecosystem (Table 1).

While there is evidence of progress—such as improved access to hospitalization, increased enrollment, and a gradual expansion of coverage—significant gaps remain in terms of financial protection, awareness, and service delivery. Many studies highlight that health insurance schemes, particularly public ones like RSBY, have not significantly reduced out-of-pocket expenses. Socio-economic factors such as education and income continue to influence enrollment rates, with rural and low-income populations often underrepresented due to low awareness and systemic barriers. Regulatory reports from IRDAI corroborate these findings by noting growth in insurance uptake but also persistent challenges like claim rejections and service quality concerns. These results underscore the need for targeted reforms and greater inclusion to make health insurance more equitable and effective (Table 2).

Despite increasing efforts, the literature underscores persistent challenges like lack of awareness, limited rural outreach, and inadequate product customization. However, recent years have seen a surge in digital innovations and government initiatives, pointing to a promising future. The key challenges faced by Health Insurance companies and TPAs in India are given below (Table 3).

DISCUSSION

The comparative table illustrates a gradual but impactful evolution of India's health insurance landscape. Initially constrained by state-funded programs with limited scope, the sector saw pivotal changes in the mid-1980s with the launch of Mediclaim, marking the entrance of private insurers. However, true sectoral growth began post-2000 with liberalization and the formation of the Insurance Regulatory and Development Authority of India (IRDAI), which provided a regulatory framework that encouraged competition and innovation [3].

In the current scenario, the sector has diversified with various products tailored for specific demographics. Digital transformation has played a key role in improving accessibility and reducing bureaucratic delays [9]. Nevertheless, persistent challenges—especially high out-of-pocket expenses and low rural outreach—suggest that innovation must be paired with inclusive policy frameworks [1].

A major challenge is the fragmented healthcare system. India's hospitals and providers lack uniform treatment protocols, billing formats, and coding practices. There's a stark variation in pricing and care quality, particularly between urban and rural areas. This contrasts

with countries like the United States and Germany, where standardized billing codes (ICD, CPT) and unified healthcare practices are the norm [11, 12]. Singapore's National Electronic Health Record (NEHR) is another example of seamless integration [13]. To address this in India, implementing standard treatment guidelines and mandatory coding systems across providers, along with encouraging NABH accreditation, can bring much-needed uniformity.

Table 1. Historical Mile stones in India's Health Insurance Sector

Category	Pre-1986	1986–1999	Post-2000	Current Scenario	Future Outlook
Policy Initiatives	ESI (1952), CGHS (1954)	Introduction of Mediclaim by GIC	RSBY (2008), IRDAI establishment (1999)	Ayushman Bharat - PMJAY	UHC by 2030, Expansion of Ayushman Bharat
Coverage	Minimal, mostly government employees	Very limited	Increased with private insurers and public schemes	~30% of population covered	Target: Coverage Universal
Product Variety	Not applicable	Standard Mediclaim policies	Critical illness, family floater, senior citizen plans	Specialized plans for maternity, chronic disease	Micro-insurance sachet-based plans
Technology	None	Manual processing	Limited digital support	Digital platforms (Acko, Policybazaar, etc.)	AI, blockchain, wearables integration
Challenges	Public funding limitations	Low awareness	Implementation inconsistencies	Low rural penetration, high OOP, trust issues	Integration, real-time data sharing, inclusiveness

Table 2. The key areas of focus and findings in the Health Insurance sector in India

Study	Key Focus	Major Findings
Berman, P. et al. (2010) [14]	Out-of-pocket expenditure and insurance penetration	Highlighted catastrophic health expenses affecting a large portion of the population, inadequate financial protection from existing insurance mechanisms
Karan, A. et al. (2017) [15]	Effectiveness of RSBY and public schemes	Found improved access to hospitalization, but limited reduction in out-of-pocket expenses; variability in state-level implementation
Nair et al. (2007) [16]	Awareness and utilization of health insurance among rural households	Found low awareness levels and underutilization of health insurance in rural areas. Education and income were significant predictors of enrollment.
Binny & Gupta (2017) [17]	Role of health insurance in improving healthcare access	Health insurance improved access to healthcare services and reduced out-of-pocket expenses, especially among low-income groups.
Nandi, A. et al. (2016) [18]	Socio-economic factors influencing insurance enrollment	Demonstrated that education and income significantly influence enrollment; stressed on need for awareness and inclusion programs
Reshmi et al. (2021) [19]	Impact of health insurance on financial protection and health outcomes	Showed that insured individuals experienced better health outcomes and reduced catastrophic health expenditures.
Kalita et al. [20]	Challenges and barriers in health insurance enrollment	Identified barriers such as lack of awareness, mistrust in schemes, and administrative hurdles as key challenges to enrollment.
IRDAI Annual Reports [3]	Market trends and regulatory insights	Documented growth in insured population, premium collections, and claim settlements; highlighted persistent issues like claim rejections and service quality
World Bank & WHO Reports [1,2]	Global policy perspective on UHC	Advocated for financial risk protection through health insurance; emphasized integration, pooling mechanisms, and increased public health spending
Saxena et al. (2023) [21]	Effectiveness of government-sponsored health insurance programs	Concluded that while government schemes like PMJAY improved access to care, gaps remained in service quality and scheme awareness.

Table 3. Key Areas, Challenges and Likeable solutions in the Health insurance sector

Variables	Key Challenges	Likely Solutions
Healthcare System	- Fragmented ecosystem with inconsistent billing and protocols	- Standardize billing codes (ICD-10, CPT) - Empanel only accredited hospitals (e.g., NABH)
Claims & Fraud	- High claim ratios - Fraudulent claims, inflated bills	- AI/ML-based fraud analytics - Central fraud watchlist - Pre/post-audits of high-value claims
Data Infrastructure	- Limited digitization in hospitals - Lack of interoperability	- Push digitization via ABDM - API integrations for real-time data sharing
Claim Processing	- Manual workflows - Delays due to poor coordination	- Automate with RPA & workflows - Dedicated support teams for faster turnaround
Regulatory Compliance	- Frequent IRDAI updates - Capped pricing on treatments	- Establish compliance teams - Engage with regulators through industry forums
Customer Experience	- Policyholders unaware of coverage limits - Poor grievance redressal	- Simplify policy documents - Use AI chatbots and mobile apps for real-time support
Hospital Network	- Quality control across empanelled hospitals - Non-standard pricing	- Hospital scoring/rating systems - Use analytics to monitor and optimize hospital networks
Cybersecurity & Privacy	- Rising risk of data breaches with digitization	- Invest in cybersecurity tools - Comply with data privacy laws
Manpower & Skills	- Shortage of trained claims processors - High attrition	- Launch medical coding training programs - Improve employee retention with career pathways
Public Scheme Competition	- Ayushman Bharat & other schemes offer free/low-cost care	- Differentiate via faster claims, value-added services - Collaborate with government as implementation partners

Fraudulent claims and high claim ratios represent another critical issue. With inflated bills, ghost patients, and unnecessary procedures becoming commonplace, insurers and TPAs suffer financial losses. Globally, countries like the USA use AI-based fraud detection and maintain databases for fraudulent providers [11]. Germany ensures compliance through tight audits by sickness funds [12]. In India, similar mechanisms—like deploying AI/ML to detect anomalies, maintaining a central blacklist of errant providers, and conducting real-time audits—can help mitigate fraud effectively [13].

One of the most foundational problems is the lack of robust data infrastructure. Many hospitals still operate with paper-based records, which leads to delays and inaccuracies in claims processing. In contrast, countries like Estonia have digitized their entire national health system, while the USA mandates FHIR-based interoperability between health IT systems [11]. India's Ayushman Bharat Digital Mission (ABDM) offers a promising solution by pushing hospitals toward electronic health records and real-time data exchange through open APIs [4].

Delayed claim processing remains a significant pain point for TPAs, primarily due to manual workflows and a lack of automation. Compared to countries like South Korea or Germany, where claim processing is often completed in days through digital systems [12], Indian TPAs deal with excessive paperwork and coordination delays. Automating backend processes using robotic process automation (RPA), real-time dashboards, and fast-track approvals for low-risk claims can greatly improve efficiency and customer satisfaction [9].

Regulatory compliance in India poses another operational burden. Constant updates from IRDAI and pricing caps create a highly dynamic and often restrictive environment. While countries like Germany and the USA also have stringent regulations, they tend to offer more stable and predictable frameworks [11,12]. Indian TPAs should establish dedicated compliance teams to adapt quickly and participate in industry forums like FICCI or CII to ensure that regulatory reforms consider practical implications [3].

Customer experience, too, remains suboptimal in India. Many policyholders are unaware of exclusions, sub-limits, or waiting periods, leading to frustration during claims. Globally, insurers in the US are required to provide clear Explanation of Benefits (EOBs), and Singapore's HealthHub app offers full transparency to policyholders (Ministry of Health Singapore, 2021). Indian TPAs can replicate these practices by creating simplified, visually engaging policy summaries, leveraging AI-driven chatbots, and setting up real-time alerts to guide customers through the claim journey [4].

Managing hospital networks is a unique challenge in India, with insurers having to deal with thousands of hospitals with varying service quality and pricing. This is unlike countries such as Germany or Singapore, where provider tariffs and quality standards are negotiated centrally [12,13]. TPAs in India should consider grading hospitals based on past claims, outcomes, and service quality while using analytics to streamline the empanelment and de-empanelment process.

As TPAs move toward digital ecosystems, cybersecurity and data privacy become critical. India's Digital Personal Data Protection (DPDP) Act introduces new responsibilities for data handlers, similar to GDPR in the EU or HIPAA in the US [1]. Indian insurers and TPAs must invest in encrypted systems, conduct regular security audits, and ensure compliance with evolving data laws [2].

Another operational issue is the shortage of skilled professionals in claims adjudication, coding, and fraud analytics. While countries like the US and Germany offer formal certifications and career tracks in health insurance operations [11, 12, India faces a dearth of trained talent. To overcome this, TPAs can partner with educational institutes to launch certification programs and create structured career pathways to retain talent and reduce attrition [21].

Finally, government health schemes like Ayushman Bharat have created pricing pressure on private health insurers and TPAs, as public schemes offer free or subsidized care. However, this is not unique to India—Germany and Singapore also have basic public insurance, with private insurers offering top-up or supplementary plans [12,13]. Indian insurers should similarly focus on creating differentiated offerings—such as faster claim approvals, wellness programs, and superior customer service—while also exploring partnerships with state or national schemes as technology or process partners.

CONCLUSION

In conclusion, India's health insurance landscape is at a critical juncture. While the country faces significant challenges, it also has a unique opportunity to leapfrog traditional systems by embracing digital innovation and regulatory reforms. By adopting global best practices, improving infrastructure, and putting customers at the center of operations, TPAs and insurers can transform into agile, tech-enabled, and trusted pillars of India's healthcare ecosystem.

Data Availability: Data are available with the author, can be shared on a reasonable request.

Funding: Nil

Conflict of interest statement: The author declares no conflict of interest.

REFERENCES

1. World Bank. Health Financing in India: Opportunities and Challenges [Internet]. World Bank; 2020 [cited 2025 Apr 3]. Available from: https://www.worldbank.org
2. World Health Organization (WHO). Global Spending on Health: A World in Transition [Internet]. WHO; 2019 [cited 2025 Apr 3]. Available from: https://www.who.int
3. Insurance Regulatory and Development Authority of India (IRDAI). Annual Report 2020-21 [Internet]. IRDAI; 2021 [cited 2025 Apr 3]. Available from: https://irdai.gov.in
4. NITI Aayog. Health System for a New India: Building Blocks [Internet]. Government of India; 2021 [cited 2025 Apr 3]. Available from: https://www.mcrhrdi.gov.in
5. Kadam S. Possible domains for integrating Artificial Intelligence (AI) in healthcare sector. Int J Ayurveda Res. 2024;5(4):239-43.
6. Sengupta A, Nundy S. The private health sector in India. BMJ. 2005;331(7526):1157-8.
7. Government of India. Rashtriya Swasthya Bima Yojana (RSBY) [Internet]. Ministry of Labour and Employment, Government of India; 2008 [cited 2025 Apr 3]. Available from: https://www.india.gov.in/spotlight/rashtriya-swasthya-bima-yojana
8. Ministry of Health and Family Welfare, Government of India. Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana [Internet]. 2018 [cited 2025 Apr 3]. Available from: https://nha.gov.in/PM-JAY
9. Confederation of Indian Industry (CII) & Boston Consulting Group (BCG). Health Insurance Vision 2025 [Internet]. CII; 2021 [cited 2025 Apr 3]. Available from: https://cii.in
10. Huguet N, Hodes T, Liu S, Marino M, Schmidt TD, Voss RW, et al. Impact of Health Insurance Patterns on Chronic Health Conditions Among Older Patients. J Am Board Fam Med. 2023;36(5):839-50.
11. Centers for Medicare & Medicaid Services (CMS). ICD-10-CM Official Guidelines for Coding and Reporting. CMS; 2020.
12. Busse R, Blümel M, Knieps F, Bärnighausen T. Statutory health insurance in Germany: A health system shaped by 135 years of solidarity, self-governance, and competition. Lancet. 2017;390(10097):882-97.
13. Ministry of Health, Government of Singapore. National Electronic Health Record (NEHR) [Internet]. 2021 [cited 2025 Apr 3]. Available from: https://www.synapxe.sg
14. Berman P, Ahuja R, Bhandari L. The impoverishing effect of healthcare payments in India: New methodology and findings. Econ Polit Wkly. 2010;45(16):65-71.
15. Karan A, Selvaraj S, Mahal A. Moving to universal coverage? Trends in the burden of out-of-pocket payments for health care across social groups in India, 1999-2014. PLoS One. 2017;12(1):e0170102.
16. Reshmi B, Nair NS, Sabu KM, Unnikrishnan B. Awareness

and utilization of health insurance among rural households in Udupi taluk, Karnataka State, India: A community based study. Health Popul Perspect Issues. 2008;31(1):35–44.

17. Binny, Gupta M. Health insurance in India: Opportunities and challenges. Int J Manag IT Eng. 2017;7(5):168-75.
18. Nandi A, Ashok A, Laxminarayan R. The socioeconomic and institutional determinants of participation in India's health insurance scheme for the poor. PLoS One. 2016;11(8):e0160472.
19. Reshmi B, Unnikrishnan B, Rajwar E, Parsekar SS, Vijayamma R, Venkatesh BT. Impact of public-funded health insurances in India on health care utilisation and financial risk protection: a systematic review. BMJ Open. 2021 Dec 22;11(12):e050077.
20. Kalita A, Carton-Rossen N, Joseph L, Chhetri D, Patel V. The Barriers to Universal Health Coverage in India and the Strategies to Address Them: A Key Informant Study. Ann Glob Health. 2023 Oct 9;89(1):69.
21. Saxena A, Trivedi M, Shroff ZC, Sharma M. Improving hospital-based processes for effective implementation of government-funded health insurance schemes: Evidence from early implementation of PM-JAY in India. BMC Health Serv Res. 2022;22(1):1-13.

SSN Journal of Management & Technology Research Communications
Vol 2 No (1) Jan-Feb-Mar-Apr 2025
Society for Science and Nature

E-ISSN: 3049-0014
CrossRef DOI: https://dx.doi.org/10.21786/mntrc

Nutritional and Health Beneficial Properties of Psoralea corylifolia and Withania somnifera: A Comprehensive Review

Tasneem Husain

Department of Biotechnology and Zoology,

Saifia College of Science, Bhopal- 462001, India.

ABSTRACT

Medicinal plants have been a cornerstone of traditional medicine for centuries, offering a wide range of bioactive compounds with therapeutic effects. Among them, *Psoralea corylifolia* (Babchi) and *Withania somnifera* (Ashwagandha) are medicinal plants extensively used in traditional and modern medicine for their diverse therapeutic and nutritional benefits. *Psoralea corylifolia* is a rich source of bioactive compounds such as flavonoids, coumarins, bakuchiol, and essential oils, which contribute to its potent antioxidant, antimicrobial, anti-inflammatory, and hepatoprotective properties. Traditionally, it has been employed in managing skin disorders, osteoporosis, vitiligo, and immune-related conditions. *Withania somnifera*, known as Ashwagandha, is a well-established adaptogenic herb with a broad spectrum of pharmacological benefits. It contains withanolides, alkaloids, and saponins, which are crucial in stress management, neuroprotection, anti-aging, and immune modulation. Its anxiolytic, anti-fatigue, and cognition-enhancing properties have made it a valuable component in managing neurodegenerative disorders, anxiety, and fatigue-related syndromes. Moreover, its anti-inflammatory and anti-diabetic effects contribute to improved metabolic health and overall well-being. Both plants exhibit significant potential in modern integrative medicine due to their ability to regulate oxidative stress, enhance immune function, and modulate inflammatory pathways. Their nutritional and therapeutic applications extend to functional foods, nutraceuticals, and pharmaceutical formulations. This comprehensive review highlights their phytochemical composition, nutritional and potential health benefits, emphasizing their role in disease prevention and holistic health management. Understanding the synergistic effects of these botanicals can pave the way for novel therapeutic strategies and evidence-based applications in clinical and dietary interventions.

KEY WORDS: BIOACTIVE COMPOUNDS, *PSORALEA CORYLIFOLIA, WITHANIA SOMNIFERA*, NUTRITIONAL BENEFITS.

INTRODUCTION

Medicinal plants have been an integral part of traditional medicine systems across various cultures, offering therapeutic benefits through their bioactive compounds. For centuries, these plants have played a crucial role in healing practices, providing natural remedies for a wide range of ailments [1,2]. Their bioactive constituents, including alkaloids, flavonoids, terpenoids, and polyphenols, exhibit diverse pharmacological properties such as anti-inflammatory, antimicrobial, antioxidant, and analgesic effects. As interest in natural medicine continues to grow, scientific research is increasingly validating the efficacy of medicinal plants, paving the way for their integration into modern healthcare and pharmaceutical development [3,4]. Among them, (commonly known as Babchi) and *Withania somnifera* (commonly known as Ashwagandha) are widely recognized for their medicinal and nutritional properties. These plants have been extensively used in Ayurveda,

Article Information: *Corresponding Author: tasneem19.11@gmail.com
Received 02/01/2025 Accepted after revision 29/03/202
Publication Date: 30th April 2025 Pg No- 50-55

Available at: https://mntrc.in/
DOI: http://dx.doi.org/10.21786/mntrc/2.1.6

Traditional Chinese Medicine, and other indigenous healing practices for their diverse pharmacological activities [5].

Psoralea corylifolia, also known as "Babchi" or "Bu gu zhi" in traditional Chinese medicine, is a perennial herbaceous plant belonging to the Fabaceae family. *P. corylifolia* is indigenous to Asia, mainly China and India, and has been used in traditional medical systems for ages [6]. It is a commonly used spice and medicinal plant in the region and is often used in flavorings and pharmaceuticals [7, 8]. *Psoralea corylifolia* is valued for its rich composition of flavonoids, coumarins, and essential oils, which contribute to its antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective properties. It has been traditionally utilized for managing skin disorders like psoriasis, vitiligo, eczema and leprosy, bone health, and reproductive wellness.

Similarly, Withania somnifera, often referred to as the "Indian Ginseng," has been used in Ayurvedic medicine for more than 3000 years. It belongs to the Solanaceae (nightshade) family of plants, and grows wild in Africa, the Mediterranean and India. Ashwagandha is also cultivated for medicinal purposes [9]. Although the berries and leaves appear to have medicinal properties, it is the roots that have been traditionally employed and are the focus of modern medical research. It is renowned for its adaptogenic and rejuvenating properties. It contains a wide array of bioactive compounds, including withaferin A, withanolides, alkaloids, and saponins, which exhibit immunomodulatory, neuroprotective, and anti-stress effects [10, 11]. This review aims to provide a comprehensive evaluation of the nutritional and health-beneficial properties of *Psoralea corylifolia* and *Withania somnifera*. It explores their phytochemical composition, pharmacological activities, and potential applications in modern healthcare. By analyzing recent scientific findings, this review highlights the therapeutic potential of these medicinal plants and their role in promoting human health and well-being.

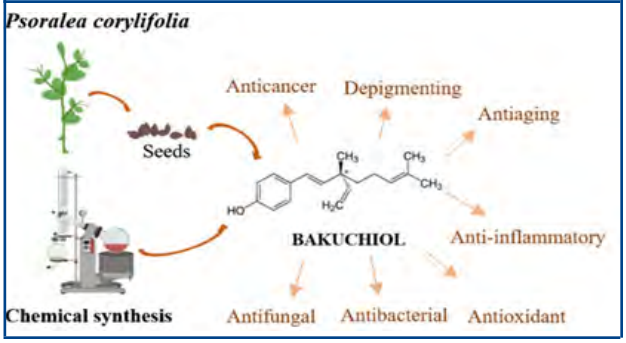
Psoralea corylifolia: *Psoralea corylifolia*, also known as "Babchi" or "Bu gu zhi" in traditional Chinese medicine, is a perennial herbaceous plant belonging to the Fabaceae family. *P. corylifolia* is indigenous to Asia, mainly China and India, and has been used in traditional medicine for generations [12]. The plant is extremely valuable biologically, and it has long been used to treat a variety of skin ailments, including psoriasis, leukoderma, and leprosy.

P. corylifolia is valued in traditional Chinese medicine (TCM) for its numerous medicinal properties, and it has been used to treat a variety of ailments, including skin disorders and reproductive health issues. *P. corylifolia* has been valued for centuries for its dermatological characteristics, especially in the treatment of skin conditions such as psoriasis, eczema, and vitiligo. Its seeds contain bioactive compounds, such as furanocoumarins like psoralen, which have long been utilized to improve skin pigmentation and alleviate dermatological complaints [13, 14].

Pharmacological research on *P. corylifolia* extends well beyond its dermatological uses. This remarkable botanical exhibits a broad spectrum of medicinal properties, including anti-inflammatory, antioxidant, antidiabetic, and hepatoprotective effects. Its diverse pharmacological benefits highlight its importance in traditional medicine and its potential as a valuable therapeutic agent in modern pharmacology. With the growing demand for natural remedies and traditional treatments, interest in the pharmacological potential of botanicals like *P. corylifolia* is also increasing. The plant's rich chemical composition and bioactive compounds offer promising avenues for drug discovery and development. Given the rising prevalence of chronic diseases and the challenge of antibiotic resistance, there is a pressing need for novel therapeutic agents with diverse mechanisms of action. *P. corylifolia* stands out as a promising candidate due to its multifaceted pharmacological properties and long history of use in traditional medicine [15].

Phytochemical composition of *Psoralea corylifolia*: *P. corylifolia,* a member of the Fabaceae family, has a diverse phytochemical profile throughout its plant sections. The seeds, fruits, roots, and aerial sections of *P. corylifolia* contain a varied array of chemical components. A literature review revealed over 155 phytochemicals belonging to different chemical classes viz flavones, coumarins, monoterpenes, chalcones, lipids, resins, stigmasteroids and flavonoids have been isolated from *P. corylifolia* plant parts [16]. Some of its important pharmacologically active constituents are bakuchiol, corylin, genistein, isobavachalcone, isopsoralen, psoralen, psoralidin which attributes to its anti-microbial, anti-inflammatory, anti-psoriasis, anti-vitiligo, anti-cancer, and many other activities. It is interesting to note that most of the active constituents of this herb are found in the seeds. These compounds are crucial and widely used in traditional medicine, skincare, and modern pharmacology [17, 18].

Figure 1: The comprehensive pharmacological benefits of *Psoralea corylifolia* (Adapted from [17])



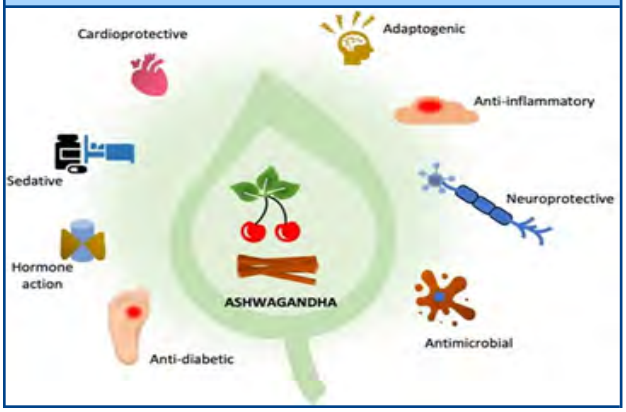
Traditional Uses Exploration: *P. corylifolia* has been used traditionally across several cultural systems for ages. In traditional Chinese medicine (TCM), it is regarded for its varied therapeutic capabilities and is used to cure a variety of diseases. Traditional use includes the treatment of skin illnesses such as psoriasis, eczema, and vitiligo, owing to its ability to promote skin pigmentation and reduce symptoms. It is also used for its anti-inflammatory, antibacterial, and analgesic qualities, making it an attractive option for treating inflammatory diseases and infections [19]. Furthermore, *P. corylifolia* is used to promote reproductive health,

increase libido, and treat menstruation irregularity. Scientific data supporting these traditional uses continues to develop, validating the efficacy of *P. corylifolia* in traditional medicinal systems [20].

Bioactive compounds derived from *Psoralea corylifolia* have a wide range of pharmacological actions, making them a promising therapeutic target. Studies have shown that it has anti-inflammatory qualities, which are attributed to compounds such as bakuchiol and flavonoids that suppress pro-inflammatory mediators [21]. Furthermore, *P. corylifolia* extracts have powerful antioxidant properties, scavenging free radicals and protecting cells from oxidative damage. Its antibacterial capabilities have been tested and found effective against numerous bacterial and fungal diseases. Furthermore, *P. corylifolia* chemicals have anti-diabetic properties by controlling glucose metabolism and insulin sensitivity. Hepatoprotective qualities have also been found, with substances such as bakuchiol protecting the liver from toxins and oxidative stress. Furthermore, research indicates anticancer potential, with *P. corylifolia* substances displaying cytotoxic effects on cancer cells and suppressing tumor growth via multiple methods [22].

***Withania somnifera*:** Indian ginseng, also known as Ashwagandha, Indian winter cherry, or *Withania somnifera*, has been a cornerstone of Ayurvedic medicine since ancient times. Traditionally valued for its nervous system-strengthening properties, this herb boasts adaptogenic effects and medicinal uses, earning its reputation as a potent 'rasayana' or rejuvenating agent. [23, 24].

Figure 2: The comprehensive health benefit of Ashwagandha (Adapted from [24])



Ashwagandha's rich history in traditional Indian medicine spans nearly 3000 years, with its root utilized for diverse purposes, including as an aphrodisiac, narcotic, tonic, diuretic, anthelmintic, and stimulant. Native to India, it is also cultivated in regions like the Mediterranean countries, the Himalayan areas, Africa, Canary Islands, Cape of Good Hope and Australia [25,26]. In recent years, Ashwagandha has garnered significant attention for its potential health benefits, particularly in enhancing stress resilience, cognitive function, and physical performance. Research suggests that Ashwagandha supplementation may offer neuroprotection, relief from obsessive-compulsive disorder, and exhibit anti-inflammatory, immunomodulatory, and antibacterial properties [27].

Furthermore, there is evidence that Ashwagandha administration may aid with infertility, cancer, and diabetes treatment. Studies have revealed that Ashwagandha may display cardioprotective qualities, be useful in the treatment of sleep disorders, improve stress resilience, reduce anxiety, be beneficial in hypothyroidism, and promote muscle strength and recovery [28,29]. Although Ashwagandha shows potential health benefits, more research is required to uncover how it works and confirm its effectiveness in addressing different health issues.

Nutritional and Chemical Composition: Ashwagandha has gained attention from researchers due to its beneficial bioactive compounds. The primary active constituents of *W. somnifera* are alkaloids, including ashwagandhine, anaferin, and steroidal compounds (such as withaferin A and withanolides A-Y) [30]. Various phytochemicals have been extracted from different parts of the Ashwagandha plant (aerial portions, berries, leaves, and roots). Approximately 13 alkaloids, 138 withanolides, and numerous sitoinosides have been reported in Ashwagandha. However, the primary bioactive compounds in Ashwagandha are withanolide A, withanolide D, and withaferin A [31, 32]. These withanolides play pivotal roles in conferring therapeutic benefits, and include withaferin A, withanolide D, and sitoindosides-IX and X [33,34]. Additionally, from the aerial parts of Ashwagandha, withanosmoniferin-A, and five dihydroxy withanolide-R have been extracted. Other components identified in the species include reducing sugars, starch, acylsterylglucosides, hentriacontane, ducitol, glycoside withanolides (withanosides-IV, V and VI), and alkaloids such as anaferin, choline, hygrine, and somniferine, among others [35,36].

Table 1. Nutritional composition of root powder per 100 grams

Nutritional content	*W. somnifera* root powder	References
Moisture (%)	7.45	[40,41]
Ash (g)	4.41	
Protein (g)	3.9	
Fat (g)	0.3	
Crude fiber (g)	32.3	
Energy (kcal)	245	
Carbohydrate (g)	49.9	
Iron (mg)	3.3	
Calcium (mg)	23	
Total carotene (µg)	75.7	
Vitamin C (mg)	3.7	

In addition to these bioactive ingredients, Ashwagandha contains amino acids, including tryptophan. Notably, the precise

composition and concentration of bioactive components vary significantly. They are influenced by factors such as the cultivation conditions, specific parts of the plant, and extraction methods [37]. Previous studies indicate that Ashwagandha's active compounds impart adaptogenic properties, which may have a positive impact on health. Moreover, saturated, and unsaturated fatty acids have been extracted in Ashwagandha [38, 39], and its roots are notably rich in iron, playing a crucial role in haem production and oxygen transport throughout the body. Additionally, W. somnifera roots provide a significant source of dietary fiber, as highlighted in Table 1.

Therapeutic and Nutritional Benefits of *Psoralea corylifolia* and *Withania somnifera*: Herbal medicines have been used in traditional healing systems for centuries. Among them, *Psoralea corylifolia* (Babchi) and *Withania somnifera* (Ashwagandha) are well-known for their medicinal properties. These plants offer a wide range of therapeutic and nutritional benefits, making them valuable in natural medicine and holistic health practices. *Psoralea corylifolia*, also known as Babchi, is a rich source of antioxidants, including flavonoids, phenolic acids, and terpenoids, which can help protect against oxidative stress and inflammation. It is also a good source of minerals like potassium, magnesium, and iron, essential for maintaining various bodily functions. *Psoralea corylifolia* is traditionally used in Ayurvedic and Chinese medicine for treating various skin conditions, including vitiligo, psoriasis, eczema, and leprosy. Psoralen, a major component, is used in PUVA (Psoralen + UVA) therapy for repigmentation in vitiligo. Its anti-inflammatory and wound-healing properties make it effective for acne and dermatitis treatment. Additionally, *Psoralea corylifolia* has been shown to exhibit antimicrobial and antifungal properties, making it a potential natural remedy for infections [42,43].

While *Withania somnifera* (Ashwagandha) is widely recognized for its dermatological benefits, owing to its rich content of withanolides, alkaloids, flavonoids, and antioxidants. It is also a good source of vitamins A, C, and E, as well as minerals like potassium, magnesium, and iron. It supports skin health through its anti-inflammatory, anti-aging, wound-healing, and antimicrobial properties [44]. Ashwagandha helps in reducing dark spots and pigmentation by inhibiting melanin production. Its natural skin-lightening properties improve overall skin tone and radiance. The ability to promote collagen synthesis, reduce stress-induced skin issues, and protect against environmental damage makes it an excellent choice for holistic skincare [45].

Both *Psoralea corylifolia* and Ashwagandha can help to boost the immune system, though Ashwagandha is more commonly used for immune support. As it also works synergistically for reducing stress, improving skin conditions, and enhancing overall well-being. While Ashwagandha is primarily an adaptogen and Psoralea corylifolia focuses more on skin and bone health, combining the two can provide a comprehensive therapeutic approach for those dealing with chronic inflammation and stress. Both plants have been shown to have neuroprotective effects, and may help protect against neurodegenerative diseases like Alzheimer's and Parkinson's. Overall, *Psoralea corylifolia* and Withania somnifera are two medicinal plants with a wide range of nutritional and therapeutic applications, and have the potential to provide natural remedies for various health conditions. These two herbs can be used individually or together as a part of a holistic approach to health, supporting both physical and mental wellness [46].

Future Perspectives: The increasing interest in natural health solutions has positioned *Psoralea corylifolia* and *Withania somnifera* as promising candidates for various therapeutic and nutritional applications. However, several aspects are required for further exploration and development to fully harness their potential. Future research and development should focus on enhancing bioavailability, ensuring sustainable cultivation, achieving regulatory compliance, and integrating these herbs into evidence-based healthcare models. With continued scientific innovation and interdisciplinary collaboration, these medicinal plants may emerge as key contributors to natural therapeutics and functional nutrition in the years to come.

An upcoming study will conduct an in-depth analysis of *P. corylifolia* phytochemistry and pharmacology, exploring its bioactive compounds and therapeutic potential. Building on existing research, the study aims to highlight the potential of *P. corylifolia* and *Withania somnifera* in drug discovery and development. Through rigorous research, scientists seek to uncover the full range of benefits offered by this plant, ultimately informing the creation of new pharmaceuticals, and advancing medical knowledge. Hence further studies are required to explore their molecular mechanisms, clinical efficacy, and potential integration into modern therapeutic strategies. As scientific research continues to uncover its full pharmacological and industrial benefits, it is essential to ensure responsible utilization, sustainable cultivation, and regulatory compliance to maximize its benefits while minimizing risks. By integrating traditional knowledge with modern scientific advancements, *P. corylifolia* and *W. somnifera* can emerge as a valuable resource for natural healthcare and sustainable innovations in the coming decades.

CONCLUSION

Psoralea corylifolia and *Withania somnifera* are two medicinal plants with a rich history of traditional use. Recent studies have validated their medicinal and nutritional properties, highlighting their potential applications in promoting health and well-being. *Psoralea corylifolia* and *Withania somnifera* offer immense medicinal and nutritional benefits, making them valuable candidates for further research and clinical application. Their bioactive compounds exhibit diverse pharmacological activities, providing a scientific basis for their traditional use. The purpose of this research is to evaluate the current literature on the activity of Ashwagandha, with an emphasis on its potential benefits for stress management, cognitive function, and physical performance.

In conclusion, *Psoralea corylifolia* and *Withania somnifera* hold great promise as medicinal and nutritional agents,

supporting their traditional use in managing various health conditions. Future research should focus on bridging the gap between traditional knowledge and modern scientific validation, ensuring the safe and effective incorporation of these plants into contemporary medicine. As a result, it emerges as a botanical gem with the potential to open new pharmacological and cosmetic paths. Its complex pharmacological potential emphasizes its significance in modern medicine and urges further investigation and use of its bioactive elements.

ACKNOWLEDGMENTS

The authors are thankful to the Secretary and Principal of Saifia Science College, Bhopal, India, for providing the necessary facilities.

Consent for publication: Not applicable.

Availability of data and material: All the data generated and analyzed during the study are included in the main manuscript.

Competing Interests: The author declares that there are no competing interests.

Funding: NA

REFERENCES

1. Ramawat KG, Dass S, Mathur M. The chemical diversity of bioactive molecules and therapeutic potential of medicinal plants. Herbal drugs: ethnomedicine to modern medicine. 2009:7-32.
2. Wang H, Chen Y, Wang L, Liu Q, Yang S, Wang C. Advancing herbal medicine: enhancing product quality and safety through robust quality control practices. Frontiers in pharmacology. 2023 Sep 25; 14:1265178.
3. Xutian S, Zhang J, Louise W. New exploration and understanding of traditional Chinese medicine. The American journal of Chinese medicine. 2009;37(03):411-26.
4. Mustafa G, Arif R, Atta A, Sharif S, Jamil A. Bioactive compounds from medicinal plants and their importance in drug discovery in Pakistan. Matrix Sci. Pharma. 2017 Feb 15;1(1):17-26.
5. Balkrishna A, Sharma N, Srivastava D, Kukreti A, Srivastava S, Arya V. Exploring the safety, efficacy, and bioactivity of herbal medicines: Bridging traditional wisdom and modern science in healthcare. Future Integrative Medicine. 2024 Mar 25;3(1):35-49.
6. Pandey R, Gupta S. Psoralea corylifolia (Babchi): An overview. Int J Pharm Sci Rev Res. 2016; 38(1), 51-58.
7. Khushboo PS, Jadhav VM, Kadam VJ, Sathe NS. *Psoralea corylifolia* Linn. — "Kushtanashini". Pharmacognosy reviews. 2010 Jan;4(7):69.
8. Yang A, Kong L, You Z, Li X, Guan J, Li F, Zhong L, Jiang H. A review of *Psoralea corylifolia* L.: a valuable plant with profound biological significance. Frontiers in Pharmacology. 2025 Jan 20; 15:1521040.
9. Bashir A, Nabi M, Tabassum N, Afzal S, Ayoub M. An updated review on phytochemistry and molecular targets of *Withania somnifera* (L.) Dunal (Ashwagandha). Frontiers in Pharmacology. 2023 Mar 29; 14:1049334.
10. Bharti VK, Malik JK, Gupta RC. Ashwagandha: multiple health benefits. InNutraceuticals 2016 Jan 1 (pp. 717-733). Academic Press.
11. Paul S, Chakraborty S, Anand U, Dey S, Nandy S, Ghorai M, Saha SC, Patil MT, Kandimalla R, Proćków J, Dey A. *Withania somnifera* (L.) Dunal (Ashwagandha): A comprehensive review on ethnopharmacology, pharmacotherapeutics, biomedicinal and toxicological aspects. Biomedicine & Pharmacotherapy. 2021 Nov 1; 143:112175.
12. Chopra B, Dhingra AK, Dhar KL. *Psoralea corylifolia* L.(Buguchi)—folklore to modern evidence. Fitoterapia. 2013 Oct 1; 90:44-56.
13. Ali H, Dixit S, Alam P. *Psoralea corylifolia* L. (Buguchi) - folklore to modern evidence: review. Fitoterapia. 2018, 124, 92-96.
14. Yang X., Xu Q., Lv Q., He Z., Xu W., Zhang Y. Research progress in chemical constituents of psoraleae fructus. Mod. Chin. Med. 2024; 26, 733–748. 10.13313/j.issn.1673-4890.20231221001.
15. Bhagirath G, Surendra Reddy G, Mustafa M.D. Exploring pharmacologically significant bioactive compounds of *Psoralea corylifolia* L.- A review. Int. J. Biomol. Biomed. 2024; Vol. 18, No. 2, p. 11-18.
16. Gao HT, Gao PP, Zang YD. Study on the chemical constituents of Psoralea. Chin J Pharm. 2021; 18:556-61.
17. Mascarenhas-Melo F, Ribeiro MM, Kahkesh KH, Parida S, Pawar KD, Velsankar K, Jha NK, Damiri F, Costa G, Veiga F, Paiva-Santos AC. Comprehensive review of the skin use of bakuchiol: physicochemical properties, sources, bioactivities, nanotechnology delivery systems, regulatory and toxicological concerns. Phytochemistry Reviews. 2024 Mar 1:1-37.
18. Patel S, Sharma V. *Psoralea corylifolia* Linn: Ethnobotanical, phytochemical and pharmacological review. Journal of Applied Pharmaceutical Science, 2021; 11(4), 157-166.
19. Zhou J, Wu J, Chen X,. Chemical composition and pharmacological activities of *Psoralea corylifolia* Linn. Phytother Res. 2020; 34(9), 2229- 2254.
20. Nabi NG, Shrivastava M. Endangered medicinal plant *Psoralea corylifolia*: Traditional, phytochemical, therapeutic properties and micropropagation. Pharmaceutical and Biosciences Journal. 2017 Feb 16:40-6.
21. Sharma P, Rani R, Pal S, Malhotra S. *Psoralea corylifolia* Linn. - A comprehensive review of its ethnopharmacology, phytochemistry, and pharmacological properties. Journal of Ethnopharmacology. 2020; 247, 112255.
22. Dong X, Zhang Z, He S, Wang X. Progress on the Pharmacological Research of *Psoralea corylifolia* Linn.: A

Review. Frontiers in Pharmacology. 202;11, 457.
23. Singh N, Bhalla M, de Jager P, Gilca M. An overview on ashwagandha: a Rasayana (rejuvenator) of Ayurveda. African journal of traditional, complementary, and alternative medicines. 2011;8(5S).
24. Mikulska P, Malinowska M, Ignacyk M, Szustowski P, Nowak J, Pesta K, Szeląg M, Szklanny D, Judasz E, Kaczmarek G, Ejiohuo OP. Ashwagandha (*Withania somnifera*)—current research on the health-promoting activities: a narrative review. Pharmaceutics. 2023 Apr;15(4):1057.
25. Langade D, Kanchi S, Salve J, Debnath K, Ambegaokar D, Langade DG. Efficacy and safety of Ashwagandha (*Withania somnifera*) root extract in insomnia and anxiety: a double-blind, randomized, placebo-controlled study. Cureus. 2019 Sep 28;11(9).
26. Połumackanycz M, Forencewicz A, Wesołowski M, Viapiana A. Ashwagandha (*Withania somnifera* L.)–roślina o udokumentowanych właściwościach prozdrowotnych. Farm Pol. 2020;76(8):442-7.
27. Kayesth S, Gupta KK, Tyagi K, Mohan RR, Arora J, Nissapatorn V. Natural products and human health—A special focus on Indian Ginseng *Withania somnifera* (L.) Dunal. Indian Journal of Natural Products and Resources (IJNPR) [Formerly Natural Product Radiance (NPR)]. 2024 Jul 31;15(2):244-59.
28. Mirjalili MH, Moyano E, Bonfill M, Cusido RM, Palazón J. Steroidal lactones from *Withania somnifera,* an ancient plant for novel medicine. Molecules. 2009 Jul 3;14(7):2373-93.
29. Rakha A, Ramzan Z, Umar N, Rasheed H, Fatima A, Ahmed Z, Kieliszek M, Aadil RM. The role of ashwagandha in metabolic syndrome: a review of traditional knowledge and recent research findings. J. Biol. Regul. Homeost. Agents. 2023; 37:5091-103.
30. Singh P, Sharma YK. *Withania somnifera* (Ashwagandha): A wonder herb with multiple medicinal properties. Asian Journal of Pharmacy and Pharmacology. 2018;4(2):123-30.
31. Jain R, Kachhwaha S, Kothari SL. Phytochemistry, pharmacology, and biotechnology of *Withania somnifera* and Withania coagulans: A review. Journal of Medicinal Plants Research. 2012 Oct 25;6(41):5388-99.
32. Tharakan A, Shukla H, Benny IR, Tharakan M, George L, Koshy S. Immunomodulatory effect of *Withania somnifera* (Ashwagandha) extract—a randomized, double-blind, placebo-controlled trial with an open label extension on healthy participants. Journal of clinical medicine. 2021 Aug 18;10(16):3644.
33. Singh V, Shah HH, Guillemin GJ. Neuroprotective Effect of Ashwagandha (roots of *Withania somnifera*): The rejuvenator. Canad. J. Clin. Nutr. 2017 Jan 6; 5:34-51.
34. Shin NR, Ryu HW, Ko JW, Park SH, Yuk HJ, Kim HJ, Kim JC, Jeong SH, Shin IS. Artemisia argyi attenuates airway inflammation in ovalbumin-induced asthmatic animals. Journal of ethnopharmacology. 2017 Sep 14; 209:108-15.
35. Tomar V, Beuerle T, Sircar D. A validated HPTLC method for the simultaneous quantifications of three phenolic acids and three withanolides from *Withania somnifera* plants and its herbal products. Journal of Chromatography B. 2019 Aug 15; 1124:154-60.
36. Abdelwahed MT, Hegazy MA, Mohamed EH. Major biochemical constituents of *Withania somnifera* (ashwagandha) extract: A review of chemical analysis. Reviews in Analytical Chemistry. 2023 Mar 29;42(1):20220055.
37. Itankar PR, Kherde SD, Tawar MG, Prasad SK. Study on impact of different climatic zones on physicochemical and phytochemical profile of *Withania somnifera* (L.) Dunal. Indian Journal of Traditional Knowledge (IJTK). 2020 Jun 10;19(3):486-93.
38. Gupta GL, Rana AC. *Withania somnifera* (Ashwagandha): a review.
39. Kalra R, Kaushik N. *Withania somnifera* (Linn.) Dunal: a review of chemical and pharmacological diversity. Phytochemistry Reviews. 2017 Oct; 16:953-87.
40. Chauhan S, Srivastava MK, Pathak AK. Effect of standardized root extract of ashwagandha (*Withania somnifera*) on well-being and sexual performance in adult males: A randomized controlled trial. Health Science Reports. 2022 Jul;5(4): e741.
41. Kumari S, Gupta A. Nutritional composition of dehydrated ashwagandha, shatavari, and ginger root powder. International Journal of Home Science. 2016;2(3):68-70.
42. Alam F, Khan GN, Asad MH. *Psoralea corylifolia* L: Ethnobotanical, biological, and chemical aspects: A review. Phytotherapy Research. 2018 Apr;32(4):597-615.
43. Chen L, Chen S, Sun P, Liu X, Zhan Z, Wang J. *Psoralea corylifolia* L.: a comprehensive review of its botany, traditional uses, phytochemistry, pharmacology, toxicology, quality control and pharmacokinetics. Chinese medicine. 2023 Jan 10;18(1):4.
44. Verma SK, Kumar A. Therapeutic uses of *Withania somnifera* (Ashwagandha) with a note on withanolides and its pharmacological actions. Asian J Pharm Clin Res. 2011 Jul 4;4(1):1-4.
45. Khabiya R, Choudhary GP, Jnanesha AC, Kumar A, Lal RK. An insight into the potential varieties of Ashwagandha (Indian ginseng) for better therapeutic efficacy. Ecological Frontiers. 2024 Jun 1;44(3):444-50.
46. Castillo E, González-Rosende ME, Martínez-Solís I. The use of herbal medicine in the treatment of vitiligo: an updated review. Planta Medica. 2023 Apr;89(05):468-83.

Join Society For Science & Nature and Avail Multiple Benefits

1. Life members and fellows of Society of Science & Nature (MSSN/FSSN), Bhopal, India will be entitled to receive free early on line issues of MNTRC for life. They will get substantial waivers for publication of their research papers.
2. Selected life members on the basis of their academic and research contributions will be conferred with Honorary Fellowship of SSN (FSSN), who will be instrumental in scientific awareness programmes particularly encouragement and popularisation of Science. These members will be appointed reviewers of the Journal in different subject areas. Life Fellow members of SSN will be invited to attend society sponsored conferences and seminars on invitation.

Form For MSSN Life (Fellow Member Society For Science & Nature, along with MNTRC):

E-mail: mntrc.in.info@gmail.com or editor@mntrc.in Website: https://mntrc.in/

Kindly complete the form and send it, together with the necessary payment to the Secretary of the Society on the address below (Photocopies will be accepted). Forms can also be downloaded from our website forms. (Crossed DD in favor of Treasurer, Society for Science and Nature, C-52, Housing Board Colony, Kohe-Fiza, Bhopal-462001, India, to be sent by Speed/Regd. Post.) Life Membership One Time Subscription (MSSN) including Life Member-ship of MNTRC is Rs. 5000/- Direct NEFT can be also made on contacting the Managing Editor. Foreign Members will have to obtain separate invoices for making payment to the Society for Fellowship.

(Crossed DD in favor of Treasurer, Society for Science and Nature, C-52, Housing Board Colony, Kohe-Fiza, Bhopal-462001, India, to be sent by Speed/ Regd. Post.) Life Membership One Time Subscription (MSSN) including Life Member-ship of BBRC is Rs. 5000/- Direct NEFT can be also made on contacting the Managing Editor. Foreign Members will have to obtain separate invoices for mak-ing payment to the Society for Fellowship.

Name: Dr./Prof. (IN CAPITAL LETTERS):_____

Designation & Organization:_____

Qualification & Specialization of Research:_____

Present and Past Academic Positions:_____

Research Publications Experience Enclose Biodata* with full publications list:_____

Academic Achievements Memberships of Societies etc.:_____

Mailing Address (With tel./Mob./Email id):_____

I wish to become life Member / Fellow of Society for Science And Nature Bhopal, India. I have read the details and agree to abide by them.

Signature

Details of Accompanying Payment_____ DD No._____ Date_____

JOIN AS LIFE MEMBER MANAGEMENT and TECHNOLOGY RESEARCH COMMUNICATIONS

Kindly complete this form if you want to become life member/ of MNTRC only (Individual Life Member MNTRC Rs. 4000/-)

I wish to become Life Member of SSN Journal of Management and Technology Research Communications.

Name:_____

Address_____

E-mail:_____ Signature:_____

Date:_____

Membership Annual/Life..... Amount Rs._____

*DD No. _____enclosed._____

All payments by Demand draft, NEFT should be made in favour of Treasurer,
SSN Journal of Management and Technology Research Communications
and sent to: Treasurer, C-52, Housing Board Colony, Kohe-Fiza, Bhopal-462001, India,
Direct NEFT can be also made on contacting the Managing Editor
mntrc.in.info@gmail.com or editor@mntrc.in Website: https://mntrc.in/

1. Life Member (BBRC) Only	(INR)4000/-
2. Institutional Annual Member India Libraries for (Hard Copies of 4 Issues per year, Postage Extra)	INR 12,000/-
3. Single Hard Copy of Journal per Issue (to be ordered in advance, Postage Extra)	INR 3000/-

Declaration about the ownership of
SSN Journal of Management and Technology Research Communications
Form (IV) [See Rule 3]

1. Place of Publication	:	Bhopal, India
2. Periodicity of its Publication	:	Every Three Month
3. Printer's Name	:	Ayesha S. Ali On behalf of Society For Science & Nature
(Whether Citizen of India)	:	Yes
Address	:	H. No. C-52, H.B. Colony, Kohefiza Bhopal-462001, India
4. Publisher's Name	:	Ayesha S. Ali on Behalf of Society For Science & Nature SSN Bhopal
(Whether Citizen of India)	:	Yes
Address	:	H. No. C-52, H.B. Colony, Kohefiza Bhopal-462001, India
5. Editor's Name	:	Dr. Sharique Ali
(Whether Citizen of India)	:	Yes
Address	:	H. No. C-52, H.B. Colony, Kohefiza Bhopal-462001, India
6. Name & Address of the individual/	:	Ayesha S. Ali
who own the newspaper & partners or share holders holding more than one percent of the total capital	:	H. No. C-52, H.B.Colony, Kohefiza, Bhopal-462001, India
(Whether Citizen of India)	:	Yes

I, Ayesha S. Ali hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date : 31st July 2024

Place : Bhopal

SSN Journal of Management and Technology Research Communications
P-ISSN: _____ E-ISSN: _____
Cross Ref DOI: http://dx.doLorg/10.21786
Publishers: Society for Science and Nature, Bhopal India
Periodicity: Jan-Feb-March, April-May-June,
July-Aug-Sep and Oct-Nov-Dec
Journal Website: https://mntrc.in/

(Important Links of Journal)

1. Cover letter with Reviewers and their addresses (see template): https://mntrc.in/wp-content/uploads/2024/07/Sample-Cover-letter-MNTRC.pdf
2. Manuscript On Line Submission: https://mntrc.in/homepage/submit-article-2/

Instructions for Authors / Detailed MS Submission Guidelines For
SSN Journal of Management and Technology Research Communications

All manuscripts must be submitted to SSN Journal of Management and Technology Research Communications
Only through the journals online submission system at https://mntrc.in/ (https://mntrc.in/homepage/submit-article-2/)

Author submitting the manuscript for the first time is required to register online and create a profile as an author. This enables the authors to receive login credentials for manuscript submission. Manuscripts must consist of duly completed Author Ethical Statement / Copyright Form along with plagiarism / similarity level Certificate of the submitted MS, (which should be less than 15%. Attach Certificate checked by Ithenticate / Turnitin Software). **This is a mandatory part of manuscript submission**.

Before final submission, please make sure that the manuscript conforms to the journal guidelines and instructions to authors for the preparation of the manuscript.

MS not prepared as per instructions to authors will not be entertained and will be returned as incomplete submission.

Please note that the journal does not charge any fees for submission of articles, and we do not give any fixed frame of time to publish an article, since the review of articles depends upon the reviewers processing time, the editorial assessment, and production. Roughly a MS takes about 60 to 90 days from the date of submission to publication, depending upon the review process and number of revisions envisaged.

Academic Quality of Submitted Manuscripts

Manuscript must be written in explicit English language, with the writing clear, concise, and logical, consisting of high academic quality and scientific rigor. Authors submitting manuscripts to SSN Journal of Management and Technology Research Communications should present an accurate account of the work performed as well as an objective discussion of its significance. Underlying data should be represented accurately in the paper. There should be a clear statement of logical objectives and rationale / justification to take up the study. Study design must be robust and all methods used must be cited properly with standard references so that they can be reproduced easily. A paper should contain sufficient detail and references to permit others to replicate the work.

Discussion must have a critical and comprehensive account of statements, supported by up-to-date references. Conclusions must be drawn in corroboration with data and interpretation highlighting the novelty of the work. References need to be checked for their presence in both text and reference section with all links of references from Google Scholar, Pub Med etc.

If any of the above features are missing in the manuscript, it may not be processed for the initial internal reviews and selection of the MS

1. **Ethical & Plagiarism Policies of SSN Journal of Management and Technology Research Communications** Ethical Issues Plagiarism

On Ethical Issues:
Animal and Human Studies

Ethical declarations in research form an integral part during the submission process of a manuscript to a journal. SSN Journal of Management and Technology Research Communications requires that the experimental conditions under which animal and human assays and tests are performed are as per standard protocols used worldwide.

Authors must make it clear in writing that the procedures they used were as humane as possible and have been compiled with the guidelines for animal care of their institutions or with national / international guidelines. Studies on animals must comply with the prevailing standards of animal welfare according to Indian Council of Medical Research Guidelines or Committee for the Purpose of Control & Supervision of Experiments on Animals (CPCSEA) in India, and likewise following similar conditions elsewhere, (Ethical Approval Committees/ Institutional Review Board with Approval Number is necessary). For details of animal studies please see : ARRIVE and Guide for the Care and Use of Laboratory Animals.

Studies involving human subjects / patients / and also if the manuscript includes case reports / case series, authors need to provide the following: Name of the Ethical Committees /Institutional review Board, they have obtained consent from along with approval number /ID. Authors should specifically mention that the study was in accordance with the Helsinki Declaration of 1975 (Human Research: Helsinki Declaration as revised in 2013, SCARE criteria etc).

Case Reports: Case Reports should be followed as per the guidelines of SCARE criteria.

Informed consent should be obtained from all patients for being included in the study." If any identifying information about participants is included in the article, the following sentence should also be included: "Additional informed consent was obtained from all individuals for whom identifying information is included in this article." If you have not included or cannot include this statement in your manuscript, please provide the reason or an alternative statement here and in the manuscript.

Disclosure of Interest

Authors must provide details of any financial or personal relationships that might bias the work being submitted. In a section of text preceding the References, please provide relevant information for each author(s) with regard to any conflicts of interest. All submissions must include disclosure of all relationships that could be viewed as presenting a potential conflict of Interest.

Acknowledgement of sources: Proper acknowledgement of the work of others must always be given.
Funding acknowledgement must be properly made with grant details, number etc.

Data access and retention: Authors may be asked to provide the raw data in connection with a paper for editorial review, and should be prepared to provide public access to such data.

PLAGIARISM
(Author Ethical Statement / Copyright form / Plagiarism Check Report)

Plagiarism is the unauthorized use or close imitation of the language and thoughts of another author and representing them as one's own original work and SSN Journal of Management and Technology Research Communications strictly International Committee of Medical Journal Editors (ICMJE) and Committee on Publication Ethics (COPE), condemns all forms of plagiarism, following a very vigilant policy of removing this malady. Within the academia, it is considered dishonesty or fraud and offenders are subject to academic censure. Plagiarism can be unintentional or intentional, reproducing academic material without appropriate credit to the original authors (Citations).

Similarly self -plagiarism is the re-use of significant, identical or near identical portions of one's own work without citing the original work. This is also known as recycling fraud. Worst form of plagiarism is to steal the whole article or in parts from some source and publish it under one's own name in another journal. Plagiarism, fabrication, unethical or redundant publication grossly violates the editorial policies of SSN Journal of Management and Technology Research Communications which follows best practice guidelines given by the as mentioned in the Journals Instructions for Authors. SSN Journal of Management and Technology Research Communications strongly condemns any form of plagiarism and unethical practices.

All authors submitting their MS to SSN Journal of Management & Technology Research Communications must complete and sign the ethical statement form (downloaded from above link) and append the Plagiarism Check Certificate of their MS along with ethical statement form, failing which their MS will be not processed further.

Authors submitting their work to SSN Journal of Management and Technology Research Communications must also mention the names, addresses and email ids of three subject experts to serve as independent reviewers for their submitted MS, in their cover letter. The reviewers must not be of their Institution, it is not necessary the same reviewers will be appointed for their submitted manuscript, selection of independent unbiased reviewers is under the purview of editorial board / editors.

The following files need to be submitted with every article:

1. **Cover Letter stating the originality of research and why you think it should be published in SSN Journal of Management and Technology Research Communications with names / addresses and emails of 3 external reviewers must be attached,** (See Cover Letter template).

Original Research Articles Manuscript MS Text: For preparation and style of MS: (See Manuscript Template): Articles must be a minimum of 3,000 words to a maximum of 4,000 words excluding abstract and references. Please note that only the main text is included in the word count; the abstract, references, figure captions, and tables are not counted toward the word count. The full manuscript should contain first page with full author names, affiliation, ORCID No and the corresponding author email / ORCID details, followed by full text of the MS file in word format. **All data/tables/figures/Images (images must be submitted with the MS in high print-reproducible resolution)**.

2. **Article Types: Submission of the following article types is considered for publication in SSN Journal of Management and Technology Research Communications**

1. **Original research articles, (4000) words**
2. **Critical analytical reviews (4000-5000 words)**
3. **Case reports with discussion (2500 words)**
4. **Short Communications (1500 words)**
5. **Letters to the Editor / Editorials / Perspectives / Correspondence (up to 1000 words)**

(I) Original Research Articles

Manuscript must be written in explicit English language, with the writing clear, concise, and logical, consisting of high academic quality and scientific rigor. It must be typewritten using Times New Roman font size 12 only, double-spaced with one inch margin on all sides. All manuscripts must be accompanied by author declaration with ethical certificate signed by the corresponding author and all co -authors that they have seen and approved the final version of the manuscript and that the article has NOT been published or submitted to any other journal for publication. The corresponding author is responsible for obtaining permission from the copyright owner for the use of any copyrighted material in the submitted article.

Each original article must contain the following in the order as:

Title page: Title page should contain the following information:
Main Title of the article followed by short running title, Name (s) of author(s), Department (s)/Institution(s) City / Code & Country, where the work was performed, with all author ORCID links, (https://orcid.org/login). **E-mail address of the corresponding author marked with an asterisk * is necessary.**

Abstract: Abstract should be factual summarization of the entire work and should NOT TO EXCEED 250 words, with 5 keywords written below it.

Abstract must have following subheadings:

Introduction (Objectives / Justification /Rationale), Brief Methods, Results and Conclusion

3. Main Text of the Manuscript: Text must be arranged under the following headings:

- Introduction
- Material and Methods (Must have cited references so that they can be replicated easily)
- Results (Including Tables/Fig/ Clear Images)
- Discussion (Must be critical and comprehensive with up-to-date citations)
- Conclusion (must be based on data)
- Funding Statements /Acknowledgements (if any).
- References (In Vancouver Style ie in numbers serially arranged as per standard format).

References should be numbered in superscript, serially in the order in which they appear, first through the text and then through table and figure legends. References should not include unpublished source materials. The list of References at the end of the text should be in the following format.

Lindley, S. T., Estimation of population growth and extinction parameters from noisy data. Ecol. Appl., 2003, 13, 806-813.

Martin, H., The Archaean grey gnesisses and the genesis of continental crust. In Archaean Crustal Evolution (ed. Condie, K. C.), Elsevier, Amsterdam, 1994, pp. 205-259.

Rao, K. N. and Vaidyanadhan, R., Geomorphic features in Krishna Delta and its evolution. In Proceedings of the National Symposium on Morphology and Evolution of Landforms, Department of Geology, Delhi University, New Delhi, 1978.

1. Introduction: This section must provide a brief review of literature, purpose of the study, objectives and the rationale of the research undertaken should be given with proper clarity.

2. Material and Methods: This section of material and methods /procedures should be concise but detailed enough to enable the reader to reproduce the experiments / methodology. Commonly used procedures and methods in detail need not be described, but require a reference to the original source.

Results (Including Tables/Fig/Images): Give only brief findings, presented in the form of tables or figures, should be included without duplication of presentation and no discussion of the significance of the data, either tables or figures be given, avoid duplication of data.

Discussion should present the significance of the present data under the prevalent understanding and interpretation of the phenomenon. Speculative discussion is allowed but it should be concise and corroborated by the presented data.

Conclusion summarizes the study and is drawn from the results and discussion, should not be more than 100 words.

Acknowledgements/ Financial Acknowledgements if any, should be placed at the end of Conclusion before References.

References: (Strictly as per Vancouver Style)

References should be numbered in superscript, serially in the order in which they appear, first through the text and then through table and figure legends. References should not include unpublished source materials.

References in text of the manuscript should be written using numbers in super script.

The final bibliography in the **References Section** should be **arranged by Arabic numbers cited in text matter: All references must be written in 11 point font Roman letters.**

Use Italic styles only for scientific names of organisms, genera, species in the entire MS as well as in the Reference section.

In this section et al should be used only after three names of authors.

In reference section, DOIs / Links of the references from PubMed, WoS–Clarivate Analytics, Scopus, Google Scholar and others must also be provided.

All references should be checked minutely, for their appearance in text as well as in References, incomplete or missing references in the text or in Reference List & Vice versa will not be accepted, and the MS will be returned as **Incomplete Submission.**

1. Example of Reference from a Standard Journal Article:

The list of References at the end of the text should be in the following format.

Ali Sharique A, S Salim, Sahani T, Peter J and Ali Serotinergic receptors as novel target for optimizing skin pigmentary responses in Indian bull frog, Hoplobatrachus tigerinusBritish Journal of Pharmacology 2012 Vol 165 No 5 Pages 1515-1525.

2. Example of Reference from a book:
Falconer DC Introduction to Quantitative Genetics. 1960 Oliver & Boyd Edinburgh 165-185.

3. Reference from article in a book:
Ali, Sharique A, N Parveen and Ayesha S Ali In Herbal Medicine: Back to The Future, Promoting Melanocyte Regeneration Using Different Plants and Their Constituents – Vol 3
(Ed. Ferid Murad, Nobel Laureate) Bentham Science, USA 2021 Pages 247-276.

Tables and Figures (or Images): Short, Precise Tables and sharp image figures must be included, complete with legends /footnotes / explanation / units should be right below them. The tables and figures pages should be consecutively numbered, and arranged between results and discussion. Position of the tables or figures in the text of the MS must be indicated using same numbers.

Instructions for Preparation of Images: An image refers to the following: Graphs, photographs, maps, charts, paintings, drawings, diagrams, etc. Images must be embedded within the manuscript text between Results and Discussion of the article, not separately or at the end of the article. Once the article is accepted for publication, the author may be asked for submission of image in high resolution file formats. It is strongly recommended before embedding images in the manuscript, images must be prepared as mentioned below in the image specifications section.

Image specifications: Images must be prepared in accordance with the instructions mentioned on the PubMed Central.

Website: https://www.ncbi.nlm.nih.gov/pmc/pub/filespec-images/ The key factor for preparation of MS images for sufficient quality is images must have a minimum resolution of 300 dots per inch (dpi) for the grayscale (or black and white) and at least 600 dpi for color scale. The acceptable image formats are tiff, jpeg, gif, psd or png.

Image Copyright: For any image that the authors have not made themselves, the authors will need to have written permission to reproduce that image, even if the image is posted on the internet. It is the author's responsibility to obtain permission to use the images, not the publishers. Permission must be obtained in writing before the article can be submitted. For complete information, please visit the Copyright Agency Limited website: http://www.copyright.com.au/get-information/about-copyright.

(II) Review Articles / Systematic Reviews / Meta-Analysis

Systematic Reviews or Meta-Analysis should be systematic, critical assessments of most recently updated literature and data sources pertaining to basic biological or bio-medical science topics that include a statistical technique for quantitatively combining the results of multiple studies that measure the same outcome into a single pooled investigation. Data must be searched for and selected systematically for inclusion and critically evaluated, and the search and selection process for compiling the review must be mentioned. The text should NOT exceed 5000 words excluding abstract, references, tables and figures.

Each of the sections of the **Systematic Review** or **Meta Analysis** articles should include specific sub-sections as follows:

1. **Structured Abstract:** (Not exceed 250 words):Objectives, Methodology, Results and Conclusion
2. **Introduction:** Rationale, Objectives, Research questions
3. **Methodology:** Study design, Participants, interventions, comparators
4. **Systematic Review Protocol:** Search strategy, Data sources, Studies Sections and Data Extraction, Data analysis/ Statistical tools used
5. **Results and Discussion:** In results provide flow diagrams / attractive tables / figures of the studies retrieved for the review, study selection characteristics synthesized findings, risk of bias etc.
6. **Summary:** Abstract of main findings, Limitations, Conclusions etc.**For all other information including title page, typing and reference style etc, please follow the instructions to authors for Research Articles.**

(III) Case Reports with Discussion

The case reports, of two or more patients must contain genuinely new interpretational information, discussed with up to date literature. The reports should have clinical significance, new adverse effect(s) of a drug or other unique first time observations, etc. Patient consent for publication must be obtained from the patient in written or, if this is not possible, the next of kin before submission. The author(s) must have been involved in the care of the patient.

Case Reports: Case Reports should be followed as per the guidelines of SCARE criteria

Case Report /case description should start with a single paragraph abstract followed by text, which should not exceed 2000 words (excluding references, tables and figures) with maximum 10 bibliographic references and either three figures or three tables. Case report / case presentation must contain:

1. Brief Abstract (should not exceed 150 words)
2. Introduction
3. Case Presentation
4. Reviews & Discussion
5. Conclusion
6. References

Patient Consent, Competing interests, Funding Statement, Acknowledgements (if any). For all other information including title page, typing and reference style, please follow the instructions for original articles.

(IV) Short Communications

Short communication should be original work, such as complete results of a short pilot study, not merely a preliminary report and should not exceed 2000 words with one or two figures and/or one table. An editorial decision will be provided rapidly without reviews. For writing and references style, follow the same instructions listed above.

(V) Letters to the Editor/Editorials / Perspectives / Correspondence

Opinions on topics and articles recently published in the journal will be considered for publication if they are objective and constructive in nature and provide academic interest to the readers. These letters may also be forwarded to the author of the cited article for possible response. The editor reserves the right to shorten these letters, delete objectionable comments, make other changes, or take any other suitable decision to comply with the style and policies of the journal. For writing and references style, follow the same instructions listed above.

(VI) Editorials

Editorial will be written by one member of the editorial board as solicited by the Editor-in-Chief. The editorial is generally a scientific review on one or two of the current topics pertaining to biomedical sciences.

Article Processing Charges (APC) and Waivers

SSN Journal of Management and Technology Research Communications does not have any article submission charges, however authors will be required to pay only article processing charges (APC) that too after acceptance of their peer reviewed manuscripts.

We do not have any other charges for publication of MS in SSN Journal of Management and Technology Research Communications like color print charges or reprint charges, author subscription charges or any other fees.

The moderate APC taken from authors contributes to the handling/ editorial/ production / open access/ HTML/ DOI / costs and hence is non-refundable. APC is to be deposited via Net Banking/ Electronic Transfer after acceptance of the manuscript only.

- Article Processing Charges (APC) for Authors from India- Rs.4000/*
- *Article Processing Charges (APC) for SAARC Countries – US Dollars 100
- *Article Processing Charges (APC) for Low Income Countries- US Dollars 150
- *For All other Countries the APC is US dollars 200
- *Waivers available for Non-Funded Research.

Publication Fee Waivers: In order to meet the rigorous academic standards on a fast track, the open access journal has some expenses as stated above, and for these reasons we charge a very modest article processing fee. **Nevertheless, as we believe that lack of funds should not be a barrier to quality open access publication, SSN Journal of Management and Technology Research Communications has a policy to provide significant waivers to deserving authors from middle and low income countries without any financial support. Authors can request for a waiver in such cases.**

5. Conditions of Acceptance of Manuscripts

Acceptance of Manuscript: On acceptance, the editors retain the right to make stylistic changes in the MS, shorten the material as necessary and decide on the date and periodicity of publication.

Galley Proofs: Authors will be sent an online copy of the galley proofs to the email id of only the corresponding author. Corrections should be confined to typographical errors or matters of accuracy. Authors should return their galley proofs within two days of receipt. If there is a delay in returning the proofs beyond the given deadlines the MS will be published in next issue, no changes in the MS will be possible once the author sends the corrected galleys.

2. Early On Line Ahead of Print Publication / Final Publication

Early on Line E- Prints, ahead of final publication, is provided by SSN Journal of Management and Technology Research Communications to enable authors and readers to have early and free access to their published work.

SSN Journal of Management and Technology Research Communications
An Open Access International Journal https://mntrc.in/
Post Box 01, GPO, Bhopal 462001 India

(AUTHOR ETHICAL STATEMENT / COPYRIGHT FORMS / PLAGIARISM CHECK REPORT)

Articles must be submitted by only the corresponding author of the manuscript, and should not be submitted by anyone on behalf. The corresponding author may submit this Copyright/ Ethical Statement Form along with the manuscript, on behalf of all the co-authors (if any). The author (s) will confirm that the manuscript (or any part of it) has not been published previously or is not under consideration for publication elsewhere. Furthermore, any illustrations, structures or tables that have been published elsewhere must be roperly reported with citations/ and or, copyright permission for reproduction must be obtained.

1. I / (We) confirm that the enclosed article entitled----------Authored by: 1……..2……3……4……5……et al has not been published previously in whole or in part, nor is being considered elsewhere for publication, and if accepted for publication in MNRTRC, it will not be published elsewhere.
2. I / We acknowledge that on the condition of acceptance, MNRTRC and its authors will have the copyright of the scholarly work which grants usage rights to others using an open license (Creative Commons) allowing for immediate free access to the work, provided it is properly cited as per standard guidelines. Financial support / fundings have been duly acknowledged.
3. I / We also confirm that all necessary permissions, ethical considerations for animal and human rights for experimentation to carry out this research have been obtained by the authors from the concerned authorities.
4. **It is also certified that the manuscript has been prepared as per instructions to the authors, complying all the author instructions, policies of plagiarism, its check and ethical statement as required by MNRTRC All authors have seen the final manuscript and approve its publication.**
5. **We also certify that the similarity / plagiarism levels of the attached manuscript have been checked using Ithenticate /Turnitin software. It has been found to be less than 20% as per international standards and the certificate of same is duly attached with the manuscript.**

Corresponding Author Name……..….....Orcid Id.....…..Signature……..….....……..…

Date…….....….....…….

Department…….....Institution:…….....City:.....Country…….....……

Email:…….....

Author 2 Name…….....Orcid Id.....….....….....Signature…….....……

Address…….....….....……Email…….....

Author 3 Name…….…….....Orcid Id.....……Signature:…….....

Address…….....……..…Email……

Use Extra Space if required.