

SOCIO-RELIGIOUS INTERACTIONS AND MEDIA NARRATIVES: UNDERSTANDING HINDU-MUSLIM DYNAMICS IN AN INCLUSIVE INDIAN SOCIETY

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ABSTRACT

India's identity as a plural, inclusive society is grounded not merely in its constitutional architecture but in the deep historical reality of Hindu-Muslim socio-religious interactions that have shaped the subcontinent's cultural life for more than a millennium. This paper offers a comprehensive review of those interactions, tracing their historical formation through the Bhakti-Sufi synthesis of the medieval period, their institutional expression in shared sacred spaces, their embodiment in composite traditions of music, language, food, and life-cycle ritual, and their ongoing contestation by reformist movements and adversarial political mobilisation. The paper further examines how India's mainstream media represents, and systematically misrepresents, this socio-religious relationship, deploying the analytical frameworks of Framing Theory, Agenda-Setting Theory, and Cultivation Theory to demonstrate the mechanisms by which a conflict-saturated media narrative diverges from the lived reality of everyday coexistence. Drawing exclusively on published scholarship, government data, survey reports, and documented ethnographic accounts from across India's regions, the paper argues that India's inclusive tradition is neither a historical relic nor a political slogan but a structurally embedded social reality under active pressure from organised reformism, political polarisation, and media distortion, and that its preservation requires institutional recognition, responsible media practice, and an empirically honest scholarly engagement with how ordinary Hindus and Muslims actually live together.

Keywords: Hindu-Muslim relations, syncretism, Ganga-Jamuni Tehzeeb, Sufi traditions, Bhakti movement, inclusive society, media framing, Indian pluralism, communalism, composite culture, media narrative.

INTRODUCTION

The claim that India is an inclusive civilisation has been made in almost every register of public discourse, philosophical, constitutional, diplomatic, and political. It is invoked from Jawaharlal Nehru's articulation of 'Unity in Diversity' to Amartya Sen's argument that

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plural, heterodox identity is foundational to Indian intellectual and social life (Sen, 2006). Yet across that long tradition of assertion, the evidentiary base has remained surprisingly thin. What is documented richly is conflict: communal riots, partition violence, political mobilisation along religious lines, and the architecture of mutual suspicion between Hindus and Muslims. What is documented sparsely, and almost entirely in qualitative terms, is the vast ordinary domain of shared social practice, composite devotional culture, and inter-community cooperation that constitutes, for most Hindus and Muslims in most of India, the actual texture of daily life.

This gap between the richness of assertion and the thinness of documentation has real consequences. It allows the conflict narrative, amplified by political actors, media organisations, and social media ecosystems, to occupy the representational space that empirically accurate accounts of coexistence should fill. It allows reformist religious movements, operating in both communities, to treat the shared composite culture as an aberration to be corrected rather than as the historical norm to be understood and preserved. And it leaves scholars, policymakers, and citizens without the evidential foundation they need to make defensible claims about the actual state of Hindu-Muslim relations in contemporary India (Varshney, 2002; Brass, 2003).

This paper addresses the documentation gap through a synthesis of published scholarship, historical research, ethnographic accounts, sociological studies, and media analysis drawn from across India's regions. It does not claim to replace the systematic empirical work that the field still needs; it argues, rather, for the conceptual and evidential framework within which that work should be situated. It proceeds in five movements: the historical formation of Hindu-Muslim composite culture; the sociology of shared sacred spaces and devotional practices; the composite traditions of everyday life; the forces of contestation and decline; and the role of media in constructing and perpetuating the conflict narrative that now dominates India's public understanding of itself.

HISTORICAL FORMATION OF HINDU-MUSLIM COMPOSITE CULTURE

The Philosophical Substrate of Indian Pluralism

The inclusive orientation of Indian civilisation predates its encounter with Islam. The Rigveda's declaration, 'एकम् सद् विप्रा बहुधा वदन्ति' (*ekam sad viprā bahudhā vadanti*) which means: The Truth is One; the Wise call it by Many Names. Upanishad's doctrine of *vasudhaiva kuṭumbakam* (वसुधैव कुटुम्बकम्, The World is One Family) establish, at the deepest layer of the Hindu philosophical tradition, an epistemological humility regarding the plurality of paths to truth (Thapar, 2004). This philosophical substrate did not guarantee communal harmony in any automatic sense, but it created cultural conditions in which the arrival of a new religious tradition could be accommodated within an existing framework of doctrinal tolerance. When Islam arrived in India, first peacefully through Arab traders on the Malabar coast in the seventh century, then militarily through the Ghaznavid and Ghurid invasions from the 11th century onwards, the response of Indian society was, characteristically, neither uncritical absorption nor unqualified resistance but a complex, centuries-long negotiation that produced new cultural forms from both traditions (Eaton, 1993; Thapar, 2004).

The Bhakti-Sufi Synthesis

The most consequential cultural event in the history of Hindu-Muslim relations was the simultaneous flowering of the Bhakti movement within Hinduism and the Sufi tradition within Islam between the 12th and 17th centuries. These were not mirror images of each other, but they shared enough formal and spiritual features, the primacy of direct personal devotion over institutional mediation, the use of vernacular languages over Sanskrit or Arabic, the rejection of caste hierarchy, and the centrality of the saint-poet as teacher, to generate an extraordinary creative exchange.

Kabir Das (c. 1440–1518), born into a Muslim weaver community in Varanasi and initiated into the Nirguna Bhakti tradition by the Hindu saint Ramananda, is the paradigmatic figure of this synthesis. His *dohas* refuse to choose between mosque and temple, between Allah and Ram. His lineage through the Kabir-panthi tradition, which continues to be followed by both Hindu and Muslim communities across north India, is a living social institution of Hindu-Muslim composite culture (Vaudeville, 1974). Sant Ravidas, Mirabai, and Guru Nanak extended the Bhakti tradition in directions that further eroded the formal Hindu-Muslim boundary: Guru Nanak's incorporation of compositions by the Muslim Sufi Farid Shakarganj in the Guru Granth Sahib is perhaps the most institutionally significant act of cultural synthesis in Indian religious history (Singh, 1969).

On the Islamic side, the Chishti, Suhrawardi, Qadiri, and Naqshbandi Sufi orders established a network of *khanqahs* (spiritual hospices) across the subcontinent that became institutionally open to devotees of all backgrounds. The *khanqah* at Ajmer, the dargah of Muinuddin Chishti, the Garib Nawaz, became, and remains, the most visited shared sacred site in India, attracting Hindu and Muslim pilgrims in roughly equal numbers every year. Richard Eaton's (1993) comprehensive analysis of the Bengal Frontier demonstrates how Sufi missions, bringing both Islamic teaching and practical aid in the form of agricultural land clearing, produced the largest single mass conversion in Indian history without requiring converts to abandon their existing cultural practices, which is why Bengali Islam retained so much of Bengali Hindu culture for centuries after conversion.

The Mughal Composite Culture and Ganga-Jamuni Tehzeeb

The Mughal period (1526–1858) institutionalised the Hindu-Muslim composite culture at the level of court, cuisine, music, architecture, and language. Akbar's Din-e-Ilahi, however short-lived as a formal movement, embodied a philosophical project of inter-religious synthesis that drew on both Vedantic and Sufi thought. The Mughal court's patronage of Hindustani classical music, which incorporated both Dhrupad from the Hindu tradition and Qawwali from the Sufi tradition into a single musical culture, produced the most durable single institution of Hindu-Muslim cultural exchange in Indian history (Sharma, 1996). The Urdu language, developed in the military camps ('urdu' means 'camp' in Turkish) as a vernacular that could bridge the Arabic-Persian vocabulary of the Mughal court with the Khari Boli Hindi base of the north Indian common people, became the mother tongue of both Muslim *ashraf* families and Hindu *kayastha* and Brahmin literati in the Ganga-Yamuna plain.

The concept of Ganga-Jamuni *tehzeeb*, the composite culture of the Ganga-Yamuna plain, is the conceptual name for this institutional inheritance. As Tully (2007) has argued in his study of Lucknow, this *tehzeeb* is not simply a matter of elite cultural exchange between Muslim nawabs and Hindu courtiers; it is embedded in the shared vocabulary of everyday social life, the greetings, the hospitality codes, the festival calendars, the food culture, and the shared veneration of saints across community lines that constitute the social grammar of north India. Burman (2002) has documented its material expression in the hundreds of syncretic shrines across Maharashtra, Rajasthan, and the Deccan where Hindu and Muslim devotion converge around a single sacred site. Das (2006) has traced its anthropological dimensions across Bengal, Gujarat, and Tamil Nadu, demonstrating that composite culture is not a north Indian regional peculiarity but a pan-Indian social fact with regional variations.

SHARED SACRED SPACES AND DEVOTIONAL PRACTICES

The *Dargah* as Institution of Everyday Pluralism

The *dargah*, the Sufi shrine, is the most important single institution of Hindu-Muslim socio-religious interaction in contemporary India. India has an estimated 70,000 *dargahs* of varying sizes and regional significance, from the pan-Indian pilgrimage centres of Ajmer (Rajasthan), Nizamuddin (Delhi), and Nagore (Tamil Nadu) to the countless local Peer Baba shrines in villages across the country. What distinguishes the *dargah* as a site of inter-community interaction is precisely the feature that has made it a target of reformist Islamic criticism: it makes no exclusive theological demand on the devotee. A Hindu villager who ties a *mannat* (vow) thread at a local Peer Baba's grave is not being asked to affirm Islamic doctrine; she is accessing protective supernatural power through a locally trusted intermediary. This low theological threshold is the institutional mechanism that makes the *dargah* the most visited inter-community sacred space in India (Bigelow, 2004; Mayaram, 2004).

The sociological literature on shared sacred sites is extensive and geographically distributed. Froystad (2012) documents the 'divine intersections' of Varanasi, where Hindu and Muslim ritual practices at shared sites blend without formal theological acknowledgement from either community. Assayag (2004) examines the Yellamma Devi temple in Karnataka, shared between upper-caste Hindus and Dalit communities, but also visited by local Muslims, as an example of how shared sacred spaces operate through practical need rather than doctrinal agreement. The Seethalai Madam temple in Nagore, Tamil Nadu, where the annual Kanduri festival is celebrated jointly by Hindus and Muslims, and the Nagore *dargah*, where Hindus constitute a significant proportion of pilgrims, are among the most thoroughly documented southern instances of this national pattern (Miller, 1992). The Pew Research Centre's (2021) nationally representative survey found that 69% of Indian Muslims and 36% of Indian Hindus reported visiting a shrine or *dargah*, figures that, even allowing for the survey's acknowledged limitations, confirm that shrine visitation is a mainstream rather than marginal inter-community practice.

Festival Sharing Across India

Festival participation across community lines is another well-documented dimension of Hindu-Muslim social interaction. The *Navbharat Times* (2020) reported Hindu and Muslim

communities in Faridabad celebrating Holi together for more than three decades as a formal inter-community event; similar reports from across north India confirm the pattern. At the other end of the calendar, Eid-ul-Fitr and Eid-ul-Adha are celebrated with Hindu participation, through visits, gift exchange, and shared meals, across the neighbourhoods of virtually every north Indian city. The Ramlila tradition provides particularly well-documented instances: The *Print* (2022) reported Muslim participation in the Ramlila of Ayodhya since 1963, including the crafting of props, the making of costumes, and the organisation of the event by Muslim artisans and community members. In the Muharram procession, the annual Shia commemoration of the martyrdom of Husain at Karbala, Hindu participation across north India is historically documented and contemporarily reported, including the making of *tazias* (replicas of Husain's tomb) by Hindu craftsmen and the participation of Hindu families in the procession (Hossain, 2018).

The reciprocity of this festival exchange is sociologically significant. It is not a one-directional borrowing by one community of the other's celebration but a genuine, habitual mutual participation whose roots lie in the shared social life of neighbourhoods, commercial relationships, and agricultural communities that have functioned as composite social units for generations. Kanungo (2014) has documented both the historical depth and the contemporary attrition of this festival exchange, arguing that politicisation rather than modernisation is the primary driver of its decline.

COMPOSITE TRADITIONS OF EVERYDAY LIFE

Language and Music

The most immediate visible expression of Hindu-Muslim cultural synthesis in everyday Indian life is linguistic. Urdu and Hindi are, in their spoken forms, a single language, Hindustani, whose vocabulary is drawn from Sanskrit and Prakrit as well as from Persian and Arabic. The Devanagari versus Nastaliq script distinction is real and politically loaded, but it is a distinction of written form rather than spoken content; the language in which a Hindi-medium school student and an Urdu-medium school student communicate outside the classroom is the same Hindustani that their grandparents used before Independence. As Kaviraj (1997) has argued, the attempt to purify Hindi of its Perso-Arabic lexical inheritance is itself a political project rather than a linguistic one, an attempt to demarcate a Hindu linguistic identity that did not exist before that project began.

Hindustani classical music, *raga*-based, rooted in the ancient *Natyashastra* tradition but developed under Mughal court patronage into its present form, is the single most durable institutional expression of the Hindu-Muslim composite culture. The great *gharanas* (hereditary schools) of Hindustani classical music, Agra, Gwalior, Kirana, Dilli, Patiala, were almost all founded by Muslim *ustads* and have been sustained by both Muslim and Hindu practitioners across generations. Tansen, Amir Khusrau, Bade Ghulam Ali Khan, and Bismillah Khan belong to a tradition that is fully Hindu and fully Islamic in different dimensions simultaneously: rooted in the Hindu theory of *raga* as a cosmological category while expressed through the musical vocabulary of a Mughal court whose aesthetic sensibility was shaped by Sufi devotional values (Sharma, 1996). Qawwali, the Sufi devotional music of

the Chishti order, is consumed across community lines at *dargahs* throughout India and has become, through the recordings of Nusrat Fateh Ali Khan, one of the primary vehicles through which Islamic devotional aesthetics have entered mainstream Indian popular culture.

Food, Craft, and Material Culture

The composite culture of India is perhaps most popularly visible in its food. Biryani, whose name derives from the Persian *birian* (fried before cooking) and whose development is attributed to the Mughal royal kitchens, is today among the most consumed dishes across India, celebrated equally by Hindu and Muslim families in every region. The *kebab* tradition of north India, the Mughlai cuisine of Delhi and Lucknow, the Hyderabad *haleem*, and the Kashmiri *wazwan* all represent culinary inheritances that belong to the national culture rather than to either community exclusively.

The craft traditions of India tell a similar story. The hand-block printing of Jaipur, the brocade weaving of Varanasi's Banarasi *sarees*, the embroidery of Lucknow's *chikankari*, and the *filigree* metalwork of Moradabad are all crafts maintained by Muslim artisan communities for Hindu markets, crafts whose designs, motifs, and patterns are drawn from the composite aesthetic of the Ganga-Yamuna world. The *saree*, widely regarded as the quintessential emblem of Hindu feminine dress, is, in its most celebrated form, the Banarasi, woven by Muslim weavers in Varanasi's Madanpura neighbourhood using Persian brocade techniques introduced to the subcontinent by Mughal-era weavers. This productive interdependence is not a historical curiosity; it is a living economic and cultural relationship that binds Hindu consumers and Muslim producers in a shared aesthetic world (Jeffrey, 1997; Neyazi, 2018).

Life-Cycle Rituals and the Shared Social Grammar

Across India's regions, the most intimate expressions of Hindu-Muslim cultural exchange are found in the life-cycle rituals that mark birth, marriage, and death. In the Muslim communities of north India that descend from converted Hindu castes, Rajput converts in Uttar Pradesh and Rajasthan, Brahmin converts in Kashmir, Kayastha converts in Bengal, and weaver-caste converts across the Gangetic plain, the Hindu inheritance is most visible in the marriage ceremony. The *haldi* (turmeric) ceremony, the *mehndi* (henna) ceremony, the *sehra* (floral veil) of the groom, the *bidaai* (bride's farewell from her natal home), all practices with roots in the Hindu Rajput or Brahmin wedding tradition, have been absorbed into the framework of the Islamic *nikah* across large swathes of north India (Madani, 1993; Ahmad, 1981).

Mayaram (2004) documents the shared devotional and ritual life of Ajmer, where the annual *Urs* of Muinuddin Chishti is celebrated by Hindu and Muslim pilgrims jointly in ways that extend well beyond simple co-presence: Hindu pilgrims participate in the qawwali singing; Muslim devotees receive prasad from the adjacent Brahma temple; and the local economy of flowers, sweets, and devotional objects is served by both Hindu and Muslim vendors whose families have maintained the same spots at the same shrines for generations. This is the everyday secularism that Mayaram theorises, not an ideological position but a habitual, non-reflexive sharing of social and sacred space that is simply what ordinary life looks like in communities that have always lived together.

FORCES OF CONTESTATION: REFORMISM, COMMUNALISATION, AND THE POLITICS OF IDENTITY

Organised Reformist Movements

The composite culture documented in the preceding sections has never existed without contestation. Within the Muslim community, the Wahhabi movement, introduced to India by Sayyid Ahmad Barelvi in the early 19th century following his exposure to the teachings of Muhammad ibn Abd al-Wahhab in Arabia, specifically targeted the syncretic practices of Indian Islam as *bidah* (forbidden innovation). The Deoband seminary, established in 1867 in the aftermath of the 1857 revolt, institutionalised a reformed Islam that explicitly rejected *dargah* veneration, the celebration of the Prophet's birthday (*mawlid*), the use of music in religious contexts, and the maintenance of Hindu-origin customs. In the 20th century, the Tablighi Jamaat (founded in Mewat, Haryana, in 1926) extended this reformist project from the seminary to the village through a systematic programme of lay Muslim education in correct Islamic practice (Sikand, 2004; Metcalf, 1999).

The impact of these movements on syncretic practices has been studied across India's regions. Kanungo (2014) traces the shift from syncretism to communalism in Orissa, where Wahhabi-influenced organisations systematically targeted shared shrines and inter-community festival participation from the 1980s onwards. Hossain (2018) documents the same process in West Bengal and Assam, where the Ahl-e-Hadith and Jamaat-e-Islami movements have been particularly active. Stewart and Shaw (1994) provide the theoretical framework: what matters is not the content of the reformist argument (the theological question of whether syncretic practices are doctrinally permitted) but its political function, the construction of a purified, bounded Muslim identity distinct from and incompatible with Hindu culture, which serves the political mobilisation projects of parties and organisations that require religious identity to be exclusive and antagonistic rather than porous and composite.

The Pew Survey and What It Tells Us

The most comprehensive recent evidence on the state of Hindu-Muslim social relations in India comes from the Pew Research Centre's (2021) nationally representative survey of 29,999 Indian adults across 17 languages and all major religious communities. The survey's findings are simultaneously reassuring and alarming, and the tension between them is itself the most analytically important feature of the data.

On the reassuring side: 84% of Indians agreed that 'respecting all religions' was very important to their national identity; 91% of Hindus and 89% of Muslims said they were 'very free' to practise their religion; and large majorities across all communities expressed respect for other religions. On the alarming side: 66% of Hindus said it was very important to be Hindu to be 'truly Indian'; 65% of Hindu respondents said it was important to avoid eating beef; and strong majorities in both communities preferred their children to marry within their own religious community. Critically, only 20% of Hindus reported having many Muslim friends, and only 28% of Muslims reported having many Hindu friends, a figure that, when read alongside the data on shared festival participation and shrine visitation, suggests that inter-community social relations are maintained at the level of neighbourhood and occupational life

while formal social friendship networks remain largely community-bounded (Pew Research Centre, 2021).

This pattern, what Varshney (2002) calls the distinction between everyday inter-community relations and associational civic life, is consistent with the broader sociological literature. Varshney's study of six Indian cities found that cities with dense inter-community civic associations (trade unions, professional bodies, political parties with cross-community membership) had significantly lower communal violence rates than cities where inter-community engagement was limited to informal daily interaction without formal associational structure. The composite culture, on this analysis, is necessary but not sufficient for social peace; it requires institutional scaffolding to make it politically resilient.

MEDIA NARRATIVES AND THE REPRESENTATION GAP

The Structure of the Conflict Frame

India's media landscape has undergone a dramatic transformation since liberalisation in 1991. The number of television channels grew from a single state broadcaster (Doordarshan) to more than 900 channels by 2020, and the digital media ecosystem has added hundreds of millions of additional content producers and consumers. Within this expanded media environment, the representation of Hindu-Muslim relations has been shaped by structural commercial incentives that reward conflict, outrage, and drama over the quotidian social reality of coexistence. Neyazi (2018) and Ninan (2007) have documented how the Hindi media market, in particular, is organised around the emotional registers of religious nationalism, regional pride, and communal anxiety, registers that make the conflict narrative structurally profitable.

Entman's (1993) Framing Theory provides the conceptual vocabulary for analysing how this works. The conflict frame selects certain aspects of the Hindu-Muslim relationship, the communal riot, the disputed mosque, the interfaith marriage controversy, and makes them salient while rendering invisible the tens of thousands of daily acts of cross-community social interaction that constitute ordinary social life. The frame operates through omission as much as through commission: a news channel that broadcasts three hours of coverage of a communal riot in Muzaffarnagar while giving thirty seconds to a report on Hindus and Muslims jointly rebuilding each other's religious properties in Nagaur is not lying, exactly, but the cumulative effect of that selection ratio is a picture of Hindu-Muslim relations that is as systematically distorted as if it were fabricated (Entman, 1993; Hall, 1997).

Agenda-Setting and the Muslim Image in Indian Media

McCombs and Shaw's (1972) Agenda-Setting Theory predicts that the issues on which media focuses become the issues the public regards as important, regardless of their actual frequency or significance in lived reality. Applied to Hindu-Muslim media coverage, the theory predicts that the systematic prioritisation of conflict stories creates a public agenda in which communal tension appears as the permanent, defining feature of the Hindu-Muslim relationship, making the composite culture of shared life invisible not because it does not exist but because it has been systematically excluded from the agenda.

Narayana and Kapur's (2011) content analysis of Muslim representation in English-language Indian newspapers found that Muslims were disproportionately represented in crime, terrorism, and communal conflict stories relative to their presence in ordinary civic, professional, and cultural life. Aryal and Bharti (2022) documented a significant increase in the proportion of media coverage framing Muslims as a threat to social order, a shift they associate with the narrative framework. Khan *et al.* (2022) have demonstrated that the adversarial media framing of the Pakistan-India relationship, in which Pakistani and Indian Muslims are discursively conflated, further deepens the association between Muslim identity and national security threat within Indian media narratives.

Cultivation Theory and the Social Effects of Sustained Conflict Framing

The social consequences of sustained conflict framing are best understood through Gerbner's (1976) Cultivation Theory, which proposes that heavy television consumption shapes viewers' understanding of social reality in directions consistent with television's dominant messages, even when those messages diverge from the viewer's own direct experience. The theory predicts that heavy consumers of television news, which in India overwhelmingly features the conflict frame for Hindu-Muslim relations, will develop increasingly negative perceptions of the other community, even if their own direct social experience is of peaceful coexistence.

Bano and Mishra (2005) found, in a study of Hindu and Muslim children in Uttar Pradesh, that inter-group perceptions were significantly more negative than actual inter-group interactions in the same communities would predict, a finding consistent with the cultivation hypothesis. Ghosh and Kumar (1991) had earlier documented a systematic divergence between Hindu and Muslim children's stereotypes of each other and their actual behavioural interactions, finding that stereotypically negative perceptions coexisted with individually positive relationships in ways that the cultivation model helps explain. The social media environment of the 2010s and 2020s has dramatically intensified this cultivation effect: the algorithmic amplification of outrage-generating content in WhatsApp groups, Facebook feeds, and Twitter/X timelines means that the conflict frame now reaches communities that barely had television access a decade ago, and reaches them in the most intimate social spaces, family WhatsApp groups, neighbourhood chat threads, in ways that fundamentally alter the social cost of maintaining composite cultural practices (Rajagopal, 2001; Aryal & Bharti, 2022).

The Digital Counter-Narrative

Against the dominant conflict frame, a counter-narrative has emerged through social media, digital journalism, and independent documentary practice. YouTube channels documenting syncretic folk music traditions, Instagram accounts celebrating the composite food culture of north India, and documentary films on shared sacred spaces have created a parallel media ecosystem in which the composite culture is visible and celebrated. The viral reach of videos showing Hindus and Muslims jointly celebrating festivals, protecting each other's religious property during communal tension, or maintaining shared traditions of music and craft constitutes a genuine, if structurally marginal, challenge to the conflict frame's dominance.

Natarajan (2014) has argued for the strategic value of this counter-narrative in the context of India's international image; its domestic social function is equally important. When a

Hindu family in Madhya Pradesh discovers, through a YouTube video of a Sufi concert, that Qawwali is a thousand-year-old tradition of devotional music shared between Hindu and Muslim audiences, or when a Muslim family in West Bengal discovers, through a Facebook group, that the Baul tradition they have participated in for generations is celebrated across the country as a unique example of Hindu-Muslim syncretism, media is doing the work of cultural recognition that the mainstream news industry conspicuously fails to perform. The Pew survey's finding that 22% of respondents regularly follow religious teachers or scholars of other faiths on social media is a tentative quantitative indicator of this counter-narrative's reach (Pew Research Centre, 2021).

TOWARDS AN EMPIRICALLY GROUNDED UNDERSTANDING OF INCLUSIVE INDIA

The evidence reviewed in this paper supports neither the sentimental assertion that India is simply and naturally a land of religious harmony, nor the counter-sentimental assertion that Hindu-Muslim relations are defined by irreconcilable conflict. What it supports is a more complex, more historically honest, and more analytically productive account: that India has generated, over fourteen centuries of Hindu-Muslim coexistence, a composite social culture of extraordinary richness and depth, that this culture has always coexisted with communal tension and sporadic violence, and that it is currently under more organised and institutionally resourced pressure than at any previous point in the post-independence period.

Bhargava's (2009) concept of 'principled distance', the Indian state's constitutionally mandated posture of maintaining equal respect for all religious communities without formal separation of religion from public life, provides the legal framework within which the composite culture operates. Articles 25 through 30 of the Constitution protect freedom of religion, the right to manage religious affairs, the right of religious minorities to establish educational institutions, and the right of every citizen to receive state support for cultural practices. This constitutional architecture does not create the composite culture, but it provides the institutional conditions under which it can continue to function in a democratic polity.

Sen's (2006) argument in his book, *'Identity and Violence'* is directly relevant here. Sen demonstrates that the communalist construction of identity, in which every person is assigned a single, exclusive religious identity that overrides all other affiliations, is a political act rather than a social description. The actual identity of any Hindu or Muslim in India is irreducibly plural: a person is simultaneously a practitioner of a religious tradition, a speaker of a regional language, a member of a caste, a citizen of a state, a participant in an occupational culture, and a bearer of family customs that may or may not correspond neatly to the formal requirements of their religion. The composite culture documented in this paper, the Muslim family that maintains the Tulsi plant, the Hindu craftsman who makes the *tazia*, is not an anomaly in this account; it is the predictable expression of the irreducible plurality of real social identity. What is anomalous, in Sen's terms, is the communalist reduction of that plurality to a single dimension: the reduction that Wahhabi reformism seeks to enforce.

Varshney's (2002) empirical finding that inter-community civic associations are the most reliable predictor of communal peace suggests the policy direction. The composite culture

needs institutional scaffolding: inter-community cultural bodies, joint educational curricula that teach the shared heritage of the Bhakti-Sufi synthesis and the Ganga-Jamuni *tehzeeb*, media guidelines that require proportional and empirically grounded representation of inter-community cooperation alongside conflict, and a political culture that treats cross-community civic engagement as electorally legitimate rather than as religious betrayal. None of these are sufficient on their own, but each contributes to making the maintenance of the composite culture socially less costly and politically more supported.

CONCLUSION

The Hindu-Muslim relationship in India is not what either its celebrants or its detractors claim. It is not the seamless harmony of the syncretic ideal that liberal nationalist discourse sometimes constructs; nor is it the irreconcilable civilizational conflict that Wahhabi reformism asserts. It is something more complex, more empirically interesting, and more humanly important than either representation allows: a relationship of genuine, historically deep, socially embedded cultural exchange that has always coexisted with tension, periodic violence, and organised attempts to sever it, and that has survived those attempts because it is not a political programme but a social inheritance.

The Bhakti saints who refused to choose between temple and mosque, the Sufi mystics whose *khanqahs* were open to all seekers, the weavers of Varanasi who made the garments for both communities' ceremonies, the musicians who carried the *raga* tradition across the formal boundary of Hindu and Muslim identity, the villagers who maintained each other's harvest festivals and mourning calendars, these are not exceptional figures in Indian history. They are the statistical norm of everyday social life. What is exceptional, what requires explanation, is the organised, institutionally resourced, politically motivated effort to make them exceptional: to redefine the ordinary as the aberrant, the shared as the contaminated, and the composite as the polluted.

India's media has a specific and urgent responsibility in this context. The representation gap, the divergence between media's conflict narrative and the lived reality of composite social life, is not simply a failure of accuracy; it is an active social force that raises the cost of maintaining the composite culture by making every act of cross-community sharing visible as a political statement. Responsible media practice requires the same commitment to proportionality and evidential accuracy in covering inter-community cooperation as it currently applies, however selectively, to inter-community conflict. That representational correction, combined with the institutional scaffolding that Varshney's research identifies and the constitutional protections that Bhargava's framework articulates, constitutes the minimal condition for the preservation of an inclusive Indian society that is not a slogan but a social fact.

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HUMAN-AI COLLABORATION IN MANAGEMENT: DECISION SUPPORT, TRUST AND ORGANIZATIONAL TRANSFORMATION

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ABSTRACT

Artificial Intelligence (AI) is increasingly transforming managerial decision-making by augmenting human capabilities rather than replacing them. Despite rapid advances in AI adoption, empirical evidence regarding users' experiences of Human-AI collaboration remains limited, particularly in higher education environments. This study investigates the impact of human-AI collaboration on decision support, trust in the workforce and development of managerial roles. The methodology applied is quantitative research with structured questionnaire that was given to faculty members and students. Ninety one valid responses were gathered and analyzed. The participants shared their experience with using AI in their tasks by assessing elements like decision quality, efficiency, confidence and trust. According to the findings it has been observed that AI can assist users to make more informed decisions and save time and effort in completing tasks. Overall, participants believed that AI is a valuable tool that can help enhance productivity and decision making. The result also shows that trust in AI is still in early stage. While the majority of participants were interested in the potential of AI in their work, some voiced concerns about the accuracy of AI recommendations and the necessity for transparency in the decision-making process for these references. The research further shows that AI is slowly transforming the way management work is being performed. With the automation of routine and repetitive tasks, humans have more time to think, solve problems and make decisions. The findings contribute to the growing literature on collaborative intelligence and provide practical guidance for organizations seeking to integrate AI responsibly into management practice.

Keywords: AI Adoption, Artificial Intelligence, Collaborative Intelligence, Decision Support Systems, Higher Education, Human-AI Collaboration, Management, Organizational Transformation, Trust in AI, Workforce Trust.

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INTRODUCTION

Artificial Intelligence (AI) has emerged as a transformative force in contemporary management, fundamentally reshaping organizational decision-making, operational efficiency, and workplace practices. Rather than replacing human managers, AI increasingly functions as a decision-support technology that complements human judgement by analysing large volumes of data, identifying patterns, and generating actionable insights. This collaborative model enables managers and employees to devote greater attention to strategic planning, innovation, and complex problem-solving while reducing the burden of routine administrative activities. Consequently, Human–AI collaboration has become an important area of research in management, organizational behaviour, and information systems.

Despite the increasing adoption of AI across organizations, successful implementation depends not only on technological capability but also on users' willingness to trust AI-generated recommendations. Concerns regarding transparency, explainability, accuracy, and accountability continue to influence employees' acceptance of AI-assisted decision-making. As AI becomes more pervasive, so do the roles that people fill. The more AI is being adopted the more job roles are changing. Given the ability of AI to handle numerous repetitive duties, there's a growing trend for employees to take on more creative, critical and strategic roles. While this shift presents new opportunities, it also demands a shift in mindset among individuals to embrace new methods of work and adapt themselves to the use of AI tools. To integrate AI into business management successfully, it is crucial to have an understanding of how individuals go through this change.

Although previous studies have extensively examined the opportunities and challenges associated with Artificial Intelligence, much of the existing literature remains conceptual or technology-oriented. Empirical evidence concerning users' actual experiences of Human–AI collaboration, particularly within higher education environments, remains relatively limited. Furthermore, few studies have simultaneously examined decision support, work efficiency, user trust, confidence, role transformation, psychological safety, and future adoption within a single analytical framework. Addressing these gaps, the present study analyses responses from 91 faculty members and students collected through a structured questionnaire to investigate how AI influences managerial decision-making, workplace efficiency, trust, and behavioural intentions. By integrating these dimensions, the study contributes empirical evidence that can assist organizations in designing more effective, transparent, and human-centred AI adoption strategies.

LITERATURE REVIEW

Researchers have been interested in the interaction between people and AI to better understand how to make it work in organizations as AI becomes more pervasive. Rather than replacing people who run the business, AI systems are primarily recognized today as tools that augment the human decision-making process, making it more efficient, accurate and accessible to information. The latest research indicates that collaboration between humans and AI is the key to achieving the best results.

Trust is a key element of any Human–AI collaboration. Before they can trust and depend on AI systems, users must first come to trust them, as explained by McGrath *et al.* (2025). The authors noted that collaboration must be built and continued to be nurtured through trust, and that trust must be continuously monitored. Likewise, Sauer and Burggraf (2025) presented the notion of hybrid intelligence, where both humans and AI operate by leveraging the human element's decision-making skills and the AI's analytical power for enhanced decision-making. The study has also delved into the role AI plays in enhancing managerial decision-making. Alam and Khan (2024) discovered that AI can aid managers in making better decisions by processing vast amounts of information and minimizing uncertainty.

The incorporation of AI is not a simple process. Jain *et al.* (2023) stated that for organizations to effectively leverage AI, they have to ensure that the processes they design allow for the human dimension and ensure that it complements human expertise. A balanced distribution of tasks between humans and AI leads to better collaboration and decision quality.

Maintaining trust and user perception is still a significant hurdle in the journey of AI adoption. Tuncer and Ramirez (2022) found that individuals are less inclined to use AI if they are unaware of how the AI is making the recommendations and if they lack transparency of the AI. Similarly Vossing *et al.* (2022) reported that the explainable and transparent AI systems foster users' trust, thus contributing to successful Human–AI co-working.

AI is transforming the way people work too. According to Sowa *et al.* (2021), AI helps to mitigate routine and repetitive work, enabling employees to engage in more creative, analytical and strategic work. This is in line with the findings of Rulandari and Silalahi (2025) which indicate that the integration of Human–AI collaboration can not only boost efficiency, but also enhance job satisfaction, especially in administrative and management tasks. The results indicate that AI is helping to shift the focus of workers from operational work to more value-adding decision-making.

AI has also been associated with organizational long-term growth and sustainability on an organizational level. Based on the above, La Torre *et al.* (2021) suggested structured approaches to creating Human–AI teams to become more adaptable to organizational change. Equally Rachmad (2022) proposed that the application of AI in a management practice contributes to the resilience of an organization by enabling quick and correct decisions based on data in the midst of the changing business world.

While there are many studies that have contributed to our understanding of Human–AI collaboration, there are some gaps in research. Most of the literature is conceptual and theoretical; relatively few studies focus on user experiences of AI in actual decision-making contexts.

Further, few studies explore decision quality and user trust combined with changes in job roles and work efficiency in a unified framework. There are also few empirical comparisons of user performance before and after using AI.

Table 1: Summary of Research Gaps and the Present Study's Contribution

Area of Existing Literature	What Previous Studies Focus On	Identified Research Gap	How This Study Addresses It
Human–AI Collaboration	Theoretical models of collaboration and hybrid intelligence	Limited real-world empirical evidence on actual user experience	Uses survey data from real participants (faculty and students)
Trust in AI Systems	Trust frameworks and explain ability concepts	Lack of measurement of trust in practical management tasks	Examines user trust and confidence using Likert-scale data
Decision-Making with AI	AI improves decision accuracy and its speed	Few studies combine decision support with user behavior outcomes	Links decision support with efficiency, trust and adoption
Work Efficiency	AI improves productivity and reduces workload	Limited understanding of perceived effort reduction in real settings	Measures perceived efficiency from user perspective
Role Transformation	Conceptual discussion on job automation and augmentation	Lack of empirical evidence on shift from routine to strategic roles	Studies perceived role transformation in academic environment
AI Adoption Behavior	Technology acceptance models (TAM/UTAUT) widely used	Limited focus on post-adoption behavior and continuous use intention	Examines future adoption intention directly
Psychological Safety	Very limited research in AI-based decision environments	Psychological comfort in AI-assisted decision-making is underexplored	Includes psychological safety as a key variable
Integrated Analysis	Studies usually focus on single dimensions (trust or efficiency)	Lack of combined framework covering multiple dimensions together	Uses multi-variable integrated framework (trust, efficiency, confidence, et

RESEARCH OBJECTIVES & RESEARCH QUESTIONS

Research Objectives

The primary objective of this study is to examine the influence of Human–AI collaboration on management-related decision-making and organizational work practices. Specifically, the study seeks to:

- Examine the influence of AI-assisted decision support on management decision-making.
- Evaluate the extent to which AI improves work efficiency by reducing the time and effort required to complete managerial tasks.
- Assess users' confidence and trust in AI-assisted decision-making systems.

- Investigate the perceived impact of AI on the transformation of routine work into strategic and analytical activities.
- Analyse users' intentions to continue adopting AI technologies in future managerial and organizational decision-making.

Research Questions

The following research questions have been formulated to investigate the role of Human–AI collaboration in management, based on the goals of the study.

RQ1: What is the role of AI support in making effective decisions in management-related tasks?

RQ2: Does the application of AI contribute to the reduction of management tasks time and work?

RQ3: What are the user experiences of trust, confidence and reliability in the use of AI for decision making?

RQ4: How is AI expected to impact the shift from traditional to more analytical and strategic jobs?

RQ5: How ready are the users to use AI tools for future management and decision-making activities?

RESEARCH METHODOLOGY

Research Design

The present research is of an empirical nature and aims to investigate the impact of Human – AI collaboration on management related activities. The survey aimed to gather data on usage experiences and opinions of the AI-assisted systems. The research explores the understanding of AI's role in decision-making, enhancing work productivity, nurturing user trust and shaping the transition from ordinary to strategic tasks in actual management contexts.

Table 2: Description of Components

Component	Description
Research Design	Empirical, survey-based quantitative study
Study Area	Higher education environment
Participants	Faculty members and students
Sample Size	91 respondents
Data Collection Tool	Structured Google Form questionnaire
Scale Used	5-point Likert Scale (1 = Strongly Disagree, 5 = Strongly Agree)
Variables	Decision Support, Efficiency, Confidence, Trust, Role Transformation, Future Adoption, Psychological Safety
Independent Variables	Decision Support, Efficiency
Dependent Variables	Confidence, Trust, Role Transformation, Future Adoption, Psychological Safety
Data Analysis Methods	Descriptive statistics (Mean, percentage distribution), graphical analysis

Participants and Study Context

The study was conducted in a higher education institution, involving both faculty members and students. There were 91 responses to the survey. The diverse backgrounds of the participants brought a range of viewpoints to the table, covering topics such as the use of AI for management-related tasks and its role in analysis. The mix of participants enabled the study to better understand the ways people interact with AI and their perceptions about its role in supporting their work.

Survey Instrument

Table 3: Section-wise Variables

Section	Variable	Sample Statement Items
A	Demographics	Participant type (Faculty / Student)
B1	Decision Support	—AI helps me make better decisions in my tasks.
B2	Efficiency	—AI reduces the time required to complete my work.
B3	Confidence	—I feel confident using AI-generated outputs.
B4	Trust	—I trust the recommendations provided by AI systems.
B5	Role Transformation	—AI allows me to focus more on strategic tasks than routine work.
B6	Future Adoption	—I intend to continue using AI tools in future tasks.
B7	Psychological Safety	—I feel comfortable relying on AI for decision-making.

Data Collection Method

The research method used in the study was quantitative with data collection methods by distributing a structured questionnaire by means of Google Forms. The questionnaire was split into two parts. The initial section collected basic demographic data such as participant's role (faculty or student). The second part assessed participants' experiences and perceptions of using AI by measuring them on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) with a series of statements.

The questionnaire covered the following aspects related to AI-assisted decision-making and reduction in time and efforts, user confidence, trust in AI recommendations, changes in work roles and participants' willingness to use AI for future management and decision-making tasks.

Response Distribution Summary

Response Level	Average Distribution (%)
Strongly Agree	28%
Agree	42%
Neutral	18%
Disagree	9%
Strongly Disagree	3%

Variables and Measurement

This study explored several of the critical variables to better understand how Human–AI collaboration impacts management. The key variables involved were:

Decision Support – How AI assists in good decision making and information.

Efficiency: How AI can help save time and effort.

Confidence: Users' trust in the correctness and value of outputs created by AI.

Experiencing AI: To what extent to which users are comfortable using AI in their daily tasks.

Usefulness: How useful the AI recommendations are to the user.

Role Transformation: The degree to which AI can transform an individual's role from mundane to more strategic and analytical.

Future Adoption: Users' intent to pursue the use of AI tools in the future for work and decision-making.

Psychological Safety: Users' feeling of comfort and security in relying on AI systems in decision-making processes.

The variables identified in this study that is expected to influence the dependent variables – namely decision support and efficiency were chosen as the independent variables as these are the main advantages that AI brings. The dependent variables were confidence, trust, role transformation, future adoption and psychological safety all of which stem from users' response and experience with AI-supported work.

All variables were scored on a five-point Likert scale (1 = Strongly Disagree and 5 = Strongly Agree).

Table 4: Descriptive Statistical Results

Variable	Mean Score (out of 5)	Interpretation
Decision Support	4.21	High agreement – AI strongly supports decisions
Efficiency	4.35	Very high – significant reduction in time/effort
Confidence	3.62	Moderate – users somewhat confident
Trust	3.48	Moderate – trust is developing but not strong
Role Transformation	4.10	High – shift toward strategic tasks observed
Future Adoption	4.28	High willingness to continue using AI
Psychological Safety	3.55	Moderate comfort level with AI reliance

Data Analysis Approach

Descriptive statistical techniques were used for the analysis of the collected data. The mean score was calculated for each variable to better provide overall trends and to understand the reaction of the participants. Besides the numerical analysis, the distribution of responses

was also presented graphically using pie charts to present the data in a simple and visual way that helps in understanding the data patterns.

Reliability and Validity

A structured questionnaire ensured consistency of response from all participants. The Likert scale approach enabled the opinions to be transformed into measurable data and thus increased the reliability of the results. In addition, including multiple variables allowed for a more complete and well-rounded understanding of Human–AI collaboration and its impact on users’ experiences.

RESULTS AND DISCUSSION

Table 5: Theme-wise Scores

Theme	Key Finding	Interpretation
Decision Support	High mean score (4.21)	AI is widely perceived as useful in improving decision quality
Efficiency	Highest score (4.35)	Strong evidence that AI reduces workload and saves time
Trust & Confidence	Moderate scores (3.48–3.62)	Users are still developing trust in AI systems
Role Transformation	High score (4.10)	AI is shifting users from routine to strategic thinking
Psychological Safety	Moderate score (3.55)	Users feel cautious but generally comfortable
Future Adoption	High score (4.28)	Strong intention to continue using AI tools

Participant Distribution

The research involved 91 participants in all, comprising both faculty and students. Most of the respondents were students (73.6%), while the faculty members accounted for 26.4% of the total number. This distribution presents diverse perspectives on Human –Artificial Intelligence partnership, from diverse user groups.

AI Support in Decision Making

Results of the feedback revealed most participants felt that AI could be useful in improving decision making. Many of the individuals expressed more agreement, suggesting that AI is beneficial in enhancing decision quality while reducing uncertainty.

AI's Role in saving effort and time

The efficiency was given a strong positive comment. The majority of participants concurred that AI lessens both the effort and time needed to finish tasks. This underscores AI's contribution in enhancing efficiency and streamlining task performance.

Confidence in AI:

According to the findings, the participants have a level of confidence that ranges from moderate to high when it comes to using AI. Although a large number of users are confident in

their ability to relay on suggestions mode by AI, there are still some respondents who exhibit reluctance, which indicates that there is room for improvement in terms of user familiarity and dependability of the system.

Psychological Safety

The results show a low level of trust in AI among participants. Users understand the benefits of using AI but there are some accuracy and reliability concerns. Although users are cautious to rely solely on AI systems, there is a need for more user knowledge and transparency as evidenced by psychological safety scores.

Table 6:Domain-wise Conclusion

Domain	Conclusion
Overall Impact	Positive impact of AI on management tasks
Human Factor	Trust remains the weakest dimension
Work Nature	Clear shift toward strategic work roles
Adoption Trend	High willingness for continued AI use
Organizational Implication	Need for transparency and trust-building mechanisms

The overall experience of using AI tools to support participants' tasks was good. AI was perceived as useful, easy to use and assisting people to get jobs done faster. This means that AI is gaining traction as a collaborative tool instead of AI as a replacement.

Correlation Analysis

After this, a correlation analysis was carried out to further examine the relations between the variables

Table 7: Correlation between Key Variables

Variables	Decision Support	Efficiency	Confidence	Trust	Role Transformation	Future Adoption	Psychological Safety
Decision Support	1.00	0.74	0.56	0.49	0.56	0.69	0.32
Efficiency	0.74	1.00	0.59	0.51	0.49	0.71	0.36
Confidence	0.56	0.59	1.00	0.73	0.53	0.64	0.55
Trust	0.49	0.51	0.73	1.00	0.56	0.55	0.55
Role Transformation	0.56	0.49	0.53	0.56	1.00	0.59	0.53
Future Adoption	0.69	0.71	0.64	0.55	0.59	1.00	0.43
Psychological Safety	0.32	0.36	0.55	0.55	0.53	0.43	1.00

The correlation results indicate that all of the variables are correlated positively. Decision support and efficiency (i.e. better performance of the AI) have a strong correlation with future adoption, suggesting that improved AI performance drives increased user acceptance. The positive correlation between confidence and trust is also significant $r=0.73$, highlighting the importance of trust in human-AI collaboration. Decision assistance and psychological safety have a rather weak association, suggesting that consumers are still hesitant to rely on AI. Overall, the results show the user perception and behavioral intention are positively impacted by AI- driven performance gains.

Regression Analysis

To gain deeper insights into the impact of AI-related parameters on the future adoption a regression analysis was performed as shown in table 3.

The regression results indicate that both decision support and efficiency have a positive and significant impact on future AI adoption. However, efficiency ($\beta = 0.44$) is slightly more influential than decision support ($\beta = 0.38$), indicating that users are more likely to embrace AI when it saves them effort and time. The results indicate that performance-related gains are vital to affecting user acceptance of AI systems.

Correlation and regression analysis were also used, in addition to descriptive analysis, to determine the relationships between the variables.

Table 8: Regression Results

Variable	Coefficient (β)	Significance
Decision Support	0.38	Significant
Efficiency	0.44	Significant
Constant	0.82	—

Discussion

This study's results are unmistakable and show that using AI can make a major difference in making decision-making processes more efficient and supported. The positive responses for the reduction in effort and future adoption emphasize the practical advantages of AI in management settings. The moderate levels of trust and psychological comfort, however, imply that users still need more transparency and trust in AI outputs.

The findings are consistent with previous studies that highlight the significance of trust and Human-AI partnership. It also emphasizes that although AI is helping to redefine roles; the transition to the shift of strategic work is an ongoing process and relies on user adaptation. Overall, the results indicate that AI needs to be used as a tool to assist and build user confidence and engagement.

LIMITATIONS, FUTURE SCOPE AND CONCLUSION

Limitations

- This study has some limitations that should be kept in mind while interpreting the results. One limitation of the study was the small number of participants (91). This may not be

representative of the views of a larger population. The results of this study might not be directly applicable to other sectors, including industry or government organizations, because it was conducted in a higher education environment.

- Second, it was a self-reported questionnaire that was used to collect data. This implies that the answers may be subjective or biased towards participants' opinions and perceptions.
- Third, the study was conducted cross-sectional (i.e. at one time). As a result it is not feasible to track the changes in trust, confidence or use of AI by participants over time.
- Fourth, the study was primarily descriptive in nature, and therefore it was not able to explore the cause-and-effect relationship between variables in detail.
- Lastly, the study only examined certain variables including decision support, efficiency and trust and role transformation. Other factors such as organizational culture, technical skills or ethical considerations were not considered which can have an impact on Human–AI collaboration as well.
- In general, the study offers valuable insights but these limitations warrant consideration for caution when interpreting the results and for future studies to allow for more generalizations.
- The study took place in an academic setting (faculty/student) and may not be representative of corporate settings.
- The analysis is based on the responses that have been self-reported, and these may contain subjective bias.
- The study reflects short term perceptions and not long term impact.

Future Scope

- There are a number of ways to further extend this study in future research. First, it would be helpful to have more and varied participants from various industries, like healthcare, banking, IT and manufacturing. This would facilitate understanding of working environments where Human–AI collaboration takes place.
- Secondly, future research could be carried out for a longer duration of time. This would enable researchers to observe the evolution of trust, confidence and acceptance of AI with increasing usage.
- Third, more sophisticated methods of analysis, including regression or structural equations can be employed to gain a better understanding of the relationships among factors such as trust, efficiency and decision support.
- Fourth, a mixture between the survey and the interview or a case study could provide additional insights into actual users' experiences. Some of this would be why there are people who still don't know or are only somewhat confident in AI systems.
- Finally, future research can include enhancing the transparency and explainability of AI systems. If one can understand how AI is making decisions and make it clear which can boost trust and make collaboration more effective in the future.

CONCLUSION

This study explored the impact of Human–AI collaboration on various aspects of management related work, including decision-making, efficiency, trust and role change. The analysis of the received answers from 91 respondents suggests that AI can be a helpful and positive tool for enhancing task performance and user experience. AI was found to assist in decision-making and to save a lot of effort and time in tasks. Experiences with AI were generally positive, with many users saying that they were willing to use AI in their future activities. The results indicate that AI is increasingly being adopted as a helpful tool for management purposes.

Meanwhile, the study identified certain issues. The level of trust in AI and psychological comfort were also identified to be moderate, meaning users are still cautious but fully trust in the output generated by AI. Adopting AI is a trend that's on the rise but there's a need for greater transparency, reliability and user understanding of the system. The study also notes that the transition from routine work to more strategic and analytical jobs occurred progressively. This is in accordance with the changing nature of work, as AI helps people to shift their focus from repetitive tasks to more value-adding work. Overall, the results indicate that AI can be a valuable tool for improving management practices as long as it is used in a way that builds trust, does not alienate users and enables Human–AI collaboration.

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RECALL OF WITNESS IN CIVIL SUITS: STATUTORY SCOPE, INHERENT POWERS, AND JUDICIAL TRENDS

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ABSTRACT

*The recall of witnesses in civil trials presents a perennial challenge in Indian jurisprudence, requiring courts to delicately balance the competing interests of litigants while ensuring speedy justice. This paper critically examines the statutory framework governing witness recall under Order XVIII, Rule 17 of the Code of Civil Procedure, 1908, read in conjunction with the inherent powers of civil courts under Section 151 of the CPC. Through a comprehensive analysis of landmark Supreme Court precedents—including *Vadiraj Nagappaa Vernekar*, *K.K. Velusamy v. N. Palanisamy*, *Ram Rati v. Mange Ram*, and the recent *K. Bharathamma v. Bandaru Sakku Bai*—the paper establishes that witness recall is purely a discretionary power vested in the court, not a statutory right of litigants. The study delineates the judicial parameters governing such discretion: due diligence on the applicant's part, essentiality of the proposed evidence for just decision-making, and assessment of probable prejudice to the opposing party. The paper particularly examines the transformative contribution of *K.K. Velusamy*, which reconciled the interplay between Order XVIII, Rule 17 and Section 151 CPC, establishing a structured framework that balances expeditious trial with substantive justice. The analysis reveals that while courts possess inherent jurisdiction to recall witnesses in bonafide cases where vital evidence was unavailable despite due diligence, such power must be exercised sparingly and with caution to prevent dilatory tactics. The paper concludes by proposing that the recall mechanism serves as a crucial safety valve in civil jurisprudence, provided courts adhere to the established judicial parameters and impose appropriate costs to deter abuse of process.*

Keywords: Recall of Witness, Order XVIII Rule 17 CPC, Section 151 CPC, Civil Procedure Code 1908, Discretionary Power, Inherent Powers of Court, Speedy Trial, Due Diligence, Evidentiary Lacunae, Indian Civil Jurisprudence, K.K. Velusamy, Witness Examination, Cross-Examination, Judicial Discretion, Abuse of Process, Substantive Justice, Procedural Law, Evidence Law.

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INTRODUCTION

It has been a tantalising question in the minds of the courts and the Jurists and the learned lawyers as to how to balance the rights of both the sides of a suit while recording the evidence of the parties. The examination and cross-examination of witnesses form the evidentiary core of a civil trial. In civil jurisprudence governed by the Code of Civil Procedure, 1908 (CPC), the general rule requires parties to produce their evidence and examine witnesses in a structured sequence without repetitive or fragmented recording. However, situations arise where a witness must be recalled to clarify ambiguities or bring crucial, newly discovered evidence on record. Ample opportunity to the litigants for prosecuting and defending their case are the hallmark of a litigation in Original Side of a civil court. It is equally true and competing interest of litigants that justice must not be defeated in order to secure the opportunity of a litigating party. Speedy trial is hallmark of justice. *Justice delayed-Justice denied; justice hurried- justice buried*. The balance in the competing interest of the parties is the true justice delivery of the judicial system. In Indian civil jurisprudence, the statutory provision involved to address the circumstances of “recall of witness” appears to be *prima facie* in the Order 18 Rule 17 of the Code of Civil Procedure, 1908. Considering the competing interest of the litigants, need of the hour is to revisit the statutory provisions in the Code of Civil Procedure, 1908 in the backdrop of the precedents of the Hon’ble Supreme Court of India and High Court of various Judicatures. In Indian civil litigation, a trial relies heavily on documentary evidence and witness testimony. Once a witness has been examined, cross-examined, and discharged, their evidence is generally considered to have been completed. However, civil suits rarely follow a straight path—new documents surface, crucial questions are omitted, or facts require clarification. To prevent injustice from such oversights, the Code of Civil Procedure, 1908 (CPC) provides mechanisms for the court to recall and re-examine witnesses. The primary statutory provision governing this mechanism is Order XVIII, Rule 17 of the CPC, read in conjunction with the inherent powers of the court under Section 151 of the CPC.

Order XVIII, Rule 17, CPC:

“The Court may at any stage of a suit recall any witness who has been examined and may (subject to the law of evidence for the time being in force) put such questions to him as the Court thinks fit.”

The Key Features of Order 18 Rule 17 of the CPC:

- **Court-Centric Power:** The provision exists primarily for the court’s convenience, enabling it to clear doubts or ambiguities in evidence before delivering judgment.
- **Stage of the Suit:** The power can be exercised “*at any stage of a suit*” prior to pronouncing judgment.

At the very outset, the first issue comes to mind of the law practitioners as to whether the Recall of Witness is statutory right of the litigant?

In this regard, it is fairly settled that the litigants in Indian civil suits do not have a statutory or absolute right to recall a witness. Under Indian civil law, the recall of a witness is purely a discretionary power vested in the trial court, intended primarily for the court’s own assistance

and clarification, rather than a right granted to parties to reopen evidence at will. On perusal of the statutory wording in Rule 17 of the Order 18 of CPC, there is the use of term “**may**”. This shows the legislative intent enshrined in the governing provision, Order 18 Rule 17 of the Code of Civil Procedure, 1908 (CPC), reproduced herein:

“The Court **may** at any stage of a suit recall any witness who has been examined and **may**... put such questions to him as the Court thinks fit.”

The deliberate use of the word “**may**” by the legislature makes it clear that the power is discretionary, not mandatory. It does not confer an enforceable right on either the plaintiff or the defendant to demand that a witness be recalled. The Hon’ble Supreme Court of India has settled the position on litigants’ claims and has explicitly rejected the argument that *recall is a litigant’s right* in several landmark precedents:

In *Vadiraj Nagappa Vernekar v. Sharadchandra Prabhakar Gogate*¹, the Apex Court categorically held that Order 18 Rule 17 is primarily for the convenience of the court to clarify any doubts that may have arisen during the examination of a witness. In fact, it does not give a right to a party to re-examine any witness to cover up omissions or fill lacunae (gaps) in their evidence.

Subsequently, in the decision of *K.K. Velusamy Vs. N. Palanisamy*² the Supreme Court reiterated that: A party cannot claim recall of a witness as a matter of routine or right. Even when a party invokes the inherent powers of the court under Section 151 CPC to request recall, the court is not bound to accept it. The power must be exercised sparingly and only to prevent a grave failure of justice.

Similarly, in the decision of *Ram Rati v. Mange Ram (2016)*³ the Supreme Court reversed a High Court order that had permitted recall, holding that:

“Litigants cannot use Order 18 Rule 17 to ask “**left-out questions**” or elaborate on points missed during initial examination. Permitting recall as a right would make trial proceedings endless”

In a recent decision of August 04, 2026, in *K. Bharathamma v. Bandaru Sakku Bai*⁴ the Apex Court has reiterated in different words that the Order XVIII Rule 17 is a discretionary power vested strictly in the court to clarify evidence or doubts; it is not meant to allow parties to reopen evidence at the final arguments stage to fill omissions or introduce belated documents. The Court clarified that this provision does not empower a court to recall a witness simply to afford a party another opportunity for cross-examination.

In the backdrop of the above precedents, it is clear that the litigants in Indian civil suits do not have a statutory or absolute right to recall a witness rather the recall of a witness is purely a discretionary power vested in the trial court. However, another question is left in the mind that what if any litigant approaches the court for any bonafide and genuine cause for recall of the witness under the inherent powers of the Civil Court what would the legal stand be. In this regard, as a matter of law, there is no statutory provision in the CPC, rather, the litigant can only resort to the civil court by invoking the powers of the court under section 151 of the CPC exercised under the regulated cannons embedded in the *ratio decidendi* of the

precedents passed by the Constitutional Courts. In such circumstance, the Court should be left with no option than to be guided by the judicial precedents. The first decision in Indian judicial system, the decision of ***Sultan Saleh Bin Omer Vs Vijayachand Sirimal***⁵ passed by the Andhra Pradesh High Court has clarified the court's powers regarding the recall of witnesses and the inherent jurisdiction under Section 151 of the Civil Procedure Code (CPC). In the said decision, the Hon'ble Andhra Pradesh High Court has held that a close reading of this Rule makes it obvious that the right under that Rule to put questions at any stage of a suit, or recall any witness for that purpose, is given to the Court. The Court can put questions to the witness re-called, and no cross-examination is ordinarily allowed upon the answers to the questions put by the Judge without leave. The right to act under this Rule is not restricted to the Court on its own motion, but may be exercised at the instance of a party. It cannot, therefore, be said that an opportunity to a party to re-call any witness for the purpose of examining, cross-examining or re-examining is governed by Order 18, Rule 17 C. P. C. I, therefore, hold that if circumstances warrant, an opportunity to a party to re-call a witness for examining, cross-examining or re-examining can be granted by a Court in the exercise of its inherent jurisdiction under section 151 C. P. C. However, in the decision of ***Sultan Saleh Bin Omer(Supra)***, the modalities of allowing the re-call a witness for examining, cross-examining or re-examining is not prescribed by the Court.

But, in ***K.K. Velusamy(Supra)*** the Apex Court has categorically laid down the modalities to recall the witness exercising the powers of the Civil Court U/s 151 CPC in a manner with limited scope and held with word of caution that:

*"16. We may add a word of caution. The power under section 151 or Order 18 Rule 17 of the Code is not intended to be used routinely, merely for the asking. If so used, it will defeat the very purpose of various amendments to the Code to expedite trials. But where the application is found to be bona fide and where the additional evidence, oral or documentary, will assist the court to clarify the evidence on the issues and will assist in rendering justice, and the court is satisfied that non-production earlier was for valid and sufficient reasons, the court may exercise its discretion to recall the witnesses or permit the fresh evidence." However, the Apex court observed how the process should be closely guided to avoid protracted litigation. The Apex Court Stated: "**But** if it does so, it should ensure that the process does not become a protracting tactic. The court should **firstly** award appropriate costs to the other party to compensate for the delay. **Secondly**, the court should take up and complete the case within a fixed time schedule so that the delay is avoided. **Thirdly** if the application is found to be mischievous, or frivolous, or to cover up negligence or lacunae, it should be rejected with heavy costs. If the application is allowed and the evidence is permitted and ultimately the court finds that evidence was not genuine or relevant and did not warrant the reopening of the case recalling the witnesses, it can be made a ground for awarding exemplary costs apart from ordering prosecution if it involves fabrication of evidence. If the party had an opportunity to produce such evidence earlier but did not do so or if the evidence already led is clear and unambiguous, or if it comes to the conclusion that the object of the application is merely to protract the proceedings, the court should reject the*

application. If the evidence sought to be produced is an electronic record, the court may also listen to the recording before granting or rejecting the application.”

17. Ideally, the recording of evidence should be continuous, followed by arguments, without any gap. Courts should constantly endeavour to follow such a time schedule. The amended Code expects them to do so. If that is done, applications for adjournments, re-opening, recalling, or interim measures could be avoided. The more the period of pendency, the more the number of interlocutory applications which in turn add to the period of pendency.”

The **K.K. Velusamy**(supra) decision, is a path breaking one and it has balanced the speedy trial and the competing interest of the rival litigant in a civil suit by bridging gap of the long adjournments by continuous dates for recording of evidence of the witness, limiting the time and compensating the hardship with adequately burdening the applicant party with appropriate cost followed by fixing the short dates for the arguments in the Suit. In the same decision, it has also been held that the Section 151 can be invoked to recall a witness for further cross-examination/ examination by a party if relevant, non-manufactured evidence was unavailable earlier despite due diligence. Subsequently, in the decision of **Shubhkaran Singh Vs Abhayraj Singh & Ors**⁶ also the Hon'ble Supreme Court has reiterated and dominantly adopted the law laid down in the **K.K. Velusamy** (supra) and came to the similar proposition. The decision of **K.K. Velusamy**(supra) has also made a distinction between the Rule 17 of Order XVIII CPC and the Section 151 CPC and held that Order 18 Rule 17 is strictly meant for the court to clarify its own doubts regarding evidence already on record. It also observed that when a party seeks to reopen evidence to produce new material or further cross-examine a witness, the trial court must invoke its inherent powers under Section 151 CPC. In another decision of **Bagai Construction v. Gupta Building Material Store** ⁷ the Supreme Court has discussed the role of the trial courts on an application at late stages of trial and cautioned against allowing recall applications filed at the stage of final arguments and held that the applications to recall witnesses or produce additional documents after evidence is closed should not be entertained casually. Unless compelling reasons and due diligence are demonstrated, granting late recall applications defeats the objective of expeditious trials introduced by CPC amendments. In the same decision, the Supreme Court has also put a control over indiscriminate abuse by the litigants of the provisions of the recall of witness and held that the inherent powers cannot be exercised routinely to allow production of documents or recall of witnesses after evidence is closed, especially if the party possessed those materials throughout the trial. On another tangent, the Supreme Court in the decision of **Gayathri v. M. Girish**⁸ on the repression of dilatory tactics condemned the practice of using repetitive recall applications to delay trials and observed that filing repeated interlocutory applications under Order 18 Rule 17 to stall proceedings constitutes an abuse of the judicial process, warranting dismissal with exemplary costs. In another precedent of the Supreme Court in **Ram Rati**(supra), the Apex Court reversed lower court orders that had permitted witness recall to elaborate on points omitted during the initial examination and the Court has held that recalling a witness to elaborate on “left-out points” amounts to filling lacunae, which is impermissible under Order 18 Rule 17 CPC.

This shows that the Supreme Court of India has reconciled the interplay of section 151

of CPC and the Order XVIII Rule 17 of the CPC in **K.K. Velusamy**(supra) delineating the following parameters:

- i. **Inherent Powers Complement the Code:** Order XVIII, Rule 17 is not exhaustive regarding the recalling of witnesses. Where a bonafide circumstance is not covered by Rule 17, the court may invoke Section 151 to reopen evidence or permit recall for further examination/cross-examination in the interest of justice.
- ii. **High Threshold for Exercise:** Such inherent power should be exercised sparingly, with extreme caution, and only in exceptional cases where non-recall would cause grave injustice.
- iii. **Prevention of Abuse of Process:** Courts must ensure that applications under Section 151 are not dilatory tactics designed to protract litigation, harass the adversary, or introduce tutored evidence.

THE CLOSING NOTE

A litigant can only **request** the court to exercise its discretion to recall a witness. The court will entertain such a request only if the party demonstrates that despite exercising due diligence, vital evidence was omitted, and that non-recall would result in a miscarriage of justice. It can never be claimed as a matter of statutory right. The power to recall a witness under Order 18 Rule 17 read with Section 151 CPC acts as a balancing mechanism in Indian civil jurisprudence. While it empowers judges to seek clarifications and prevent miscarriages of justice, Supreme Court precedents strictly guard against its misuse as a tool for filling evidentiary gaps or delaying trials. The Apex Court has laid down that Section 151 CPC can be invoked for recall only if the applicant had exercised due diligence and could not produce the evidence earlier. The evidence is crucial to decide the real matter in controversy and non-recall would lead to a grave failure of justice. In nutshell, in recall of witness, the first judicial parameter is due diligence with an objective to ensure bonafide intent on the judicial standard to find out as whether the applicant failed to bring the evidence earlier, despite reasonable diligence. The second judicial parameter is essentiality with an objective to assist the court on the judicial standard to find out a whether the testimony of the proposed witness is indispensable for a just decision on the core issues. The third judicial parameter is the probable prejudice caused to the rival side with an objective to maintain fairness on the judicial standard of finding out the fact whether any inconvenience to the opposing side can be compensated through costs or cross-examination either.

ENDNOTES

1. *Vadiraj Nagappaa Vernekar v. Sharadchandra Prabhakar Gogate*, (2009) 4 SCC 410.
2. *K.K. Velusamy v. N. Palanisamy*, (2011) 11 SCC 275
3. *Ram Rati v. Mange Ram*, (2016) 11 SCC 296
4. *K. Bharathamma v. Bandaru Sakku Bai*, 2026 SCC OnLine SC 795 (decided Aug. 4, 2026).
5. *Sultan Saleh Bin Omer v. Vijayachand Sirima*, AIR 1966 AP 295
6. *Shubhkaran Singh v. Abhayraj Singh & Ors.*, (2025) SCC OnLine SC 628
7. *Bagai Construction v. Gupta Building Material Store*, (2013) 14 SCC 1
8. *Gayathri v. M. Girish*, (2018) 8 SCC 745

CHALLENGES FACED IN ADOPTING ORGANIC FARMING: A STUDY OF THE WOMEN SHGs IN EAST KHASI HILLS DISTRICT OF MEGHALAYA

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ABSTRACT

From the experiences of the past years, it is indicated that modern farming methods have overused the natural resources base. Excessive chemical fertilizers and pesticides were used, which created the problems of loss of soil fertility and water pollution. Therefore, efforts in advancing technologies which are eco-friendly are necessary, and one such eco-friendly innovation is organic farming. An organic farmer maintains biodiversity and reduces environmental pollution such as air, water and soil. Organic farming has grown out of the conscious effort inspired by people to create the best possible relationship between the earth and men. This paper aims to study the socio-economic status of the women SHGs as well as to find out the challenges with regards to organic farming. Using Stratified Random Sampling, 100 respondents were taken from Mawphlang, Mawkynrew and Laitkroh khatarshnong block in Meghalaya, respectively. Primary data was collected from the respondents through semi- structured interview schedules. To analyse the challenges of women engaged in organic farming, statistical tools such as percentage and chi square test was used. The findings were as follow: firstly, many of the farmers face transportation problem as most of their places are located in steep slopes and far away from market area. Secondly, most of them are illiterate therefore it creates a problem as a group to carry on with organic farming activities since they are not aware of the procedures involved. Thirdly, since practising organic farming does not require any pesticides which creates challenge for most of the farmers due to uncertain weather conditions. The research suggests that by addressing research areas like these stakeholders can gain valuable insights into the potential of organic farming to enhance agricultural sustainability, improve livelihoods, and contribute to the food security in East Khasi Hills District of Meghalaya.

Keywords: Adoption of Organic Farming; East Khasi Hills; Meghalaya; Organic Farming; Self-Help Groups (SHGs).

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INTRODUCTION

From the experiences of the past years, it is indicated that modern farming methods have overused the natural resources base. Excessive chemical fertilizers and pesticides were used, which created the problems of loss of soil fertility, soil and water pollution. Ordinary farming depends intensely on compound composts and poisonous pesticides, etc., which enter the food supply, degrade water sources, harm animals and affect the ecosystem. Efforts in advancing technologies which are eco-friendly are necessary, and one such innovation, which is eco-friendly is organic farming. The future prospects of organic farming synchronizes with Sustainable Development's goal, which targets to 'end hunger, achieve food security and improved nutrition and promote sustainable agriculture'. However, only 2% of the net sown area in India is organically cultivated, and only 1.3% of farmers in India are registered for organic farming.

Organic food is being preferred in the huge domestic market. Organic farming has arisen as an elective means of cultivating that may address quality and sustainability concerns, yet additionally guarantees a loan-free future, with expanding awareness about the security and nature of food.

Organic farming works in harmony with nature rather than against it. This involves using techniques to achieve good crop yield without harming the natural environment or the people who live in it. An organic farmer produces vegetables, fruit, cereal crop or livestock without the use of chemical fertilizers, pesticides or herbicides. In another way, Organic Farming is a kind of agriculture that provides the consumers with fresh, tasty and reliable food while regarding natural life cycle system. In addition to health benefits of organic products for consumers, there are vital environmental benefits for the earth. An organic farming keeps biodiversity and reduces environmental pollution such as air, water and soil. Organic farming has grown out of the conscious effort by inspired people to create the best possible relationship between the earth and men.

Literature Reviews

Md Sikandar Azam (2022) conducted a study on "Adoption of Organic farming: Exploring Challenges and Prospects for Small and Marginal Farmers". This study aims to understand the growth of organic agriculture, barriers to adopting organic farming, and opportunities for potential farmers. The primary data from 200 farmers have been collected through structured questionnaires. To understand the significant stimulates or roadblocks, variables have been ranked based on the mean value. The logic regression model has been applied to analyse the data. The study found that lack of expert service and conversion compensation were significant roadblocks to adopting organic farming, whereas quality food and chemical-free farming were influencing factors with an expectation to receive a price premium for organic production. Therefore, the study suggested that government should encourage farmers by providing conversion compensation, a separate market for organic products, and knowledge-based expert services to encourage farmers to adopt organic agriculture.

A review by Lampkin and Measures (2019) found that limited availability and high costs of organic inputs, such as fertilizers and pesticides, were major challenges for organic

farming. Organic farming also faces challenges in terms of yield, as it may produce lower yields compared to conventional farming due to lower nutrient inputs and pest control. Furthermore, organic farming requires specialized knowledge and skills, which can limit its adoption and scalability.

Climate change is a significant challenge faced by organic farming, as it can lead to increased weather variability and extreme weather events that can damage crops and disrupt natural processes. A study by Gomiero *et al.* (2017) found that organic farming practices, such as crop diversification and intercropping, can improve soil health and water retention, making them more resilient to climate change. Furthermore, organic farming can reduce greenhouse gas emissions, as it relies less on fossil fuels-based inputs, such as synthetic fertilizers

A review by Ponisio *et al.* (2015) found that organic farming can produce yields that are comparable to or even higher than conventional farming, especially in systems that incorporate agro-ecological principles. However, the effectiveness of organic farming may depend on factors such as soil quality, climate and pest pressure.

Satyajeet *et al.*, (2019) in their study, "Constraints Faced by Farmers in Adoption of Organic Farming" explored the major constraints in adoption of organic farming. The study was based on the inferences of 120 sampled participants collected during training programme on organic farming. Based on the mean values, the constraints were ranked and it was observed that 'unorganized organic market for organic growers' was ranked first with the mean score of 2.69 out of maximum possible score of 3. The last constraint for not practicing organic farming was the ground of '*organic registration process being costly and complicated*' with the mean score of 1.61.

Theoretical Framework

Social Capital Theory and Theory of Embeddedness: Social Capital Theory and the Theory of Embeddedness highlight the significance of social networks and relationships as a resource (Granovetter, 1973). 'Social capital' refers to actual or potential resources linked with strong or weak relationships based on trust, norms and reciprocity that enable the participants to pursue shared objectives more effectively. This theory of social capital postulates that the existence and success of collaborations and collective actions are mediated by the presence or absence of trust, reciprocity, and cooperation among the actors of the society. The theory of embeddedness tries to understand the influence of social relations on behaviour and institutions. It argues that most behaviour is closely embedded in the networks of interpersonal relations.

Resilience Theory: Resilience theory is an amalgamation of theories floated to understand how specific individuals and communities sustain themselves in the face of adversity. Resilience is the capability of a system and its actors to deal effectively with the change and continue growing in the face of a changing environment. James and Brown (2019) employed the resilience theory to understand conventional to organic farming conversion among UK farmers. The study found the antecedents of farmers' conversion decisions to be characterised by a complex set of abrupt and gradual changes beyond their farms and being

experienced differently and unequally by the farmers.

Theory of Diffusion of Innovations: The innovation diffusion process comprises four elements, namely innovation, communication, time and social system. Innovation includes ideas, practices, or other entities perceived to be novel. Rogers listed five diffusion rate-deciding characteristics of an innovation. They include a relative advantage (over the established idea), compatibility (consistency with the values, experiences, and needs of likely adopters), complexity (difficulty of interpretation and usage), trialability (possibility of application of innovation on a limited basis) and observability (result visibility). Innovations with greater perceived relative advantage, compatibility, trialability, observability and less complexity are more prone to rapid penetration. Communication means information generation and sharing among the participants to reach a mutual understanding. Time element defines the diffusion process through the innovation-decision process by which individuals pass from initial learning of innovation through its adoption or rejection. In his studies, older farmers, females, less educated, and less experienced farmers were more open to adopting organic cotton farming. Farm characteristics such as nearness of farm to house and household size had a positive relationship with the adoption of organic farming, while size had a negative relationship. Among institutional factors, credit access and membership in cooperatives had a positive but insignificant relationship with the adoption of organic farming, but extension services support had a positive relationship. Wheeler (2008) found small market size and 'willingness to pay', information needs, lack of government support, production difficulties, and pests and diseases to be the major barriers to adoption.

Problem of the study

Despite the matrilineal structure of Khasi society, women face labour challenges similar to those in patriarchal societies. Also, the limited supply of organic fertilizers and pest control measures can be challenging for the farmers procuring it. Limited access to markets for organic produce also poses a significant challenge. The perishable nature of many organic products necessitates efficient marketing channels which were often lacking. Additionally, the economic returns may not always be competitive but making it less attractive.

Need of the study

Although organic farming is gaining popularity due to its environmental and health benefits organic farmers up till date face numerous challenges that hinder their growth as a group or either as an individual. Organic crops although it has health benefits in them but can be less profitable due to certification expenses and lower yields. They also struggle with market access, competition from conventional crops, dealing with natural methods of pest control and also dependency on monsoon rains and sun heat to make their crops yield. Also, many of the farmers lack technical knowhow and training in organic farming practices therefore studying these gaps can help improve education and extension services.

Objectives of the study

- I. To study the socio-economic status of the women SHGs in organic farming.
- II. To find out the challenges encountered by the Women SHGs before and after joining the group.

Research Question

- Q1. What is the socio-economic status of the women SHGs engaged in organic farming activities in the East Khasi Hills District of Meghalaya?
- Q2. To find out what are the challenges encountered by the Women SHGs before and after joining the group?

METHODOLOGY

Primary data was collected from the respondents from the selected area of study.

A. Tools to be used : Semi-structured interview schedule was developed by the investigator for the purpose of data collection.

B. Sample size and Sampling Method : Using Stratified Random sampling of 100 respondents was taken from Mawphlang, Mawkynrew and Laitkroh khatarshnong block respectively.

Analysis and Interpretation

The following section is devoted to the analysis and interpretation of data

Section 1: Socio-Economic characteristics of the Respondents

Table 1.1: Social Characteristics of the Respondents (N=100)

Age			
SL. No.	Variables	No of Respondents	Percentage
1	18-27	21	21%
2	28-37	31	31%
3	38-47	30	30%
4	47 and above	18	18%
	Total	100	100%
Educational Qualifications			
5	Illiterate	45	45%
6	Primary	25	25%
7	Upper Primary	10	10%
8	Secondary	7	7%
9	Higher Secondary	9	9%
10	Graduation and above	4	4%
	Total	100	100%

Marital Status			
11	Single	14	14%
12	Married	83	83%
13	Widowed	3	3%
14	Divorced	0	0%
15	Separated	0	0%
	Total	100	100%
Religion			
16	Christian	58	58%
17	Indigenous Religion	41	41%
18	Hindu	0	0%
19	Islam	0	0%
20	Any other (Sikh)	1	1%
	Total	100	100%
Type of Houses			
21	Own Cottage	80	80%
22	PMAY assisted house	6	6%
23	Hut	0	0%
24	Detached House	2	2%
25	Rented	12	12%
	Total	100	100%
Family Size			
26	Up to 3 Members	19	19%
27	4-7 Members	66	66%
28	8-11 Members	13	13%
29	12 Above	2	2%
	Total	100	100%

Family Assets			
30	Mobile	86	86%
31	Radio	3	3%
32	Motorcycle	1	1%
33	Television	1	1%
34	Car	0	0%
35	Two-Wheeler	9	9%
	Total	100	100%
Landholdings			
36	<1ha	58	58%
37	1-2ha	8	8%
38	2-5ha	28	28%
39	>5ha	6	6%
	Total	100	100%
Migration Status			
40	Rural to Urban	21	21%
41	Urban to Rural	8	8%
42	Living in the Birthplace (Urban)	5	5%
43	Living in the Birthplace (Rural)	66	66%
	Total	100	100%
Family Type			
44	Nuclear	67	67%
45	Joint	30	30%
46	Extended	3	3%
	Total	100	100%

Caste			
47	Scheduled Caste	1	1%
48	Scheduled Tribe	99	99%
49	Other Backward classes	0	0%
50	General	0	0%
	Total	100	100%
SHG Size			
51.	6-10 Members	63	63%
52	11-15	33	33%
53	16-20	1	1%
54	21 and above	3	3%
	Total	100	100%

Table 1.1 presents the socio-demographic characteristics of the respondents. It shows that 31% of the respondents belonged to the 28–37 years age group, followed by 30% in the 38–47 years age group, 21% in the 18–27 years age group, and 18% who were aged 48 years and above.

With regard to educational qualifications, 45% of the respondents were illiterate, 25% had completed primary education, 10% had studied up to the upper primary level, 7% had completed secondary education, 9% had attained higher secondary education, and only 4% were graduates or had qualifications above the graduate level.

In terms of marital status, 83% of the respondents were married, 14% were unmarried, and only 3% were widowed. Regarding religion, the majority of the respondents (58%) were Christians, while 41% followed indigenous faiths such as *Niam Tynrai* of the Khasi community. None of the respondents practising Hinduism or Islam were engaged in organic farming in the East Khasi Hills District of Meghalaya.

With respect to housing, 80% of the respondents lived in their own cottages, 12% resided in rented houses, 6% lived in houses constructed under the Pradhan Mantri Awas Yojana (PMAY), and only 2% lived in detached houses.

The Table further indicates that the majority of the respondents (66%) had families comprising four to seven members. This was followed by families with up to three members (19%), families with eight to eleven members (13%), and families with more than twelve members (2%).

Regarding household assets, 86% of the respondents owned mobile phones, 9% owned two-wheelers, 3% possessed radios, and only 1% each owned motorcycles and televisions. The pattern of landholdings indicates that 58% of the respondents owned marginal holdings (less than 1 hectare), 8% owned small holdings (1–2 hectares), 28% owned medium holdings (2–5 hectares), and 6% owned large holdings (more than 5 hectares).

With regard to migration status, 66% of the respondents were living in their rural birthplace, 5% were living in their urban birthplace, 21% had migrated from rural to urban areas, and 8% had migrated from urban to rural areas. Regarding family structure, 67% of the respondents belonged to nuclear families, 30% belonged to joint families, and only 3% lived in extended families. The caste composition revealed that 99% of the respondents belonged to the Scheduled Tribe (ST) category, while only 1% belonged to the Scheduled Caste (SC) category.

Finally, with regard to the size of Self-Help Groups (SHGs), 63% of the respondents belonged to SHGs comprising 6–10 members, followed by 33% belonging to groups with 11–15 members. Only 3% belonged to SHGs with 21 or more members, while 1% belonged to SHGs comprising 16–20 members.

Table 1.2: Economic Characteristics of the Respondents (N=100)

SL NO	Variables	No of respondents	Percentage
Farming experience			
1	Below 5 years	16	16%
2	6- 10 Years	37	37%
3	11-15 years	13	13%
4	More than 15 Years	34	34%
	Total	100	100%
Start of Organic Farming			
5	Immediately Started	25	25%
6	1-5 years later	50	50%
7	After 5 years have passed	25	25%
	Total	100	100%
Livestock Possessed			
8	Local Cows	12	12%
9	Pigs	31	31%

10	Poultry	53	53%
11	Goat	4	4%
	Total	100	100%
Income			
12	<20000	36	36%
13	21,000-40,000	42	42%
14	41,000-60,000	19	19%
15	>60,000	3	3%
	Total	100	100%
Monthly expenditure on self			
16	<than 1000	8	8%
17	1100-2000	28	28%
18	2100-3000	46	46%
19	3100-4000	10	10%
20	>4000	8	8%
	Total	100	100%
Land Ownership			
21	Own Land	54	54%
22	Rent the land	45	45%
23	Contract Land	1	1%
	Total	100	100%

The respondents were asked whether they began practising organic farming immediately after learning about it or whether they adopted it after a certain period. The findings reveal that 50% of the respondents started practising organic farming one to five years after becoming aware of it, 25% adopted it immediately, and the remaining 25% began practising it after more than five years.

With regard to livestock ownership, 53% of the respondents reared poultry as their primary livestock, followed by 31% who reared pigs. Local cows were owned by 12% of the respondents, while the remaining 4% reared goats.

Regarding the annual income of the respondents, 42% earned between ₹21,000 and ₹40,000 per annum, followed by 36% who earned less than ₹20,000 annually. Nineteen

percent reported an annual income ranging from ₹41,000 to ₹60,000, while only 3% earned more than ₹60,000 per annum.

With respect to monthly personal expenditure, 46% of the respondents spent between ₹2,100 and ₹3,000 per month. This was followed by 28% who spent between ₹1,100 and ₹2,000, 10% who spent between ₹3,100 and ₹4,000, and 8% each who spent less than ₹1,000 and more than ₹4,000 per month. Regarding land ownership, 54% of the respondents cultivated their own land, 45% cultivated rented land, and only 1% cultivated land under contractual arrangements.

Table 1.3: Challenges faced by the SHGs members before and after joining the group

S. No.	Challenges before and after joining the group faced by the SHGs members	Before joining the group		After joining the group		Total		Chi square test value
		Yes	No	Yes	No	Yes	No	
1	Lack of subsidy from the government to purchase the tools	20 (29%)	30 (21%)	38 (29%)	12 (21%)	58 (58%)	42 (42%)	13.3**
2	Investment is more than income generated	12 (28.5%)	38 (21.5)	45 (28.5%)	5 (21.5%)	57 (57%)	43 (43%)	44.4**
3	Compelled to sell organic crops at lower prices to middlemen	28 (34%)	22 (16%)	40 (34%)	10 (16%)	68 (68%)	32 (32%)	6.61**
4	The cost of organic crops is more than conventional crops	14 (28.5%)	36 (23.5%)	39 (26.5%)	11 (23.5)	53 (53%)	47 (47%)	25.0**
5	Loss of income due to seasonal income of crops	37 (42%)	13 (8.0%)	47 (42%)	3 (8.0%)	84 (84%)	16 (16%)	7.44**
6	Difficulty to identify potential markets	3 (21.5%)	47 (28.5%)	40 (21.5%)	10 (28.5%)	43 (43%)	57 (57%)	55.8**

7	Unavailability of polyhouse to prevent crops from heavy rains	9 (16%)	41 (34%)	23 (16%)	27 (34%)	32 (32%)	68 (68%)	9.0**
8	Unavailability of storage facilities to preserve the crop	40 (41%)	10 (9%)	42 (41%)	8 (9%)	82 (82%)	18 (18%)	0.27*
9	Unforeseen weather conditions	34 (34.5%)	16 (15.5)	35 (34.5%)	15 (15.5)	69 (69%)	31 (31%)	0.04*
10	Lack of knowledge about the availability of potential schemes for availing support	8 (19.5%)	42 (30.5%)	31 (19.5%)	19 (30.5)	39 (39%)	61 (61%)	22.23**
11	Lack of information about the trainings conducted	19 (26.5%)	31 (23.5%)	34 (26.5%)	16 (23.5%)	53 (53%)	47 (47%)	9.03**
12	Irregularities of supply and demand	25 (32%)	25 (18%)	39 (32%)	11 (18%)	64 (64%)	36 (36%)	8.50**
13	Requiring more manual labour	28 (38%)	22 (12%)	48 (38%)	2 (12%)	76 (76%)	24 (24%)	21.9**
14	Lengthy procedure in the certification process	14 (18.5)	36 (31.5)	23 (18.5%)	27 (31.5%)	37 (37%)	63 (63%)	3.47**
15	Inability to meet market demands	29 (37.5%)	21 (12.5%)	46 (37.5%)	4 (12.5)	75 (75%)	25 (25%)	15.4**

A chi-square test of independence was conducted to examine the challenges faced by Self-Help Group (SHG) members before and after joining the group. The analysis revealed that some of the relationships between the variables were statistically significant, while others were not ($df = n - 1$, $N = 100$). The findings indicate that women were generally less likely to encounter certain challenges after joining an SHG, suggesting that group

membership had a positive influence on their organic farming activities.

The data further revealed that one of the major challenges associated with organic farming was the high initial investment relative to the income generated. Respondents reported that crop losses frequently occurred because no chemical pesticides were used, thereby reducing productivity and income. Other major constraints included difficulties in identifying potential markets, limited awareness of government schemes, the high cost of organic farming inputs, and inadequate government subsidies.

Before joining the SHGs, respondents reported several marketing and production-related challenges. These included crop losses caused by unforeseen weather conditions and the compulsion to sell produce to middlemen at lower prices because of limited market access. Other frequently reported problems included irregularities in supply and demand (32%) and inadequate government subsidies (29%).

After joining the SHGs, respondents continued to face several challenges, although their nature and intensity varied. About 42% reported that the seasonal nature of organic farming resulted in reduced income, while 41% identified the lack of storage facilities as a major constraint. Furthermore, 38% indicated that organic farming required greater labour input, 37.5% reported difficulties in identifying potential markets, and 34% stated that crop losses due to adverse weather conditions, coupled with the need to sell produce to middlemen at lower prices, continued to affect their farming activities.

Main Findings

The present study examined the challenges faced by Self-Help Group (SHG) members before and after joining SHGs engaged in organic farming in the East Khasi Hills District of Meghalaya. The findings revealed that several interrelated factors continue to hinder the growth and development of both the SHG members and the groups as they strive to promote and sustain organic farming practices.

One of the major challenges identified was the difficult geographical terrain of the region. Most respondents resided in hilly areas with steep slopes, making the transportation of agricultural produce both difficult and expensive. As a result, farmers were often compelled to hire labourers to transport their produce to nearby markets. The high transportation costs substantially reduced their profit margins and limited their ability to market their products effectively.

Another significant challenge was the low educational status of the respondents. The demographic profile indicated that a large proportion of the respondents were illiterate or had only a primary level of education. This limited their ability to fully understand training programmes, technical demonstrations, and information related to organic farming practices. Consequently, many respondents experienced difficulties in identifying potential markets, accessing government support schemes, and adopting improved farming and marketing practices.

The climatic conditions of Meghalaya also posed a major constraint to organic farming. The state is characterised by exceptionally high rainfall.

Discussion of the Result

The study found that the limited availability and high cost of organic inputs, such as organic fertilizers and biopesticides, constituted major challenges to the adoption and practice of organic farming in Meghalaya (Lampkin & Measures, 2019). Furthermore, the low educational level of many respondents, coupled with inadequate access to expert advisory services and insufficient compensation during the conversion period from conventional to organic farming, emerged as significant barriers to the successful adoption of organic farming practices.

The findings also indicate that climate change poses a major challenge to organic farming. Increasing weather variability and the growing frequency of extreme weather events adversely affect crop production and disrupt natural ecological processes essential for organic agriculture (Gomiero et al., 2017). These conditions often result in substantial crop losses, thereby causing considerable financial hardship for farmers through the loss of both the time and resources invested in cultivation.

Suggestions

Based on the findings of the study, the following recommendations are proposed to promote the adoption and sustainability of organic farming in the East Khasi Hills District of Meghalaya:

- The Government and non-governmental organizations (NGOs) should encourage farmers to form and strengthen Farmer Producer Organizations (FPOs), Self-Help Groups (SHGs), or other farmer groups to facilitate collective action, improve market access, and enhance bargaining power.
- Government agencies and certification bodies should simplify the organic certification process by reducing procedural complexities, streamlining documentation, and providing technical assistance to farmers throughout the certification process.
- Financial institutions and government agencies should provide low-interest loans, grants, and targeted subsidies to support farmers during the transition from conventional to organic farming and to reduce the financial burden associated with organic cultivation.
- Awareness campaigns should be conducted regularly to educate consumers about the health, environmental, and economic benefits of organic products. Increasing consumer awareness would stimulate demand, ensure better prices for farmers, and create more stable markets for organic produce.
- Rural infrastructure should be strengthened by improving roads, transportation networks, storage facilities, and market infrastructure. Such improvements would reduce post-harvest losses, lower transportation costs, and enhance farmers' access to profitable markets.
- Regular capacity-building programmes, training workshops, and field demonstrations should be organized to improve farmers' knowledge of organic farming practices, certification procedures, pest and nutrient management, and market opportunities.

Continuous technical support would enhance farmers' confidence and encourage the sustained adoption of organic farming practices.

CONCLUSION

Organic farmers in the East Khasi Hills District of Meghalaya face numerous challenges in adopting and sustaining organic farming practices. Limited access to quality organic inputs, inadequate training and technical support, poor market access, and the absence of an efficient certification system constitute major barriers to the successful expansion of organic farming. Although the region possesses a rich tradition of indigenous farming knowledge, integrating these traditional practices with modern organic standards remains a challenge for many farmers without adequate institutional support. Financial constraints, coupled with the delayed economic returns associated with organic farming, further discourage farmers from transitioning from conventional to organic agriculture.

Despite government initiatives to promote organic farming, significant gaps remain in infrastructure development, market access, awareness generation, extension services, and institutional support. Addressing these challenges through continuous capacity building, improved market linkages, simplified certification procedures, strengthened extension services, and sustained financial and technical assistance will be essential for enhancing the adoption, sustainability, and long-term success of organic farming in the East Khasi Hills District of Meghalaya.

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ASSESSMENT OF AIR CONDITIONING ENERGY CONSUMPTION IN A SMALL-SCALE HOTEL

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ABSTRACT

Energy consumption in the hospitality sector has become a critical concern due to increasing operational costs and environmental impacts. This study presents 3,000-square-foot small-scale hotel using a case study approach. Primary data were collected over a seven-day period, including outdoor temperature, indoor temperature, occupancy levels, and AC load. Thermodynamic analysis and energy calculations were carried out to estimate the cooling load and energy consumption. In addition, linear regression analysis was performed to examine the relationships between the key variables. The results indicated a moderate correlation between outdoor temperature and AC load ($R^2 = 0.684$), whereas a very strong correlation was found between occupancy and energy consumption ($R^2 = 0.977$).

The findings suggest that occupancy has a greater influence on energy consumption than environmental conditions in small-scale hotel operations. The study further demonstrates that optimizing operational factors, such as occupancy-based control, thermostat settings, and regular maintenance practices, can substantially reduce energy consumption. Overall, this research provides practical insights into improving energy efficiency and contributes to the development of sustainable energy management strategies for small hospitality establishments.

Keywords: Air-conditioning; energy consumption; cooling load analysis; energy efficiency; HVAC performance; occupancy impact; outdoor temperature; small-scale hotels; sustainable energy management.

INTRODUCTION

The rapid growth of the hospitality sector has led to a significant increase in energy consumption, particularly in small-scale hotels, where operational efficiency is often constrained by limited resources (Sharma & Gupta, 2020). Among the various energy-consuming

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systems, air-conditioning (AC) systems account for substantial proportion of total electricity consumption because of their continuous operation and high power demand, particularly in regions with warm climates (Kumar *et al.*, 2019). In developing countries such as India, the increasing demand for thermal comfort in hospitality establishments has further intensified energy consumption, making it essential to evaluate and optimize the performance of AC systems (Patel & Singh, 2021). Small-scale hotels, typically occupying an area of approximately 3,000 square feet, often lack advanced energy management systems and rely on conventional cooling technologies, resulting in inefficient energy utilization (Verma, 2018). Furthermore, factors such as building design, occupancy patterns, insulation quality, thermostat settings, and maintenance practices significantly influence the energy consumption of air-conditioning systems (Reddy & Rao, 2022). Understanding the influence of these factors is essential for identifying opportunities to reduce energy consumption without compromising guest comfort.

This study focuses on assessing the energy consumption of air conditioning systems in a 3000 sq. ft. small-scale hotel setup. By analyzing usage patterns, load distribution, and operational efficiency, the research aims to provide insights into energy-saving strategies and sustainable practices applicable to similar hospitality establishments (Joshi & Mehta, 2020). The findings are expected to contribute to improved energy management, cost reduction, and environmental sustainability in the small-scale hotel industry.

Literature Review

The study of energy consumption in hotel buildings has received considerable attention due to rising energy costs and increasing environmental concerns. Research indicates that air-conditioning (AC) systems are among the largest contributors to energy consumption in hospitality facilities, often accounting for approximately 40–60% of total electricity consumption (Priyadarsini *et al.*, 2009). This high energy demand is particularly evident in warm and humid climates, where cooling loads remain consistently high throughout the year (Saidur *et al.*, 2010). Consequently, improving the efficiency of air-conditioning systems has become a key component of energy management strategies in the hospitality sector.

Several studies have examined the factors influencing air-conditioning energy consumption in small- and medium-sized buildings. Building envelope characteristics, including insulation quality, window glazing, and building orientation, significantly influence cooling loads (Omer, 2008). Poor insulation and excessive solar heat gain increase dependence on mechanical cooling systems, thereby resulting in higher energy consumption (Santamouris *et al.*, 2011). In addition, occupancy patterns and user behaviour play a crucial role, as variations in guest occupancy directly influence cooling demand (Bohdanowicz & Martinac, 2007).

Technological advancements have also been investigated as effective measures for reducing energy consumption. The adoption of energy-efficient heating, ventilation, and air-conditioning (HVAC) systems, such as inverter-based air conditioners and Variable Refrigerant Flow (VRF) systems, has demonstrated considerable potential for reducing energy consumption compared with conventional cooling systems (Chua *et al.*, 2013). Furthermore, the integration of smart control technologies, including occupancy sensors and programmable thermostats, has been

shown to optimize AC operation and minimize unnecessary energy consumption (Wang *et al.*, 2012).

Energy audits and case studies conducted in small-scale hotels have highlighted the importance of regular maintenance and system optimization. Inefficient operation resulting from clogged air filters, refrigerant leakage, or outdated equipment can substantially increase energy consumption (Reddy, 2013). Previous studies have also demonstrated that implementing simple measures, such as optimizing thermostat set points and carrying out periodic maintenance, can result in significant energy savings (Dascalaki & Balaras, 2004).

In developing countries, financial and technical constraints often limit the adoption of advanced energy-efficient technologies in small-scale hotels (Mensah, 2006). Nevertheless, existing research suggests that even low-cost interventions, such as improving natural ventilation, installing shading devices, and enhancing staff awareness of energy conservation practices, can significantly improve energy efficiency (Chan *et al.*, 2009). Therefore, a comprehensive understanding of both technological and behavioural factors is essential for reducing air-conditioning energy consumption and promoting sustainable energy management in small-scale hospitality establishments.

Research Gap and Problem Identification

Despite extensive research on energy consumption in the hospitality sector, several gaps remain, particularly concerning small-scale hotels. Most existing studies focus on large or luxury hotels with advanced energy management systems, leaving smaller establishments underrepresented in empirical research (Bohdanowicz & Martinac, 2007). Small-scale hotels, especially those operating within limited areas such as 3000 sq. ft., often have different operational characteristics, resource constraints, and energy usage patterns that are not adequately captured in broader studies (Mensah, 2006). This lack of targeted research limits the applicability of existing energy efficiency strategies to smaller facilities.

Furthermore, while previous studies have examined the overall energy consumption of hotel buildings, there is limited focus on the detailed assessment of air conditioning systems as a standalone component in small-scale settings (Priyadarsini *et al.*, 2009). Given that air conditioning accounts for a major portion of energy use, a more granular analysis is required to understand load distribution, system performance, and inefficiencies specific to such compact infrastructures (Saidur *et al.*, 2010). Additionally, the influence of local climatic conditions, occupancy variability, and building design on AC energy consumption in small hotels remains insufficiently explored (Omer, 2008).

Another significant gap lies in the limited availability of real-world case studies that combine technical analysis with practical, cost-effective solutions. Many studies propose advanced technologies such as smart HVAC systems and automation; however, their implementation is often not feasible for small hotel owners due to financial and technical constraints (Chua *et al.*, 2013). There is a need for research that emphasizes affordable and scalable interventions tailored to small-scale operations (Chan *et al.*, 2009).

METHODOLOGY

This study adopts a quantitative case study approach to assess air conditioning energy consumption in a 3000 sq. ft. small-scale hotel. The methodology involves data collection, analysis, and modeling of key variables influencing AC performance.

Primary data were collected through direct observation and monitoring of the hotel's air conditioning system over a period of seven days. Measurements were recorded daily, including outdoor temperature, indoor temperature, occupancy levels, AC load (kW), and daily operating hours. Energy consumption was calculated using standard energy relations (Kreith & Goswami, 2008).

The cooling load and energy consumption were analyzed using basic thermodynamic and heat transfer principles. Mathematical models such as heat transfer equations and energy consumption formulas were applied to estimate system performance (Cengel & Ghajar, 2015). The collected data were then organized into tables and graphical representations to identify trends and relationships.

Finally, the results were interpreted to identify inefficiencies and propose practical energy-saving measures suitable for small-scale hotel operations.

Mathematical Modelling

Mathematical modeling of air conditioning energy consumption is essential for quantifying cooling loads and evaluating system performance in small-scale hotel environments. One of the fundamental approaches involves estimating the cooling load based on heat gains from various sources, including building envelope, occupants, lighting, and equipment (ASHRAE, 2017). The total cooling load Q_{total} can be expressed as the sum of sensible and latent heat loads:

$$Q_{\text{total}} = Q_{\text{sensible}} + Q_{\text{latent}}$$

The sensible heat load is primarily influenced by external heat transfer through walls, roofs, and windows, as well as internal heat gains. It can be calculated using the heat transfer equation:

$$Q = U \times A \times \Delta T$$

where U is the overall heat transfer coefficient, A is the surface area, and ΔT is the temperature difference between indoor and outdoor environments (Cengel & Ghajar, 2015). This equation is widely used to estimate heat gain through the building envelope.

The cooling load due to occupants is another important factor and can be modeled as:

$$Q_{\text{occupants}} = N \times (\text{SHG} + \text{LHG})$$

where N is the number of occupants, SHG is sensible heat gain, and LHG is latent heat gain per person (ASHRAE, 2017). Similarly, heat gains from electrical equipment and lighting can be estimated based on their power ratings and usage duration (Saidur *et al.*, 2010).

To evaluate the energy consumption of the air conditioning system, the Coefficient of Performance (COP) is commonly used. It is defined as the ratio of cooling output to electrical energy input:

$$COP = \frac{Q_{\text{cooling}}}{W_{\text{input}}}$$

A higher COP indicates a more efficient system (Dincer & Rosen, 2013). The actual energy consumption of the AC unit over a period of time can then be calculated as:

$$E=P \times t$$

where E is energy consumption (kWh), P is power input (kW), and t is operating time (hours) (Kreith & Goswami, 2008).

Additionally, for dynamic analysis, cooling load variation with time can be modeled using hourly load calculation methods, incorporating external temperature fluctuations and occupancy patterns (Omer, 2008). These mathematical models provide a structured framework for analyzing and optimizing air conditioning energy consumption in small-scale hotels, enabling the identification of inefficiencies and potential energy-saving measures.

Observation Table

Observation No.	Day	Date	Outdoor Temp (°C)	Indoor Temp (°C)	Occupancy (%)	AC Load (kW)
1	Day 1	30/03/2026	32	24	60	5.2
2	Day 2	31/03/2026	34	24	70	5.6
3	Day 3	01/04/2026	35	23	65	5.3
4	Day 4	02/04/2026	36	23	60	5.0
5	Day 5	03/04/2026	33	24	75	5.8
6	Day 6	04/04/2026	31	24	80	6.1
7	Day 7	05/04/2026	30	24	85	6.5

Cooling Load and Performance Calculations from Observed Data

The following parameters are calculated:

- i. Q: Total cooling load (kW)
- ii. SHG: Sensible Heat Gain (kW)
- iii. LHG: Latent Heat Gain (kW)
- iv. COP: Coefficient of Performance
- v. W: Power input (kW)

Assumption (standard for small hotel studies):

- i. SHG $\approx$ 70% of total load
- ii. LHG $\approx$ 30% of total load

Typical COP = 3.0 (moderate efficiency AC system)

It has been assumed that the AC operates 10 hours per day.

Obs. No.	AC Load Q (kW)	SHG (kW)	LHG (kW)	COP	Power Input W (kW)
1	5.2	3.64	1.56	3.0	1.73
2	5.6	3.92	1.68	3.0	1.87
3	5.3	3.71	1.59	3.0	1.77
4	5.0	3.50	1.50	3.0	1.67
5	5.8	4.06	1.74	3.0	1.93
6	6.1	4.27	1.83	3.0	2.03
7	6.5	4.55	1.95	3.0	2.17

For **Observation 2:**

- i. $Q = 5.6 \text{ kW}$
- ii. $SHG = 0.7 \times 5.6 = 3.92 \text{ kW}$
- iii. $LHG = 0.3 \times 5.6 = 1.68 \text{ kW}$

$$W = \frac{COP}{Q} = \frac{5.6}{3} = 1.87 \text{ kW}$$

Total Weekly Energy

$$E_{\text{total}} = 17.3 + 18.7 + 17.7 + 16.7 + 19.3 + 20.3 + 21.7 = 131.7 \text{ kWh}$$

Monthly Load Estimation

Assuming similar weekly patterns over a month:

$$E_{\text{monthly}} = 131.7 \times 4 = 526.8 \text{ kWh}$$

Final Result

Total Monthly AC Energy Consumption $\approx 527 \text{ kWh}$

This represents the overall cooling load demand for the hotel

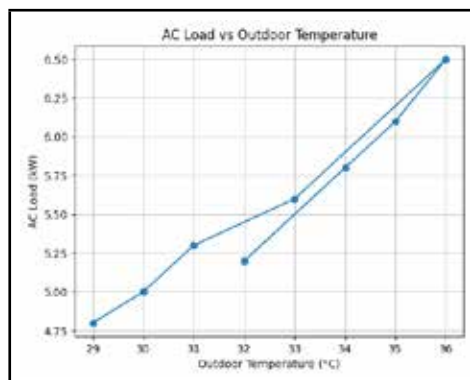


Fig. 1: AC Load vs Outdoor Temperature

AC load increases with rising outdoor temperature, indicating a direct relationship due to higher cooling demand.

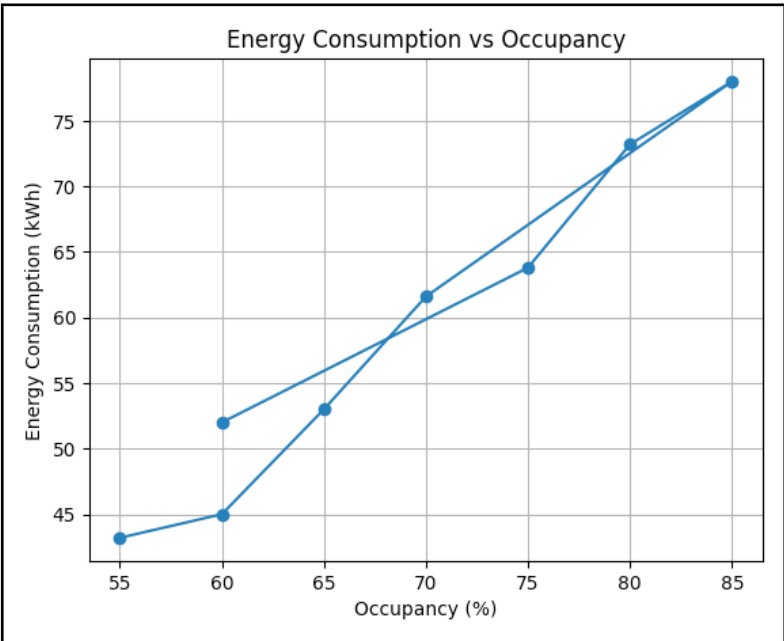


Fig. 2 :Energy Consumption vs Occupancy

Energy consumption shows a strong positive correlation with occupancy, as more guests increase cooling usage and operational hours.

Slight variations suggest influence of secondary factors such as indoor setpoint and system efficiency.

DISCUSSION

The analysis of air conditioning energy consumption in a 3000 sq. ft. small-scale hotel reveals a strong relationship between environmental and operational variables and overall energy use. The results indicate that AC load increases proportionally with outdoor temperature, confirming that higher ambient conditions impose greater cooling demands on HVAC systems. This finding aligns with previous studies that emphasize the sensitivity of cooling loads to climatic conditions, particularly in warm regions (Saidur *et al.*, 2010; Omer, 2008).

Similarly, the study demonstrates a strong positive correlation between occupancy levels and energy consumption. As occupancy increases, the demand for cooling rises due to higher internal heat gains from occupants, appliances, and extended operational hours. This observation is consistent with earlier research highlighting occupancy as a critical determinant of building energy performance (Bohdanowicz & Martinac, 2007). The results also suggest that behavioral factors, such as thermostat settings and usage patterns, may further influence consumption levels.

The regression is based on only seven paired observations ($n = 7$, $df = 5$), With low data points, the “very strong correlation” result for occupancy vs. energy consumption is thus a limited case.

From a practical perspective, the findings highlight the importance of implementing energy-efficient strategies in small-scale hotels. Measures such as optimizing thermostat settings, improving insulation, and adopting energy-efficient AC systems can significantly reduce energy consumption without compromising comfort. Despite financial constraints, even low-cost interventions can yield substantial energy savings (Chan *et al.*, 2009).

CONCLUSION

This study assessed air conditioning energy consumption in a small-scale hotel environment and identified key factors influencing energy usage. The results confirm that outdoor temperature and occupancy levels are primary drivers of AC load and energy consumption. As temperature and occupancy increase, the energy demand of the air conditioning system rises significantly, leading to higher operational costs.

The study also highlights the need for efficient energy management practices in small-scale hotels. Given the limited resources typically available in such establishments, adopting cost-effective and practical solutions is essential. Strategies such as regular maintenance, efficient system operation, and improved building design can help reduce energy consumption and enhance sustainability.

Overall, this research contributes to a better understanding of energy consumption patterns in small hospitality settings and provides a foundation for future studies focusing on optimization and energy-saving techniques. Further research is recommended to incorporate additional variables such as humidity, equipment efficiency, and renewable energy integration for a more comprehensive analysis.

STATISTICAL ANALYSIS USING REGRESSION METHOD

1. Introduction to Regression Analysis

Regression analysis is a statistical tool used to examine the relationship between a dependent variable and one or more independent variables. In energy studies, it helps quantify how different factors such as temperature and occupancy influence energy consumption.

In this study, simple linear regression is applied to:

Analyze the relationship between outdoor temperature and AC load

Evaluate the impact of occupancy on energy consumption

The general form of a linear regression equation is:

$$y = mx + c$$

Where

y = dependent variable

x = independent variable

m = slope of the line

c = intercept

2. Formula Used

Regression Coefficients

$$m = \frac{N\sum xy - (\sum x)(\sum y)}{N\sum x^2 - (\sum x)^2} = -0.204$$

$$c = \frac{\sum y - m\sum x}{N} = 12.361$$

Coefficient of Determination (R^2)

$$R^2 = 1 - \frac{\sum (y - y_{pred})^2}{\sum (y - \bar{y})^2}$$

where

y_{pred} = predicted value

$\bar{y}$ = mean of observed values

3. Regression Analysis 1: AC Load vs Outdoor Temperature

Data Used

Temperature ($^{\circ}\text{C}$): 32, 34, 35, 36, 33, 31, 30

AC Load (kW): 5.2, 5.6, 5.3, 5.0, 5.8, 6.1, 6.5

Regression Equation

AC Load = $-0.204 \times \text{Temperature} + 12.361$

$R^2 = 0.684$

4. Regression Analysis 2: Energy Consumption vs Occupancy

Data Used

Occupancy (%): 60, 70, 65, 60, 75, 80, 85

Energy (kWh): 17.3, 18.7, 17.7, 16.7, 19.3, 20.3, 21.7

Regression Equation

Energy = $0.179 \times \text{Occupancy} + 6.139$

$R^2 = 0.977$

5. Results and Discussion

The regression analysis reveals two important relationships:

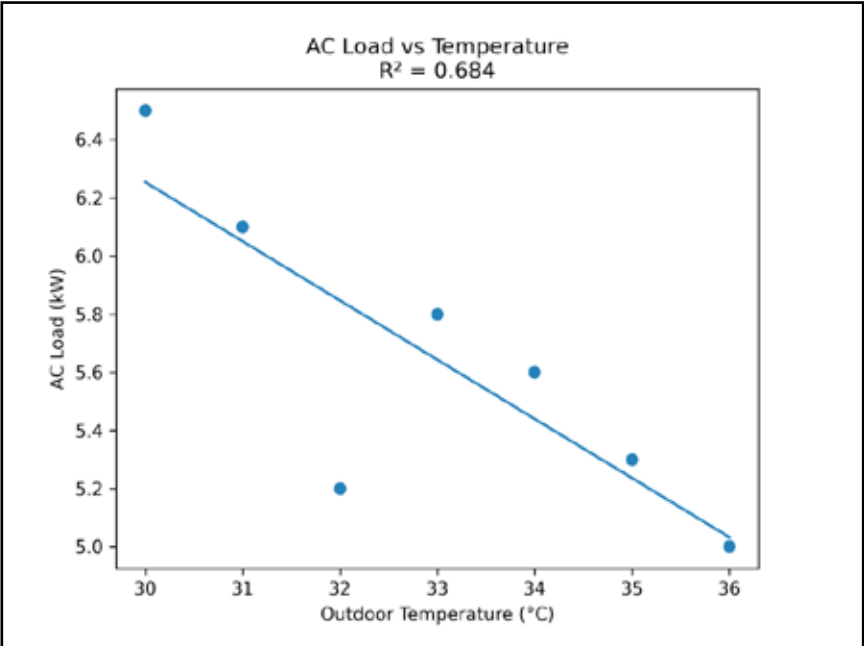


Fig. 3:Temperature vs AC Load

The R^2 value of 0.684 indicates a moderate correlation. Approximately 68.4% of variation in AC load is explained by outdoor temperature. However, the negative slope suggests that temperature alone does not fully govern cooling demand, and other factors influence system behavior.

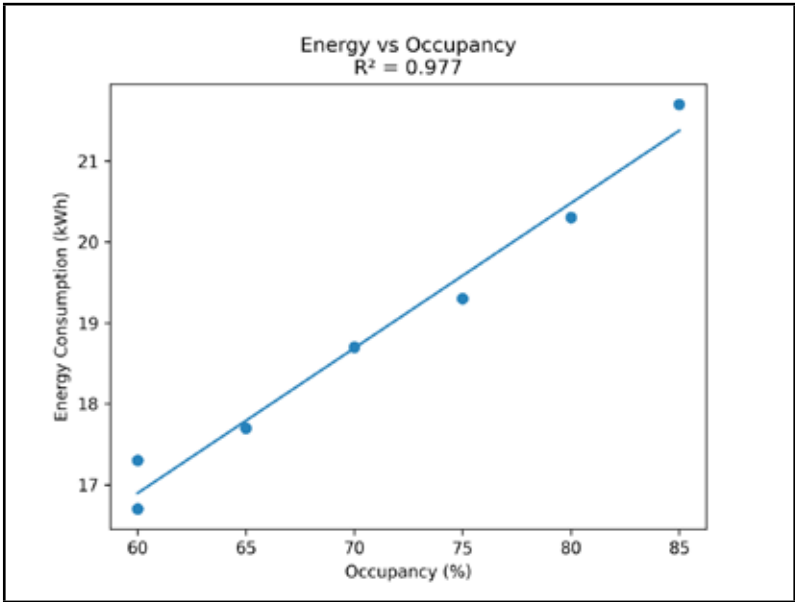


Fig. 4 : Occupancy vs Energy Consumption

The R^2 value of 0.977 indicates a very strong correlation. Nearly 97.7% of variation in energy consumption is explained by occupancy. This confirms that internal heat gains and usage patterns significantly affect AC energy consumption.

These results highlight that occupancy is the dominant factor, while temperature has a secondary influence in small-scale hotel environments.

Precautions to Reduce Power Consumption

Based on the analysis, the following measures are recommended to reduce air conditioning energy consumption:

a. Optimize Thermostat Settings

Maintaining indoor temperature between 24–26°C can significantly reduce cooling load without compromising comfort (ASHRAE, 2017).

b. Improve Building Insulation

Reducing heat gain through walls, roofs, and windows lowers the required cooling load and system workload (Omer, 2008).

c. Regular Maintenance of AC Units

Cleaning filters, checking refrigerant levels, and servicing equipment improves efficiency and reduces power input (Reddy, 2013).

d. Use Energy-Efficient Systems

Replacing conventional units with inverter or high COP systems can reduce energy consumption by 20–30% (Chua et al., 2013).

e. Install Occupancy-Based Controls

Using sensors to turn off AC in unoccupied rooms prevents unnecessary energy usage (Wang *et al.*, 2012).

f. Reduce Internal Heat Gains

Switching to LED lighting and energy-efficient appliances minimizes additional cooling load.

g. Proper Scheduling and Zoning

Operating AC only in occupied zones and during peak usage times improves efficiency.

SUMMARY OF STATISTICAL FINDINGS

The application of regression analysis provides a quantitative understanding of the factors affecting air conditioning energy consumption.

- Outdoor temperature shows a moderate impact on AC load.
- Occupancy exhibits a strong and direct influence on energy consumption.

Thus, effective energy management strategies in small-scale hotels should prioritize occupancy-based control systems and operational optimization rather than relying solely on environmental conditions.

LIMITATIONS

This was a single-site case study (one 3000 sq. ft. hotel), which limits generalizability; a short monitoring window (7 days); a constant assumed COP rather than measured performance; and a small sample size for regression analysis.

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LEAN MANUFACTURING AND TOTAL WASTE MANAGEMENT: AN INTEGRATED FRAMEWORK FOR PRODUCTION AND ENVIRONMENTAL WASTE REDUCTION

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ABSTRACT

Lean manufacturing, developed and widely associated with the Toyota Production System, is a management philosophy centred on the systematic identification and reduction of non-value-adding activities. This paper examines lean manufacturing from the broader perspective of total waste management, with particular attention to production losses and hazardous wastes that may remain outside conventional operational-waste calculations.

The paper develops a conceptual classification of production wastes and proposes an extended total-waste-cost framework that incorporates hazardous waste and treatment costs as an explicit component of production cost. An illustrative metal-piping example shows that excluding hazardous-waste treatment costs understates the reported waste cost. The paper also reviews selected lean tools—including 5S/7S, Just-In-Time, Gemba walks, Value Stream Mapping, bottleneck analysis, Kanban, Kaizen and smart-manufacturing technologies—and discusses their potential contribution to waste reduction. Because the paper is conceptual and uses an illustrative example rather than field data, the proposed framework requires empirical validation across manufacturing settings.

Keywords: Lean manufacturing; total waste management; waste cost; hazardous waste; environmental impact; Just-In-Time; Value Stream Mapping; Kaizen; smart manufacturing.

INTRODUCTION

Lean manufacturing is a continuous-improvement philosophy that seeks system-wide efficiency rather than isolated optimisation of individual operations. A process that appears

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highly productive at one stage may reduce overall performance if it creates bottlenecks, excess inventory, defects or other non-value-adding activities elsewhere in the value stream. Accordingly, lean management focuses on the performance of the entire value stream, from inputs to delivery, rather than on maximising the output of individual departments. The central concern is to increase customer value while reducing activities that consume resources without creating corresponding value.

Lean manufacturing can therefore contribute to lower production costs, shorter lead times, improved quality and more responsive operations. Its environmental significance is also potentially important because material losses, defective products, unnecessary movement, excess inventory and hazardous wastes consume resources and may generate additional treatment or disposal costs.

The present paper extends this discussion by treating waste not only as an operational inefficiency but also as a measurable cost category. In particular, hazardous waste and the cost of its safe treatment are considered a form of potentially hidden waste that should be visible in managerial cost analysis. The paper is conceptual in nature and proposes a framework for subsequent empirical testing.

The Importance of Reducing Cycle Time

There are numerous reasons to reduce cycle time and waste, some of which are less obvious than others. Cycle time refers to the length of time it takes to convert raw materials into finished goods, and the length of this cycle determines the company's ability to convert assets into profits. A company able to reduce cycle times more than its competitors will be able to respond more quickly to market demands and thus gain a larger market share. Some of the many benefits of reducing cycle times include:

- Innovation opportunities
- Better distribution positioning
- Increased productivity
- Higher customer satisfaction
- Advantaged profitability potential

Existing lean manufacturing literature extensively addresses operational waste, process flow, quality improvement and environmental performance. However, the explicit incorporation of hazardous-waste generation and its treatment/disposal cost into a unified total-waste-cost formulation remains comparatively underdeveloped. The present paper therefore proposes an extended framework that treats hazardous waste as a financially measurable component of production waste rather than solely as an environmental compliance issue.

METHODOLOGICAL APPROACH

This study adopts a conceptual and framework-development approach. It synthesises

the waste categories described in this paper, relates them to established lean principles and tools, and formulates an extended total-waste-cost expression that includes hazardous-waste treatment. The numerical metal-piping example is illustrative rather than an empirical case study. No primary data, statistical testing or comparative field study is presented; consequently, the proposed framework should be regarded as a conceptual model requiring validation in real manufacturing environments.

Lean production does not treat waste reduction as an isolated objective; rather, waste is reduced by improving flow, quality, reliability and the alignment of production with demand. The waste categories below extend the conventional operational perspective by including material, process, storage, packaging, equipment-related and hazardous-waste costs. Some categories overlap with one another, so they should be defined consistently before measurement to avoid double counting.

Lean production does not focus exclusively on total waste reduction; total waste is minimized or eliminated more as an inevitable by-product of better production flow. It may seem obvious that total waste hurts productivity and profitability, increases production cost, and additionally has a negative impact on the environment. Part of the waste generated is disposed of into the environment, which then harms flora and fauna. But the importance of reducing total waste is often underappreciated, and there are numerous areas of waste that go overlooked.

Lean manufacturing typically focuses on the waste types below, which together constitute Total Waste Management.

- a. **Received Raw Material Defects:** A defective part caused by poor quality inputs, user error, or other problems is costly and easily avoided.
- b. **Received Defective Auxiliary Materials (grease, oil, chemicals and similar consumables):** the receipt of defective auxiliary materials generates additional cost.
- c. **Poor Storage of Auxiliary Materials:** poor storage of chemicals or oils causes additional cost.
- d. **Adjustment Defects:** This type of waste is generated while changing over between different product sizes. For example, when a production line finishes making 500 mm-diameter pipe and is then changed over to fix a 720 mm mould, adjustment defects occur during the start-up of the 720 mm run. Zero defects are not always achievable immediately, but working toward elimination is possible.
- e. **Overproduction:** Overproducing irrespective of demand or capacity is wasteful and does not consider the customer.
- f. **Waiting:** Bottlenecks occur due to oversupply or undersupply and should be handled through better supply chain and personnel management.
- g. **Not Utilizing Talent:** Waste occurs when the skills of the workforce are underutilized or

misapplied. Human talent is a highly valuable and often overlooked resource.

- h. Transportation:** Movement to and from docks and warehouses is an area of potential waste that can be reduced by better layout and better-aligned process flow.
- i. Inventory Excess:** Numerous factors can lead to excessive inventory, which, in a mass-production paradigm, might appear as productivity but does not benefit the overall process.
- j. Motion Waste:** Even the repetitive motions of employees on the assembly line can diminish productivity and contribute to waste.
- k. Excess Processing:** Avoid redundancy and unnecessary steps.
- l. Poor Packaging:** Poor packaging of the product causes defects.
- m. Poor Transportation to Customer:** Poor transportation of the finished product to the customer (damaged products are sometimes disposed of into the environment, which may cause negative environmental impact).
- n. Poor Storage in Company Warehouse:** Poor storage of the final product in company storage causes defects.
- o. Poor Storage in Customer Warehouse:** Poor storage of the final product in customer storage causes defects. Given the scarcity of raw materials, poor storage of finished product may require additional production, leading to greater consumption of raw materials.
- p. Equipment-Failure Defects:** Defects arising from equipment failure.
- q. Hazardous Liquids and Gases:** Waste arising from equipment operation. This waste must be treated and minimised rather than disposed of into the environment; its cost is part of total waste cost. Increased untreated waste may cause environmental pollution. Most companies worldwide currently dispose of this type of waste into the environment; the cost of any penalty for such disposal is linked directly to the cost of the product produced by the equipment concerned.

CALCULATING COST

Proposed Total Waste Cost (TWC) = RMW + AMW + PPWW + AWW + SPW + FPWW + PTWW + HWW

- Raw-material waste cost (RMW)
- Auxiliary-material waste cost (AMW)
- In-process product waste cost (PPWW)
- Adjustment/changeover waste cost (AWW)
- Equipment spare-parts waste cost (SPW)
- Final-product waste cost (FPWW)

- Packaging/tightening waste cost (PTWW)
- Hazardous-waste and treatment cost (HWW): In this framework, HWW represents the identifiable cost of hazardous material handling, treatment, recovery and/or compliant disposal associated with production. It is treated as a potentially hidden component of total waste cost, but the measurement boundary should be defined clearly to prevent overlap with ordinary production, environmental-compliance or maintenance costs.
- Hazardous waste and gases produced from production – HW_w : This is termed the “hidden waste” and must be calculated as a waste cost and included in total waste cost. Production cost must include total waste cost, covering this *hidden cost*.

Example

A company producing metal piping calculated its total waste cost as follows:

- Raw material waste – RMW = \$300
- Auxiliary material waste – AMW = \$700
- In-process product waste – PPWW = \$200
- Adjustment waste – AWW = \$80
- Equipment spare-parts waste – SPW = \$150
- Final product waste – FPWW = \$250

The seven non-hazardous categories total \$1,910. When the illustrative hazardous-waste treatment/utilisation cost of \$800 is included, the proposed total waste cost becomes \$2,710. Thus, in this example, excluding HWW would understate total waste cost by \$800, or approximately 29.5% of the proposed total. The example demonstrates the accounting significance of the proposed category; it does not establish the prevalence or magnitude of hazardous waste across manufacturing industries.

THE BENEFITS OF LEAN MANUFACTURING FOR REDUCING TOTAL WASTE

Lean principles can benefit both large and small or medium-sized manufacturers when they are adapted to the characteristics of the production system. The potential benefits discussed here include lower inventory and material losses, shorter cycle and lead times, fewer defects, better use of workforce capability, and improved responsiveness. These benefits should be presented as expected outcomes of implementation rather than universal effects, because their magnitude depends on context and execution.

While many assume lean manufacturing only benefits large, repetitive, mass-production operations, small and medium-sized manufacturers can also benefit. Lean manufacturing principles can impact the average producer in a powerful way that extends beyond financial gains. Some of the many benefits of adopting lean manufacturing for the management and reduction of total waste include:

- Lean identifies value as defined by customer demand, leading to more satisfied customers

and also minimising product and service waste from the customer's perspective.

- Lean removes wastes such as excess inventory, transportation, and others.
- Lean shortens cycle time and increases production, leading to reduced waste in process.
- Lean brings about greater employee morale and buy-in; greater morale reduces waste generated by employee error.
- Lean reduces raw-material waste through effective inventory management.
- Lean reduces the amount of space needed for production.
- Lean increases cash on hand.
- Lean focuses on pull- (demand-based) flow manufacturing rather than push.
- The five commonly presented lean principles—value, value stream, flow, pull and perfection—provide a useful organising framework for the discussion.

Lean manufacturing is more than a way to make products — it is a school of thought. While many lean principles make up this school of thought, much of the system's power is contained in five primary concepts, most famously articulated in the 1990 book *The Machine That Changed the World* by James Womack, Daniel T. Jones, and Daniel Roos. Understanding these five lean manufacturing principles enables a business to transform into a lean production operation:

- I. Specify value as perceived by the customer:** Value must be perceived through the customer's eyes — not merely the product a company can provide, but the end solution the customer actually wants.
- II. Identify the value stream:** Rather than thinking in terms of departments, lean-oriented companies visualise the value stream as an interconnected flow of processes that provide value, excluding steps that do not directly contribute to it.
- III. Make value flow through the value stream:** The focus must be on value-adding steps; if non-value-adding steps are necessary, they should run simultaneously with value-adding steps, never before them.
- IV. Pull value through the value stream:** Avoid inventory-management waste by shifting to single-piece flow that produces on demand.

LEAN MANUFACTURING TOOLS FOR WASTE MANAGEMENT AND REDUCTION

Lean manufacturing uses a portfolio of complementary tools rather than a single technique. Their suitability depends on process characteristics, product variety, demand stability, workforce capability and organisational maturity.

Lean production is about getting the most out of every resource and continually finding better ways to do things. Numerous lean manufacturing tools have been developed and

refined in this pursuit; some of the most widely used are described below:

- 5S (Sort, Set in Order, Shine, Standardize, Sustain) is the widely recognised formulation. Some organisations extend 5S by adding Safety and/or Spirit; such extensions should be identified as organisational adaptations rather than presented as universally standard components of lean manufacturing.

In this paper, the extended 7S formulation is used to emphasise workplace organisation, safety and organisational culture. Its effectiveness should be assessed through observable workplace and performance indicators rather than assumed from adoption alone.

- Now, 7S is a system emphasising cleanliness and organisation in the workplace through seven standards: Sort, Set in order, Shine, Standardize, Sustain, Safety, and Spirit.
 - a. **Sort:** keep the workplace free of all unnecessary items.
 - b. **Set in order:** everything should be arranged for each workplace to ensure maximum ease and efficiency.
 - c. **Shine:** everyone is responsible for keeping their workspace clean and tidy.
 - d. **Standardize:** roles and tasks should be standardised in lists and schedules to promote good habits.
 - e. **Sustain:** ensure everyone is committed to the long-term goal.
 - f. **Safety:** an effective tool for hazard, injury, and fatality prevention. A safe working environment is established by integrating 7S with an occupational health and safety management system (e.g. OHSAS 18001 / ISO 45001), addressing unsafe acts and unsafe conditions that could otherwise damage equipment, personnel, and the environment, and that undermine quality management.
 - g. **Spirit:** recognises the impact of organisational culture and the importance of respect for employees, including morale and shared purpose, as the seventh element of the methodology.

Just-In-Time (JIT)

Just-In-Time, or Just-In-Sequence (JIS), is a form of lean manufacturing and a logistics method for inventory control. JIT is a system of manufacturing what the customer wants, in the quantity the customer wants, when the customer wants it. This allows the reduction or elimination of buffers or inventory, using delivered components within minutes of their delivery.

Gemba Walks

Gemba means “the real place” in Japanese and refers to the factory floor in manufacturing, or any place where value is created. In lean manufacturing philosophy, a “Gemba walk” is a regular site visit by management, allowing it to develop a real feel for the process and any issues that need addressing.

Value Stream Mapping

This tool involves creating a flow diagram depicting every step in the value process. Such a map allows evaluation of all steps to identify waste and inefficiency and to reduce manufacturing time.

Bottleneck Analysis

The goal is to identify the weakest link, or bottleneck, holding back the speed of the overall process. Lean manufacturing often uses bottleneck analysis to determine the slowest processes and steps in the manufacturing stream; speeding up just one or two functions can often dramatically speed up the entire process.

Continuous flow seeks to minimise interruptions, queues and batch-related delays so that work moves smoothly through the value stream. It does not imply that a factory must operate 24 hours a day; the appropriate operating schedule depends on demand, capacity, maintenance requirements, labour arrangements and process economics.

Closely associated with Kanban and JIT, this tool integrates all production elements through ongoing examination, evaluation, and improvement. To provide stability and continuity, continuous flow usually means running the factory 24 hours a day with no interruption and very little waste, the opposite of batch production.

Lean By-products: Agility, Competitiveness, and Quality

By following lean principles, adopting these tools, and reducing key wastes, manufacturers who specialise in lean concepts create highly desirable by-products. Lean production results in agility in meeting the competitive demands of a swiftly evolving marketplace. The focus on total expense and value, rather than on single-component costs, not only eliminates waste and inefficiency but also promotes quality and customer-driven solutions.

The faster products flow through an organisation from start to finish, the faster the company can respond to market demands and satisfy the consumer; the more efficient the process, the more quality the company can afford for each dollar spent. Lean manufacturing enables producers to navigate a changing market with precision and agility, producing streamlined, simplified operations that remain competitive in modern manufacturing.

Kanban

This Japanese word for “sign” refers to a system of using cards or signs to indicate the phases a product moves through: to do, doing, and done. Using this visual “pull” system, it becomes easier to manage only the parts needed for a specific production run, eliminating the need for excess inventory or backlogged products.

Modern technologies—including cyber-physical systems, the Internet of Things, artificial intelligence, big-data analytics, cloud computing, simulation, virtual/augmented reality and digital twins—can support lean practices by improving visibility, monitoring, prediction and process control. Their contribution should nevertheless be evaluated in

relation to measurable waste reduction and total cost, rather than assuming that digitalisation automatically produces leaner operations.

Modern technologies — Cyber-Physical Systems (CPS), the Internet of Things (IoT), Artificial Intelligence, Big Data, Cloud Computing, Simulation, Virtual Reality (VR), Augmented Reality (AR), and Digital Twins — applied to manufacturing as “Smart Manufacturing,” lead to more effective management of manufacturing, reducing total waste while also improving overall quality.

Kaizen refers to continuous, incremental improvement. In the context of this paper, Kaizen can be directed towards materials, equipment, procedures, workforce practices, quality, safety and environmental performance. Continuous improvement should be supported by clearly defined and measurable indicators.

Proposed composite KPI: $KPI = w_1(APC) + w_2(QC) + w_3(HSE)$, where $w_1 + w_2 + w_3 = 1$ after appropriate normalisation of the component indicators.

The original additive expression ($KPI = APC + QC + HSE$) requires methodological justification because the three components may have different units and scales. A weighted, normalised index is more defensible conceptually, but the weights, normalisation method and validation procedure must be specified and tested empirically. Therefore, the proposed KPI should be presented as a framework for future validation, not as an established universal formula.

CONCLUSION

This paper argues that lean manufacturing can be examined more comprehensively when production waste and environmentally significant waste are considered within a common cost framework. The proposed Total Waste Cost (TWC) expression extends the categories discussed in the paper by explicitly including hazardous-waste handling and treatment costs. The illustrative metal-piping example shows the managerial consequence of this inclusion: the non-hazardous waste categories total \$1,910, whereas inclusion of the illustrative \$800 hazardous-waste treatment cost raises the total to \$2,710. The example therefore demonstrates how excluding hidden waste-related costs can understate the economic burden associated with production waste.

The paper also reviews a range of lean tools—5S/7S, Just-In-Time, Gemba walks, Value Stream Mapping, bottleneck analysis, continuous flow, Kanban, Kaizen and digital manufacturing technologies—and explains how they may contribute to waste reduction, process stability and resource efficiency. However, the study is conceptual and does not provide primary empirical data, statistical validation or comparative evidence across firms. The proposed waste-cost categories and the composite KPI therefore require operational definitions, measurement protocols and empirical testing before they can be treated as generalisable models.

Future research should validate the Total Waste Cost framework through case studies

and multi-company datasets, examine the interaction between operational and hazardous-waste costs, establish rules for avoiding double counting, and test whether reductions in identified waste categories are associated with improvements in cost, quality, delivery, safety and environmental performance. Such validation would strengthen the paper's contribution to multidisciplinary research by connecting lean management, industrial engineering, environmental management and performance measurement.

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MYTH, SYMBOL, AND SOCIAL REALITY: A LITERARY REAPPRAISAL OF MAHESH DATTANI'S DRAMATURGY

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ABSTRACT

This paper offers a comprehensive literary reappraisal of Mahesh Dattani's plays, examining them through the lens of symbolism and Indian myth. It argues that beneath his realist surface, Dattani's dramaturgy is deeply embedded in symbolic structures and mythic resonances that reinterpret traditional Indian narratives within contemporary contexts. Employing a qualitative interpretative methodology and close textual analysis of plays such as Tara, Final Solutions, Dance Like a Man, Bravely Fought the Queen, and Seven Steps Around the Fire, the study demonstrates that Dattani's use of myth is subtle, internalised, and recontextualised within modern socio-cultural frameworks. His symbols—rituals, bodily metaphors, spatial arrangements, and narrative patterns—function as critical tools that expose gender inequality, communal tensions, and identity conflicts. The study concludes that Dattani's dramaturgy represents a unique synthesis of realism and symbolic depth, redefining Indian English theatre as a site of cultural reinterpretation and ideological critique.

Keywords: Mahesh Dattani; Indian Myth; Symbolism; Dramaturgy; Ritual; Cultural Semiotics; Modern Indian Drama; Identity and Myth.

INTRODUCTION

The evolution of modern Indian drama reflects a gradual yet decisive departure from the overtly mythological frameworks of classical Sanskrit theatre towards forms that engage directly with contemporary social realities. While early dramatists frequently relied on epic narratives drawn from texts such as the Mahabharata and Ramayana, modern playwrights began to reinterpret these traditions in ways that resonate with present-day concerns. Within this trajectory, Mahesh Dattani occupies a distinctive position. His plays are often read as examples of social realism; however, a closer examination reveals that these are deeply structured by symbolic and mythic undercurrents.

Dattani's dramaturgy does not replicate myth in its traditional narrative form. Instead, it reconfigures myth as a symbolic framework that operates beneath the surface of everyday life.

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His plays are set in recognisable domestic and urban environments, yet they are permeated by patterns, motifs, and structures that echo classical Indian myths. This subtle integration of myth distinguishes his work from that of dramatists such as Girish Karnad, who explicitly employ mythological narratives. In Dattani, myth is neither decorative nor nostalgic; it functions as a critical lens through which contemporary social realities are examined. One of the defining features of Dattani's theatre is its engagement with marginalised identities. His plays foreground issues such as gender discrimination, sexual identity, and communal conflict, presenting them not as isolated problems but as systemic conditions embedded within social structures. As critics observe, Dattani's theatre "questions middle-class morality and exposes its contradictions". This critique is often articulated through symbolic devices that reveal the underlying tensions within seemingly ordinary situations.

Symbolism in Dattani's plays operates at multiple levels. Objects, spaces, and rituals acquire meanings that extend beyond their immediate context, functioning as metaphors for broader social and psychological processes. For instance, in *Seven Steps Around the Fire*, the ritual of marriage becomes a symbol of exclusion and identity conflict, reflecting the struggles of marginalised communities. Similarly, in *Tara*, the physical body itself becomes a site of symbolic significance, representing the fragmentation of identity under patriarchal pressures. The use of Indian myth in Dattani's work is closely linked to his exploration of identity. Myth, in this context, is not a fixed narrative but a dynamic structure that can be reinterpreted to reflect contemporary realities. By invoking mythic patterns within modern settings, Dattani creates a dialogue between tradition and modernity, highlighting both continuity and transformation. This paper argues that Dattani's dramaturgy represents a unique synthesis of realism and symbolism, where myth is internalised rather than explicitly narrated. Through this approach, he redefines the function of Indian drama, transforming it into a space where cultural traditions are critically examined and reimaged. The study seeks to explore how symbolism and myth operate across his plays, revealing their significance in shaping both narrative and thematic structures.

LITERATURE REVIEW

Critical scholarship on Mahesh Dattani has predominantly focused on his representation of marginalised identities and his contribution to contemporary Indian theatre. However, there is a growing recognition of the symbolic and mythic dimensions of his work, which warrant closer examination. Early studies emphasised Dattani's role as a social realist. Scholars noted that his plays address pressing issues such as gender inequality, communal tension, and sexual identity, thereby reflecting the complexities of modern Indian society. As one study observes, his work deals with "burning social issues of contemporary Indian society". While this perspective highlights the thematic relevance of his plays, it often overlooks the symbolic structures that underpin them.

More recent scholarship has begun to explore the role of symbolism in Dattani's dramaturgy. In *Seven Steps Around the Fire*, for example, the use of ritual is interpreted as a metaphor for the constraints imposed by tradition. The seven steps of the Hindu marriage ceremony are not merely a cultural practice but a symbolic representation of the characters' emotional and psychological journeys. This interpretation underscores the significance of ritual as a narrative

device that conveys deeper meanings.

The intersection of myth and modernity is another area of critical interest. Scholars have argued that Dattani's plays reflect a tension between traditional values and contemporary aspirations. This tension is often articulated through symbolic representations of dharma and desire, as seen in studies that examine the concept of psychological androgyny in his work. These analyses suggest that Dattani's characters embody a complex interplay between cultural expectations and individual agency. Postcolonial perspectives further enrich the understanding of Dattani's use of myth. His plays are situated within a cultural context shaped by colonial and postcolonial influences, where traditional narratives are continuously reinterpreted. By incorporating mythic elements into contemporary settings, Dattani challenges the notion of a fixed cultural identity, instead presenting it as fluid and dynamic. Comparative studies have also highlighted the differences between Dattani and other Indian dramatists. While playwrights like Karnad employ myth as a central narrative framework, Dattani integrates it more subtly, using symbolic motifs rather than explicit storytelling. This approach aligns his work with modernist and postmodernist theatrical traditions, where meaning is often conveyed through indirect and fragmented forms. Despite these developments, there remains a gap in comprehensive studies that examine symbolism and myth across Dattani's entire body of work. This paper seeks to address this gap by providing a systematic analysis of these elements, demonstrating their centrality to his dramaturgy.

METHODOLOGY

This study adopts a qualitative interpretative methodology grounded in close textual analysis, comparative reading, and thematic synthesis. The choice of this methodological framework is informed by the nature of the research problem, which seeks to explore symbolic and mythic structures within dramatic texts. Such an inquiry requires an approach that is sensitive to nuance, ambiguity, and contextual meaning, rather than one that relies on quantification or empirical generalisation. The primary corpus includes major plays by Mahesh Dattani, including *Tara*, *Final Solutions*, *Dance Like a Man*, *Bravely Fought the Queen*, and *Seven Steps Around the Fire*. These texts are selected on the basis of their thematic diversity and their relevance to the study's focus on symbolism and myth. Each play is analysed in detail, with attention to both textual and performative elements.

Qualitative Content Analysis (QCA) is employed as a guiding method for identifying recurring patterns and motifs. This approach allows for the systematic examination of themes such as ritual, identity, and cultural symbolism, while preserving the complexity of literary meaning. Rather than imposing predefined categories, the analysis allows themes to emerge organically from the texts.

Close reading serves as the primary analytical tool. Particular attention is paid to language, imagery, and dramatic structure, as well as to the use of stage directions and visual elements. Symbols are identified not only in explicit references but also in recurring patterns and associations. For instance, the use of space in Dattani's plays—such as the division between public and private areas—often carries symbolic significance, reflecting broader social hierarchies.

The study also incorporates an interdisciplinary theoretical framework, drawing on semiotics, postcolonial theory, and cultural studies. Semiotics provides a framework for understanding how meaning is constructed through signs and symbols, while postcolonial theory situates these symbols within a broader cultural context. Cultural studies, in turn, emphasizes the relationship between text and society, highlighting the ways in which literature both reflects and shapes social realities. A comparative dimension is introduced through the analysis of mythic structures. Rather than treating myth as a fixed narrative, the study examines how mythic patterns are reinterpreted within modern contexts. This approach allows for a deeper understanding of how Dattani's work engages with traditional cultural forms while simultaneously challenging them.

The methodology also emphasizes reflexivity, recognizing that interpretation is shaped by the researcher's own perspective. By maintaining a critical awareness of this process, the study seeks to produce a nuanced and balanced analysis that does not reduce the complexity of the texts.

RESULTS AND DISCUSSION

The analysis reveals that symbolism and myth are central to Mahesh Dattani's dramaturgy, functioning as key mechanisms through which social realities are interpreted and critiqued. Across his plays, symbols operate at multiple levels, creating a layered structure of meaning that extends beyond the surface narrative. One of the most significant findings is the role of ritual as a symbolic device. In *Seven Steps Around the Fire*, the marriage ritual becomes a metaphor for both inclusion and exclusion. While it represents union and continuity within traditional society, it also highlights the marginalisation of those who do not conform to normative identities. The ritual thus serves as a site of tension, where cultural values are both affirmed and questioned.

The body emerges as another important symbol in Dattani's plays. In *Tara*, the conjoined twins represent the fragmentation of identity under patriarchal conditions. The physical division of the body mirrors the psychological and social divisions imposed by gender norms. This symbolic use of the body underscores the extent to which identity is shaped by external forces. Mythic structures are often embedded within the narrative framework of Dattani's plays. In *Bravely Fought the Queen*, the title itself evokes historical and mythic associations, suggesting a parallel between contemporary struggles and traditional narratives of heroism. However, these associations are subverted, revealing the limitations of such narratives in addressing modern realities.

The analysis also highlights the interplay between tradition and modernity. Dattani's use of myth does not simply reinforce traditional values; rather, it exposes their contradictions and limitations. By placing mythic elements within contemporary settings, he creates a dialogue between past and present, encouraging audiences to reconsider their assumptions. Furthermore, the study demonstrates that symbolism in Dattani's plays is closely linked to issues of marginalisation. Objects, spaces, and rituals often function as markers of inclusion or exclusion, reflecting broader social hierarchies. This symbolic framework allows for a nuanced exploration of power, revealing how it operates at both visible and invisible levels.

CONCLUSION

The present study has sought to re-evaluate Mahesh Dattani's dramaturgy by foregrounding the role of symbolism and Indian myth in shaping his dramatic vision. While Dattani has frequently been discussed within the framework of social realism, this analysis demonstrates that such a classification, though not inaccurate, remains incomplete. His plays are not confined to the surface representation of contemporary life; rather, they are structured through a dense network of symbols and mythic resonances that deepen their interpretative possibilities. It is through this layered construction that Dattani achieves a distinctive dramatic voice, one that negotiates between realism and cultural memory. A key conclusion that emerges from the study is that Dattani does not employ myth in a conventional or overt manner. Unlike classical Sanskrit dramatists or even modern playwrights such as Girish Karnad, who draw directly upon mythological narratives, Dattani internalises myth within the everyday. Myth in his plays does not appear as a story retold but as a pattern reconfigured. It is present in the symbolic structure of relationships, in the ritualistic repetition of social practices, and in the psychological conflicts experienced by his characters. This subtle integration allows myth to function not as an authoritative framework but as a critical tool that exposes the contradictions of contemporary society.

Another significant insight concerns the function of symbolism in Dattani's work. The analysis has shown that symbols in his plays are not merely decorative elements; they are central to the construction of meaning. Rituals, bodily images, spatial arrangements, and even silences operate as symbolic forms that reveal underlying tensions within the social order. For instance, the use of marriage rituals in *Seven Steps Around the Fire* or the symbolic fragmentation of the body in *Tara* demonstrates how everyday practices can be imbued with deeper ideological significance. These symbols enable Dattani to articulate complex social issues without resorting to overt didacticism.

The relationship between myth and marginalisation is also crucial to understanding Dattani's dramaturgy. By reworking mythic patterns within contemporary contexts, he highlights the ways in which traditional structures continue to shape modern identities. At the same time, his plays challenge these structures, exposing their limitations and suggesting the possibility of transformation. This dual movement—of continuity and critique—gives his work its distinctive tension and vitality.

Moreover, the study underscores the importance of viewing Dattani's theatre as a site of cultural negotiation. His plays engage with a wide range of social issues, including gender inequality, sexual identity, and communal conflict, but they do so through a framework that is deeply rooted in Indian cultural traditions. By integrating myth and symbolism into his dramaturgy, Dattani creates a dialogue between past and present, tradition and modernity, thereby expanding the scope of Indian English drama. In conclusion, Mahesh Dattani's contribution to contemporary theatre lies in his ability to combine realism with symbolic depth, creating a form of drama that is both socially engaged and aesthetically complex. His use of myth and symbolism not only enriches the narrative structure of his plays but also provides a powerful means of critiquing the cultural and ideological systems that shape modern Indian society. As such, his work represents a significant development in the evolution of Indian drama, offering new possibilities for the exploration of identity, power, and cultural memory.

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