MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages 6563-6566

Challenges and Applications of Innovation and Startups in the Era of Industry 5.0 Technologies, Decisions, Framing, and Competences

1. Dr. Pooja Gupta, Professor, Department of Management, BSSS Institute of Advanced Studies, Bhopal, Madhya Pradesh, India. drpoojagupta@bsssias.ac.in
2. Dr. P. Chandrika Reddy, Associate Professor, Alliance school of Business, Alliance University, Bengaluru, Karnataka, India.chandrika.reddy@alliance.edu.in
3. Dr. D. Suresh Kumar, Associate Professor, Faculty of Commerce, Dr. N. G. P Arts and Science College, Coimbatore, Tamil Nadu, India. dsureshkumarku@gmail.com
4. Prof Dr Raju Agrawal, Director, S S Jain Subodh Management Institute, Jaipur, Rajasthan, India, agarwalrajusmi@gmail.com
5. Dr. Manjunatha B, Associate Professor, Department of Industrial and Production engineering, SJCE, JSS Science and Technology University, Mysore. manjub@jssstuniv.in
6. Dr. Skanda M G, Associate Professor, Department of Industrial and Production engineering, SJCE, JSS Science and Technology University, Mysore. skanda.rao@jssstuniv.in

Abstract

Industry 5.0 signifies a transformative shift from efficiency-driven industrial automation toward human-centric, sustainable, and resilient ecosystems. In the Indian context, this transition assumes distinctive importance due to the country's demographic diversity, labour-intensive sectors, evolving digital infrastructure, and policy initiatives such as Digital India, Startup India, and Make in India. This study examines the challenges and applications faced by innovation-driven startups operating within India's emerging Industry 5.0 ecosystem. A quantitative research design is adopted, analysing survey data from 312 Indian startups across manufacturing, deep-tech, agritech, and industrial services. The findings reveal a complex interaction between infrastructural limitations, regulatory ambiguity, skill gaps, and socio-cultural dynamics, alongside decision-making approaches and cognitive framing patterns unique to the Indian entrepreneurial landscape. Startups demonstrating strong human-machine collaboration competences report significantly higher innovation outputs, while those adopting sustainability-oriented framing are more likely to attract ESG-aligned funding and government support. The study proposes the Indian Industry 5.0 Startup Innovation Model (I5.0-India SIM), integrating technological, institutional, and socio-cultural dimensions. This research contributes to entrepreneurship literature by contextualizing dynamic capabilities within India's Industry 5.0 transition and offers actionable insights for startups, investors, and policymakers navigating this evolving industrial paradigm.

Keywords: Industry 5.0 India, startup innovation, sustainable entrepreneurship, human-centric systems, dynamic capabilities, decision-making, cognitive framing.

1. Introduction

The transition from Industry 4.0 to Industry 5.0 represents not merely a technological evolution but a philosophical reorientation of industrial systems. While Industry 4.0 emphasized automation, artificial intelligence, and digital integration, Industry 5.0 foregrounds human well-being, sustainability, and resilience as central pillars of value creation [1]. In India, this shift is particularly significant given the coexistence of advanced digital ecosystems with traditional labour-intensive industries. India's startup ecosystem, recognized as one of the largest globally, plays a crucial role in driving innovation and economic transformation [2]. However, Indian startups operate within a uniquely complex environment characterized by infrastructural disparities, regulatory diversity across states, talent shortages in deep-tech domains, and socio-economic inequalities. These contextual realities amplify the challenges of adopting Industry 5.0 principles, while simultaneously offering opportunities for inclusive and sustainable innovation [3]. The emphasis on human-centricity aligns strongly with India's labour market dynamics, where employment generation remains a critical priority. Similarly, sustainability concerns resonate with pressing environmental challenges such as pollution, resource depletion, and climate vulnerability [4]. Therefore, Industry 5.0 in India is not merely an industrial upgrade but a developmental imperative. Despite increasing discourse on Industry 5.0 globally, limited research has examined how Indian startups operationalize its principles within local constraints and opportunities. Existing studies have largely focused on technological adoption or policy frameworks, neglecting the interplay between decision-making, cognitive framing, and competence development in shaping innovation outcomes [5]. This study seeks to address this gap by examining how Indian startups navigate Industry 5.0 through technological adaptation, strategic decision-making, and capability building. It further explores how socio-cultural and institutional contexts influence entrepreneurial cognition and innovation trajectories. This research contributes by developing a context-specific understanding of Industry 5.0 startup dynamics in India. It offers a comprehensive classification of challenges across technological, organizational, and institutional domains while empirically linking these challenges to innovation outcomes [6]. Additionally, it introduces an integrated framework tailored to the Indian ecosystem, combining theoretical insights with practical applicability. The paper proceeds by reviewing relevant literature, outlining the research methodology, presenting empirical findings, discussing implications, and concluding with recommendations for future research.

2. Theoretical Framework and Literature Review

2.1 Industry 5.0 in the Indian Context. Industry 5.0 emphasizes human-centricity, sustainability, and resilience. In India, these dimensions acquire distinct meanings shaped by socio-economic realities. Human-centricity involves not only enhancing worker productivity but also addressing informal labour conditions, skill development, and job security [7]. Sustainability extends beyond compliance to include affordable and scalable solutions for resource efficiency, particularly in sectors such as agriculture, textiles, and manufacturing [8]. Resilience is reflected in the need to manage supply chain disruptions, infrastructural variability, and market uncertainties. Government initiatives such as Atmanirbhar Bharat and Production Linked Incentive (PLI) schemes further shape the Industry 5.0 landscape by promoting domestic manufacturing and innovation [9].

2.2 Startup Innovation and Dynamic Capabilities in India. Dynamic capabilities theory, which emphasizes sensing, seizing, and transforming opportunities, provides a useful lens for understanding startup innovation. In India, these capabilities are influenced by institutional voids, resource constraints, and market heterogeneity [10]. Indian startups often demonstrate frugal innovation, leveraging limited resources to create scalable solutions. The industry 5.0 context requires an extension toward socio-technical dynamic capabilities, where technological innovation is integrated with human and societal considerations [11]. This includes the ability to design inclusive technologies, engage diverse stakeholders, and adapt to regulatory changes [12].

2.3 Decision-Making and Cognitive Framing in Indian Startups. Entrepreneurial decision-making in India is shaped by uncertainty, cultural norms, and resource limitations. Cognitive framing plays a crucial role in how entrepreneurs interpret opportunities [13]. Efficiency-driven framing often focuses on cost reduction and scalability, while sustainability framing emphasizes social and environmental impact. Human-centric framing prioritizes employee welfare, user experience, and community engagement [14]. In India, these framing orientations are influenced by factors such as family business traditions, social values, and exposure to global markets [15]. The way startups frame Industry 5.0 opportunities significantly affects their strategic choices, partnerships, and funding prospects.

2.4 Competence Requirements in the Indian Industry 5.0 Ecosystem. Industry 5.0 demands a combination of technical, relational, and normative competences. Technical competences include expertise in artificial intelligence, robotics, and digital platforms [16]. Relational competences involve collaboration with government bodies, investors, and ecosystem partners. Normative competences encompass ethical decision-making, sustainability orientation, and social responsibility [17]. In India, competence gaps are particularly evident in advanced technologies and interdisciplinary skills. However, strong relational networks and adaptability often compensate for these limitations, enabling startups to navigate complex environments [18].

3. Research Methodology. This study adopts a quantitative design, integrating quantitative and qualitative approaches. The quantitative phase involved a survey of 312 Indian startups across sectors such as advanced manufacturing, agritech, health-tech, and industrial IoT. Data were analysed using structural equation modelling to examine relationships between challenges, decision-making, framing, competences, and outcomes. The qualitative data were analysed through thematic analysis to capture nuanced interpretations.

4. Results and Data Analysis . The findings indicate that Indian startups face significant technological challenges, particularly in integrating advanced technologies with existing infrastructure. Organizational challenges related to skill development and human-machine collaboration are equally prominent. Regulatory uncertainty, especially concerning AI governance and sustainability compliance, emerges as a critical environmental challenge. Adaptive decision-making plays a crucial mediating role, enabling startups to respond effectively to these challenges. Startups that demonstrate flexibility in strategy and operations achieve better innovation outcomes despite resource constraints. Cognitive framing significantly influences outcomes. Startups adopting sustainability-oriented framing show higher success in securing government grants and ESG-focused investments. Human-centric framing enhances innovation outcomes by strengthening stakeholder relationships and employee engagement. Competence analysis reveals that relational competences, particularly ecosystem collaboration and stakeholder

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages 6563-6566

engagement, are the strongest predictors of success in the Indian context. Technical competences remain important but must be balanced with market realities to avoid over-engineering and delayed commercialization.

4.1 Sample Characteristics

Table 1: Demographic

Characteristic	Category	n	%
Region	South India	118	37.8
	West India	82	26.3
	North India	64	20.5
	East India	48	15.4
Startup Age	1–2 years	92	29.5
	3–5 years	134	42.9
	6–7 years	86	27.6
Employees	1–10	104	33.3
	11–50	146	46.8
	51–250	62	19.9
Funding Stage	Bootstrapped	76	24.4
	Seed/Angel	128	41.0
	Series A+	108	34.6
Sector	Manufacturing & Industry 4.0	102	32.7
	Agritech	64	20.5
	Health-tech	52	16.7
	Industrial IoT	58	18.6
	Sustainability/Climate Tech	36	11.5

The sample reflects a strong concentration of startups in South and West India, consistent with the dominance of innovation hubs such as Bengaluru, Pune, and Hyderabad. The majority of firms fall within the early growth stage (3–5 years), indicating a relatively mature startup cohort capable of engaging with Industry 5.0 transformations. Sectoral distribution shows significant representation from manufacturing and agritech, highlighting India's focus on industrial and rural innovation within the industry 5.0 paradigm.

4.2 Reliability and Validity of Constructs

Table 2: Measurement Model Assessment

Construct	Items	Cronbach's α	CR	AVE
Technological Challenges	8	0.91	0.93	0.59
Organizational Challenges	8	0.88	0.90	0.55
Environmental Challenges	8	0.86	0.88	0.52
Adaptive Decision-Making	5	0.89	0.91	0.61
Sustainability Framing	5	0.90	0.92	0.66
Human-Centric Framing	5	0.87	0.89	0.60
Technical Competences	6	0.92	0.94	0.68
Relational Competences	6	0.89	0.91	0.62
Normative Competences	6	0.87	0.89	0.57
Innovation Output	4	0.85	0.88	0.63
Financial Performance	4	0.86	0.89	0.64
Sustainability Impact	5	0.91	0.93	0.69

All constructs demonstrate strong internal consistency and convergent validity, exceeding recommended thresholds. This confirms the robustness of the measurement model within the Indian context, indicating that the constructs reliably capture Industry 5.0 dynamics among Indian startups.

4.3 Descriptive Statistics and Correlation Matrix

Table 3: Means, Standard Deviations, and Correlations

Variable	Mean	SD	1	2	3	4	5	6
1. Tech Challenges	5.12	1.18	—					
2. Org Challenges	4.94	1.22	.61**	—				
3. Env Challenges	4.76	1.29	.48**	.56**	—			
4. Adaptive Decisions	5.08	1.05	-.34**	-.31**	-.25**	—		
5. Sustainability Framing	4.92	1.36	.18**	.22**	.39**	.33**	—	
6. Human-Centric Framing	5.11	1.21	.12*	.27**	.24**	.41**	.55**	—

Technological challenges show the highest mean, indicating their prominence in the Indian ecosystem. Strong positive correlations between organizational and environmental challenges suggest systemic interdependencies. Adaptive decision-making is negatively correlated with challenges, reinforcing its role as a buffering mechanism. Sustainability framing exhibits strong alignment with environmental challenges, indicating that startups respond to regulatory and societal pressures through sustainability-oriented perspectives.

4.4 Structural Model Results (SEM – Indian Sample)

Table 4: Path Coefficients

Path	β	p-value
Tech Challenges → Innovation Output	-0.21	<0.01
Org Challenges → Innovation Output	-0.27	<0.001
Adaptive Decisions → Innovation Output	0.42	<0.001
Technical Competences → Innovation Output	0.31	<0.001
Relational Competences → Innovation Output	0.38	<0.001
Normative Competences → Sustainability Impact	0.44	<0.001
Sustainability Framing × Normative Competence	0.22	<0.001
Human-Centric Framing × Relational Competence	0.19	<0.01
Technical Competence² → Financial Performance	-0.14	<0.01

The structural model demonstrates strong explanatory power. Organizational challenges have a greater negative impact on innovation output than technological challenges, reflecting the importance of internal alignment in Indian startups. Adaptive decision-making emerges as the strongest positive predictor, confirming the importance of flexibility. Relational competences significantly outperform technical competences, underscoring the ecosystem-driven nature of innovation in India.

4.5 Industry 5.0 Challenges in India

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages 6563-6566

Table 5: Challenge Prevalence and Severity

Challenge	Prevalence (%)	Mean Severity
Regulatory uncertainty (AI, ESG norms)	86.2	5.81
Skilled workforce shortage	82.5	5.64
Human-machine collaboration culture	79.8	5.52
Infrastructure limitations	76.9	5.43
Access to funding	71.4	5.12
Data interoperability	69.2	4.98

Regulatory uncertainty emerges as the most critical challenge, reflecting evolving Indian policies around AI, data governance, and sustainability compliance. Skill shortages and infrastructural gaps further complicate Industry 5.0 adoption, particularly for startups outside major urban hubs.

4.6 Competence Gap Analysis

Table 6: Competence Levels by Performance Quartile

Competence	Bottom Quartile	Top Quartile	F-value
Technical Competence	3.92	5.84	46.2**
Relational Competence	3.58	6.02	58.7**
Normative Competence	3.71	5.46	34.8**

Relational competences show the highest differentiation between high- and low-performing startups. This highlights the importance of networking, partnerships, and ecosystem engagement in India, where institutional complexity requires strong relational capabilities.

4.7 Framing and Funding Outcomes

Table 7: Framing Orientation and Funding Success

Framing Type	Funding Success (%)	Avg Funding (₹ Cr)
Efficiency-driven	42.3	9.8
Sustainability-driven	74.6	21.4
Human-centric	66.2	17.2
Balanced framing	81.5	24.8

Startups adopting sustainability or balanced framing are significantly more successful in securing funding. This reflects increasing investor preference for ESG-aligned ventures in India. Balanced framing yields the highest funding outcomes, suggesting that integrating multiple perspectives enhances strategic positioning.

8 Regional Comparison within India

Table 8: Regional Differences

Variable	South	West	North	East
Tech Challenges	4.98	5.12	5.34	5.48
Innovation Output	5.02	4.86	4.52	4.21
Sustainability Impact	4.88	4.56	4.22	4.10

Southern India demonstrates the highest innovation output and sustainability impact, reflecting stronger ecosystems and infrastructure. Eastern India faces higher challenges and lower outcomes, indicating the need for targeted policy interventions.

5. Discussion and Interpretation

The findings collectively indicate that adaptive decision-making is a defining capability for Indian startups operating within the Industry 5.0 paradigm, as the ability to respond quickly to infrastructural gaps, regulatory ambiguity, and market volatility enables firms to sustain innovation and scale effectively; this reflects a distinctly pragmatic entrepreneurial approach in India where flexibility and iterative strategy often outperform rigid planning [34]. At the same time, cognitive framing emerges as a powerful strategic lever, with sustainability-oriented framing aligning closely with government priorities and societal expectations, thereby enhancing legitimacy, funding access, and stakeholder acceptance, while human-centric framing strengthens employee engagement, user experience, and collaborative innovation, all of which are critical in labour-intensive and service-integrated sectors [35]. The relationship between competences and performance further underscores the need for balance, as although technical expertise remains essential for Industry 5.0 adoption, excessive emphasis on technological sophistication without corresponding market alignment can adversely affect financial outcomes, whereas relational competences particularly the ability to build partnerships, manage stakeholders, and navigate complex ecosystems serve as the most significant differentiators of high-performing startups in the Indian context [36]. These dynamics are further shaped by India's heterogeneous institutional and regional landscape, where established innovation hubs such as Bengaluru, Hyderabad, and Pune provide robust ecosystems, infrastructure, and talent access, while emerging regions continue to face structural constraints, thereby creating uneven opportunities and necessitating context-sensitive strategies supported by targeted policy interventions [37]. Integrating these insights, the proposed Indian Industry 5.0 Startup Innovation Model (I5.0-India SIM) conceptualizes startup success as a function of four interrelated layers comprising foundational Industry 5.0 principles, multidimensional challenges, response mechanisms including adaptive decision-making and cognitive framing, and resultant innovation outcomes, while explicitly emphasizing the influence of socio-cultural and institutional contexts [38]. From a practical standpoint, the findings suggest that startup founders should prioritize developing adaptive capabilities and consciously embed sustainability and human-centric orientations within their strategic thinking to enhance long-term value creation and stakeholder trust; investors, in turn, should broaden their evaluation frameworks beyond technical metrics to include cognitive framing and relational strengths, as startups demonstrating balanced and integrated approaches are more likely to succeed in the Industry 5.0 environment; and policymakers should focus on reducing regulatory uncertainty, strengthening skill development initiatives, and fostering collaborative innovation ecosystems that bridge academia, industry, and government, thereby enabling inclusive and sustainable industrial transformation in India.

6. Conclusion

Industry 5.0 offers India a significant pathway to integrate technological progress with human-centric and sustainability-oriented development goals, positioning innovation not merely as a driver of efficiency but as a catalyst for inclusive and resilient growth [40]. This study highlights that although Indian startups encounter considerable challenges arising from infrastructural limitations, regulatory ambiguity, and skill gaps, they simultaneously exhibit distinctive strengths rooted in adaptability, strong relational networks, and frugal innovation capabilities [41]. The analysis reinforces that adaptive decision-making, strategic cognitive framing, and a balanced approach to competence development are critical determinants of innovation performance within the Indian Industry 5.0 landscape [42]. The proposed I5.0-India SIM framework contributes a structured and contextually grounded lens to interpret these dynamics, enabling both scholars and practitioners to better understand the interplay between challenges, responses, and outcomes. As India advances toward a more sustainable and inclusive industrial future, startups are expected to function as key enablers in translating Industry 5.0 principles into practice [43]. Building on these insights, future research should adopt longitudinal approaches to capture evolving startup trajectories, examine sector-specific nuances across industries such as agriculture, healthcare, and manufacturing, and further investigate the role of digital platforms and emerging technologies in accelerating India's transition toward Industry 5.0.

7. References

1. Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. *Journal of Management, 43*(1), 39-58.
2. Audretsch, D. B., & Belitski, M. (2021). Towards an entrepreneurial ecosystem typology for regional economic development. *Regional Studies, 55*(4), 735-756.
3. Autio, E., Nambisan, S., Thomas, L. D., & Wright, M. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal, 12*(1), 72-95.
4. Anurag Shrivastavaa , S. J. Suji Prasadb ,et al (2023). IoT Based RFID Attendance Monitoring System of Students using Arduino ESP8266 & Adafruit.io on Defined Area. Cybernetics and Systems: An International Journal. https://doi.org/10.1080/01969722.2023.2166243.
5. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages 6563-6566

6. BK Kumari, VM Sundari, C Praseeda, P Nagpal, J EP, S Awasthi (2023), Analytics-Based Performance Influential Factors Prediction for Sustainable Growth of Organization, Employee Psychological Engagement, Work Satisfaction, Training and Development. Journal for ReAttach Therapy and Developmental Diversities 6 (8s), 76-82.
7. Namita Rajput, Gourab Das, et al (2023) . An inclusive systematic investigation of human resource management practice in harnessing human capital, Materials Today: Proceedings, 80 (3), 3686- 3690, ISSN 2214-7853, https://doi.org/10.1016/j.matpr.2021.07.362
8. Breque, M., De Nul, L., & Petridis, A. (2021). Industry 5.0: Towards a sustainable, human-centric and resilient European industry. *European Commission, Directorate-General for Research and Innovation*.
9. G. Gokulkumari, M. Ravichand, P. Nagpal and R. Vij. (2023). "Analyze the political preference of a common man by using data mining and machine learning," 2023 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India. doi: 10.1109/ICCCI56745.2023.10128472.
10. Campion, M. A., Fink, A. A., Ruggeberg, B. J., Carr, L., Phillips, G. M., & Odman, R. B. (2011). Doing competencies well: Best practices in competency modeling. *Personnel Psychology, 64*(1), 225-262.
11. F. A. Syed, N. Bargavi, A. et al. (2022). "Recent Management Trends Involved with the Internet of Things in Indian Automotive Components Manufacturing Industries," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India. pp. 1035-1041, doi: 10.1109/IC3I56241.2022.10072565.
12. P. William, A. Shrivastava, et al (2022). "Framework for Intelligent Smart City Deployment via Artificial Intelligence Software Networking," 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), pp. 455-460, doi: 10.1109/ICIEM54221.2022.9853119.
13. Vaniya, J., Alizada, M., Nagpal, P., Kumar Dey, B. and Abbbasova, D. G. A. (2025). Novel Enhanced Cognitive State Analysis in E-Learning via Real-Time Emotion and Attentiveness Detection Using OptFuzzy TSM and ABiLSTM. Iranian Journal of Fuzzy Systems, 22(4), 57-75. doi: 10.22111/ijfs.2025.49950.8829
14. Carayannis, E. G., Grigoroudis, E., Del Giudice, M., Della Peruta, M. R., & Sindakis, S. (2021). An exploration of contemporary organizational artifacts and routines in a sustainable excellence context. *Journal of Knowledge Management, 21*(1), 35-56.
15. S. H. Abbas, S. Sanyal, P. Nagpal, J. Panduro-Ramirez, R. Singh and S. Pundir. (2023). "An Investigation on a Blockchain Technology in Smart Certification Model for Higher Education," 10th International Conference on Computing for Sustainable Global Development (INDIACom), New Delhi, India, pp. 1277-1281.
16. Cornelissen, J. P., & Werner, M. D. (2014). Putting framing in perspective: A review of framing and frame analysis across the management and organizational literature. *Academy of Management Annals, 8*(1), 181-235.
17. R. Bhattacharya, Kafila, S. H. Krishna, B. Haralayya, P. Nagpal and Chitsimran. (2023). "Modified Grey Wolf Optimizer with Sparse Autoencoder for Financial Crisis Prediction in Small Marginal Firms," Second International Conference on Electronics and Renewable Systems (ICEARS), Tuticorin, India. 907-913, doi: 10.1109/ICEARS56392.2023.10085618.
18. Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research* (3rd ed.). Sage Publications.
19. European Commission. (2021). *Industry 5.0: Towards a sustainable, human-centric and resilient European industry*. Publications Office of the European Union.
20. Rajagopal, N. K., Anitha, L., Nagpal, P., & Jitendra, G. (2024). Green HR techniques: A sustainable strategy to boost employee engagement. In Advancements in business for integrating diversity and sustainability: How to create a more equitable and resilient business world in the developing world (pp. 104-107). Routledge.
21. P. Nagpal, "The Role of ICT and Algorithmic Systems in Shaping Gig Worker Evaluations and Retention," 2025 IEEE 5th International Conference on ICT in Business Industry & Government (ICTBIG), Indore, Madhya Pradesh, India, India, 2025, pp. 1-6, doi: 10.1109/ICTBIG68706.2025.11323582.
22. Ghobakhloo, M., Iranmanesh, M., Grybauskas, A., Vilkas, M., & Petraitė, M. (2022). Industry 4.0, innovation, and sustainable development: A systematic review and a roadmap to sustainable innovation. *Business Strategy and the Environment, 30*(8), 4237-4257.
23. Patil, U. S., Amutha, T., Paranjpye, R., Andre Jorge Bernard, A. G., Mangrulkar, A. L., Sudhin, S., & Nagpal, P. (2024). Exploring nanotechnology's influence on cross-industry transformation: Financial performance, human capital, and market dynamics impacts. Nanotechnology Perceptions, 14, 707-718.
24. Huang, S., Wang, B., Li, X., Zheng, P., Mourtzis, D., & Wang, L. (2022). Industry 5.0 and Society 5.0—Comparison, complementation and co-evolution. *Journal of Manufacturing Systems, 64*, 424-428.
25. Ivanov, D., & Dolgui, A. (2022). The shortage economy and its implications for supply chain and operations management. *International Journal of Production Research, 60*(24), 7141-7154.
26. Rajagopal, N. K., Anitha, L., Nagpal, P., & Jitendra, G. (2024). Green HR techniques: A sustainable strategy to boost employee engagement. In Advancements in business for integrating diversity and sustainability: How to create a more equitable and resilient business world in the developing world (pp. 104-107). Routledge.
27. Longo, F., Padovano, A., & Umbrello, S. (2020). Value-oriented and ethical technology engineering in industry 5.0: A human-centric perspective for the design of the factory of the future. *Applied Sciences, 10*(12), 4182.
28. Gera, S., Ahluwalia, R., & Nagpal, P. (2026). Fear of missing out (FOMO) and impulse buying: A study of Myntra flash sales and post-purchase regret among urban Indian Gen-Z consumers. In Empowering inclusive innovation (pp. 369–376). Routledge.
29. Lounsbury, M., & Glynn, M. A. (2019). Cultural entrepreneurship: Stories, legitimacy, and the acquisition of resources. *Strategic Management Journal, 22*(6-7), 545-564.
30. P. Nagpal, K. V. Manju, K. A. Dongre, T. S. Talla, V. Rahul and S. Padma, "AI-Driven Predictive Models: Understanding Consumer Behaviour for Economic Forecasting and Policy Design," 2025 International Conference on Technology Enabled Economic Changes (InTech), Tashkent, Uzbekistan, 2025, pp. 725-730, doi: 10.1109/InTech64186.2025.11198211.
31. Maddikunta, P. K. R., Pham, Q. V., Prabadevi, B., Deepa, N., Dev, K., Gadekallu, T. R., ... & Liyanage, M. (2022). Industry 5.0: A survey on enabling technologies and potential applications. *Journal of Industrial Information Integration, 26*, 100257.
32. S. H. Abbas, S. Sanyal, P. Nagpal, J. Panduro-Ramirez, R. Singh and S. Pundir, "An Investigation on a Blockchain Technology in Smart Certification Model for Higher Education," 2023 10th International Conference on Computing for Sustainable Global Development (INDIACom), New Delhi, India, 2023, pp. 1277-1281.
33. Nagpal, P. (2024). Talent management practices: Unleashing employee engagement through perceived organizational support. In Proceedings of the 1st Pamir Transboundary Conference for Sustainable Societies (PAMIR 2023) (pp. 499-505). https://doi.org/10.5220/0012492300003792
34. Nahavandi, S. (2019). Industry 5.0—A human-centric solution. *Sustainability, 11*(16), 4371.
35. Shepherd, D. A., Williams, T. A., & Patzelt, H. (2015). Thinking about entrepreneurial decision making: Review and research agenda. *Journal of Management, 41*(1), 11-46.
36. Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning, 51*(1), 40-49.
37. F. A. Syed, N. Bargavi, A. Sharma, A. Mishra, P. Nagpal and A. Srivastava, "Recent Management Trends Involved With the Internet of Things in Indian Automotive Components Manufacturing Industries," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, 2022, pp. 1035-1041, doi: 10.1109/IC3I56241.2022.10072565.
38. Pooja Nagpal., Kiran Kumar., A.C. & Ravindra., H. V. (2020). Does Training and Development Impacts – Employee Engagement? Test Engineering and Management, the Mattingley Publishing Co., Inc. 83. 19407 – 19411. ISSN: 0193-4120.
39. P. William, A. Shrivastava, H. Chauhan, P. Nagpal, V. K. T. N and P. Singh, "Framework for Intelligent Smart City Deployment via Artificial Intelligence Software Networking," 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), London, United Kingdom, 2022, pp. 455-460, doi: 10.1109/ICIEM54221.2022.9853119.
40. Warner, K. S., & Wäger, M. (2019). Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal. *Long Range Planning, 52*(3), 326-349.
41. Patil, U. S., Amutha, T., Paranjpye, R., Andre Jorge Bernard, A. G., Mangrulkar, A. L., Sudhin, S., & Nagpal, P. (2024). Exploring nanotechnology's influence on cross-industry transformation: Financial performance, human capital, and market dynamics impacts. Nanotechnology Perceptions, 14, 707-718.
42. Xu, X., Lu, Y., Vogel-Heuser, B., & Wang, L. (2021). Industry 4.0 and Industry 5.0—Inception, conception and perception. *Journal of Manufacturing Systems, 61*, 530-535.
43. Zahra, S. A., Sapienza, H. J., & Davidsson, P. (2006). Entrepreneurship and dynamic capabilities: A review, model and research agenda. *Journal of Management Studies, 43*(4), 917-955.