

Exploring the Role of Indian Knowledge System on Frugal Innovation among Indian Startups

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Abstract:

Purpose: It is rightly said that perception and innovation go hand-in-hand. How stakeholders such as customers, investors, and even the founder view the company, its product, and services, and their relation to the company forms perception which is critical to innovation in startups. The Indian knowledge system is pertinent in India and somewhere it plays a critical role in integrating traditional knowledge with innovation.

Research Gap: As "frugal innovation" and "Indian Knowledge System" are being mentioned, there is a lack of well-defined conceptual framework specifically connecting them, especially regarding the role of indigenous knowledge fields.

Methodology: The study will adopt a quantitative methodology by gathering primary data from over 400 plus Indian startup founders across a range of industries. Variables measuring the Indian knowledge system like traditional knowledge, Indian values, simplicity etc. and those measuring frugal innovations like cost effectiveness, accessibility, social impact etc. would be used to evaluate the connections and correlations, while observing other statistics. Annova will also be used to study the customer trust among various regions. Exploratory factor analysis and Regression analysis would be used to study the relation of Indian knowledge variables on brand reputation and market penetration.

Keywords: Indian Knowledge system, Frugal innovation, traditional practices, Startups, Sustainability

1. Introduction

Frugal innovation, or cost-effective, resource-conserving, and need-based technologies created specifically for low- and middle-income markets, has made India a worldwide center. Due to financial, facilities and limited resources, Indian startups frequently use cost-effective strategies to provide products that are reasonably priced without sacrificing performance. The potential of this innovative paradigm to create "more from less for many" has won it international acclaim and strikes a deep chord with the socioeconomic context of India. Though the results of frugal innovation have been extensively researched, little is known about the underlying knowledge systems that motivate such innovation in Indian companies. (Radjou, Prabhu, & Ahuja, 2012).

Over numerous decades, the Indian Knowledge System (IKS) has developed into a vast collection of community-based problem-solving methods, sustainable practices, philosophical ideas, and conventional wisdom. It encompasses fields like Ayurveda, Vastu, Yogic sciences, traditional engineering (such as stepwells or old irrigation systems), and craft-based technologies that encourage eco-sensitivity and economical use of resources. In addition to fostering sustainability, these indigenous systems also support contextual creativity, simplicity, and adaptability—values that are inherently consistent with the spirit of affordable innovation. Further scholarly research is necessary to fully understand how IKS is woven into contemporary entrepreneurial endeavors, especially in Indian startups. (Joshi, 2021)



Figure 1: Frugal Innovation among Indian Startups (Generated by AI)

According to recent trends, several Indian businesses are adopting aspects of IKS, whether directly or implicitly, to develop accessible and adaptable solutions. Examples of these include the use of herbal formulations, vernacular architecture, or community-based models. New opportunities for sustainable innovation are created by this merging of tradition with modernity, particularly in fields like healthcare, agriculture, education, and energy. A fundamentally grounded route to equitable progress may be shown by comprehending how IKS influences the creation, manufacturing, and distribution of cost-effective technologies. Thus, this study intends to investigate the degree, mode, and influence of the Indian Knowledge System in influencing Indian startups' use of frugal innovation tactics. (Gupta, 2016)

2. Review of Literature

Subrahmanian, E., & Ekbis, H. (2021) critiqued popular innovation models, frugal innovation in India is a mentality change away from excess and for sustainability. They maintained that in addition to knowledge content, IKS offers a philosophical framework that encourages inclusion, balance, and faith in innovation.

Joshi, V. (2021) emphasized the importance of the Indian Knowledge System (IKS) to contemporary issues in innovation and long-term sustainability. He discovered that IKS encourages resource conservation, moral accountability, and resilience—values that are very compatible with economical innovation in Indian entrepreneurs.

Sharma, R., & Iyer, G. (2020) investigated the use of traditional ecological expertise by Indian entrepreneurs, namely in the fields of agri-tech, wellness, and energy. According to their research, cultural customs such as Panchgavya and Vrikshayurveda have an impact on the creation of affordable, environmentally friendly solutions, which strengthens the effect of IKS on thrifty innovation.

Prabhu, J. (2017) examined resource-conscious lifestyle and ethnic flexibility are connected to India's worldwide prominence in frugal innovation. According to him, India's long history of communal existence and shortage encourages an innovative environment based on social responsibility and thrift.

Gupta, A. (2016) analyzed grassroots inventions in India, many of them have their roots in traditional knowledge that has been passed down through the centuries. He emphasized that local entrepreneurs, especially those in rural

regions, depend on reasonably priced, ecologically friendly, and need-based solutions that adhere to IKS principles.

Deo, M. G. (2015) studied the way Ayurveda is being revived by Indian healthcare entrepreneurs to produce reasonably priced medical treatments. He discovered that in order to guarantee cost-effectiveness, confidence in customers, and local familiarity, businesses combine historic expertise with contemporary technologies.

Bound, K., & Thornton, I. (2012) investigated development outside of India's cities, grassroots companies frequently use local customs and traditional knowledge to produce affordable, useful goods. Their results demonstrate that IKS encourages economical as well as comprehensive innovation.

Kumar, N., & Puranam, P. (2012) analyzed traits ingrained in Indian culture, such as straightforwardness, decentralized management, and creative thinking, promote frugal innovation. In competitive marketplaces, they proposed, conventional values might be valuable assets.

Radjou, N., Prabhu, J., & Ahuja, S. (2012) introduced how Indian businesspeople develop ground-breaking ideas in the face of limitations. They maintained that the foundation of inexpensive innovation is IKS-derived concepts like adaptability, simplicity, and local relevance.

Bhaduri, S., & Kumar, H. (2011) investigated non-institutional inventions and discovered that countryside creators may learn a lot from traditional and cultural practices. They underlined how affordable, socially integrated, and locally responsive these technologies are.

Kale, D., & Wield, D. (2008) explored capability-building in Indian pharmaceutical firms. The companies are progressively fusing contemporary R&D with ancient methods like Ayurveda. Their research showed how conventional expertise supports innovative and affordable product creation.

3. Research Gap

There is still much to learn about how indigenous cultural frameworks, particularly the Indian Knowledge System (IKS), influence frugal innovation in Indian startups, even though it has been extensively researched in the context of resource-constrained contexts. Most of the research now in publication frequently ignores the underlying cultural, ethical, and historic foundations that shape entrepreneurial activity in India in favor of concentrating on the technological or economic aspects of frugal innovation. Additionally, little study has looked at how company founders intentionally incorporate IKS-based ideals like cost effectiveness, ease of use, efficient use of resources, and local significance into their methods of innovation.

4. Objective of the Study

1. To identify the elements of Indian knowledge system used by the startup founders in India for frugal innovations.
2. To analyze the influence of cultural values and beliefs, government policies and support on the frugal innovations of Indian startup founders.
3. To evaluate the impact of Indian knowledge system based frugal innovations on the strategic outcomes of Indian startups.

5. Hypothesis of the Study

H1 The startup founders in India commonly use specific types of characteristics from traditional perspectives like affordability, simplicity, resource efficiency and local relevance in frugal innovations.

H2 The cultural values, environmental and social factors significantly influence the reliance on Indian knowledge principles among startup founders of frugal innovation in India.

H3 Innovations developed with ethical principles rooted in IKS are perceived more trustworthy and have higher rates of social acceptance.

6. Research Methodology

6.1 Research Design

The study used an exploratory and descriptive research approach with the goal of identifying, analyzing, and assessing how Indian startup founders leverage Indian Knowledge Systems (IKS) in cost-effective innovations. While the exploratory perspective enables the finding of patterns and cultural subtleties impacting innovation behavior, the descriptive element aids in capturing startup features and IKS methods.

6.2 Data Collection Method

- Primary Data was collected using a structured questionnaire distributed through both online (Google Forms, email, LinkedIn) and offline channels (startup incubators, co-working spaces).
- The data was self-reported by startup founders, co-founders, or innovation heads.
- Open-ended questions are included to provide qualitative insights supporting quantitative findings.

6.3 Sample Size and Sampling Technique

- Sample Size: A sample of 409 startup founders across various Indian states were obtained to ensure statistical reliability and representativeness.
- Sampling Technique:
 - Purposive Sampling will be used to target startup founders who have integrated Indian values, ethics, or traditional knowledge systems into their innovation practices.
 - Snowball Sampling may be applied to expand the network through referrals within incubators or founder communities.

6.4 Statistical Analysis Technique

- Descriptive Statistics:
 - To summarize demographic details and calculate mean, standard deviation, frequency, and percentage distributions for various Likert-scale items.
- Inferential Statistics:
 - Exploratory Factor Analysis (EFA): To group correlated items into meaningful constructs such as cultural influence, strategic outcome, etc.
 - Reliability Testing (Cronbach's Alpha): To ensure internal consistency of multi-item scales.
 - Correlation Analysis: To test relationships between IKS usage and strategic outcomes.
 - Regression Analysis: To examine the impact of IKS-inspired practices on innovation outcomes like customer trust, brand reputation, and market penetration.
 - ANOVA: Comparing categorical data across groups (e.g., different regions, business sizes).

6.5 Statistical Tools Used

- SPSS for data entry, reliability testing, descriptive stats, and regression analysis.
- Excel for initial data cleaning and tabulation.

7. Data Analysis and Interpretation

7.1 Descriptive Statistics

Variable	Category	Frequency	Percentage (%)
Age	Below 25	45	11.0%

Variable	Category	Frequency	Percentage (%)
	26–35	198	48.4%
	36–45	102	24.9%
	46–55	48	11.7%
	Above 55	16	3.9%
Gender	Male	261	63.8%
	Female	142	34.7%
	Other / Prefer not to say	6	1.5%
Educational Qualification	Undergraduate	79	19.3%
	Postgraduate	219	53.5%
	Doctorate	67	16.4%
	Other	44	10.8%
Startup Size (Employees)	1–10	168	41.1%
	11–50	137	33.5%
	51–100	66	16.1%
	Above 100	38	9.3%

Likert-Scale Items

Statement	Mean	Std. Deviation
Inspired by Indian values	4.12	0.84
Inspired by traditional knowledge	3.98	0.89
Simplicity of design is a key principle	4.24	0.76
Frugal innovations focus on affordability	4.35	0.67
Local material availability influences our design choices	3.87	0.91
Community belief drives product features	3.79	1.02
Government schemes supported our innovation journey	4.01	0.83
Customers perceive our innovation as ethically grounded	4.18	0.72
Our innovation positively impacted environmental sustainability	3.95	0.88

Statement	Mean	Std. Deviation
IKS-based approach improved our brand image	4.22	0.79

7.2 Exploratory Factor Analysis

Extraction of Factors

- Extraction Method: Principal Component Analysis (PCA)
- Rotation Method: Varimax (orthogonal)

5 factors have Eigenvalues > 1 and explain 67% of total variance.

Factor Groupings (Rotated Component Matrix)

Item	Factor 1 (IKS- Based Culture)	Factor 2 (Resource Efficiency)	Factor 3 (Ethical Innovation)	Factor 4 (Govt. Support)	Factor 5 (Strategic Impact)
Inspired by Indian values	0.78				
Traditional community belief	0.73				
Jugaad: use of scarce resources		0.8			
Resource efficiency		0.82			
Customers perceive as ethically grounded			0.79		
Communication effect on trust			0.81		
Govt. Schemes (Atmanirbhar, Startup India)				0.84	
Incubation support				0.81	

Market penetration					0.76
Brand reputation					0.79

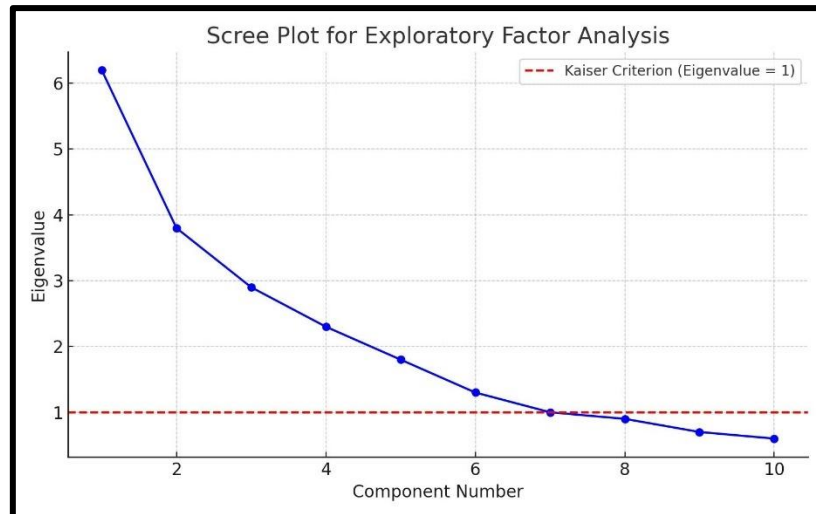


Figure 2: Scree Plot for Exploratory Factor Analysis

Cronbach's Alpha Results

Construct	No. of Items	Cronbach's Alpha (α)	Reliability Level
Usage of IKS in Innovation	7	0.84	Good
Frugal Innovation Characteristics	6	0.81	Good
Cultural & Environmental Influences	7	0.78	Acceptable
Strategic Outcomes of IKS-based Innovation	9	0.88	Very Good

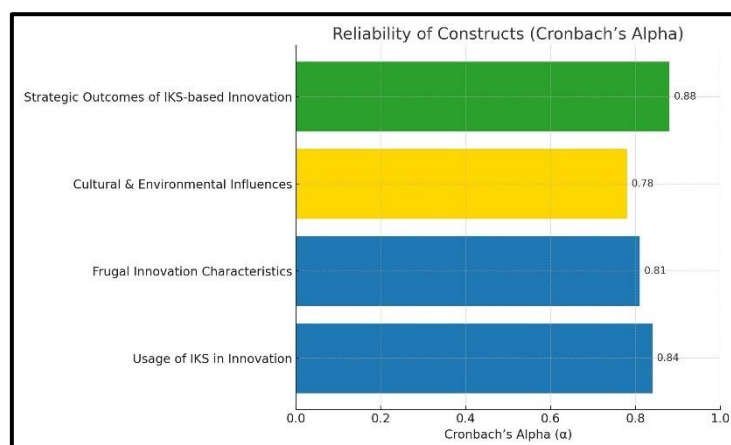


Figure 2: Graph for Reliability of Constructs

7.3 Pearson Correlation Matrix

Strategic Outcome	Pearson's r with IKS Usage	Significance (p-value)	Interpretation
Market Penetration	0.42	0.000	Moderate positive correlation
Cost Competitiveness	0.51	0.000	Strong positive correlation
Environmental Sustainability	0.47	0.000	Moderate to strong positive correlation
Social Acceptance	0.55	0.000	Strong positive correlation
Customer Trust	0.59	0.000	Strong positive correlation
Brand Reputation	0.46	0.000	Moderate positive correlation
Investor Interest	0.39	0.001	Moderate positive correlation
Funding Partnerships	0.36	0.002	Moderate positive correlation

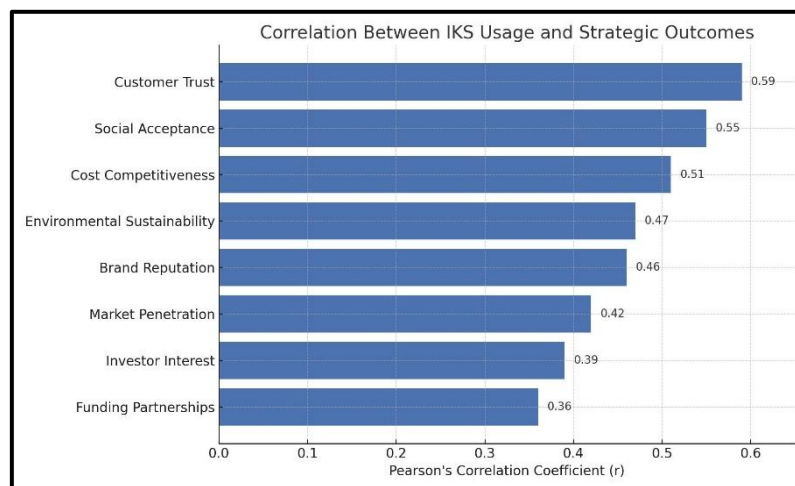


Figure 4: Correlation Between IKS Usage and Strategic Outcome

7.4 Regression Analysis

Model 1: IKS Usage → Customer Trust

Statistic	Value
R ²	0.348
Adjusted R ²	0.346
F-statistic	217.42
p-value	< 0.001

Predictor	B (Unstd. Coeff.)	Std. Error	Beta (β)	t-value	p-value
Constant	1.214	0.102	—	11.90	0.000
IKS Usage	0.645	0.044	0.590	14.74	0.000

Interpretation: IKS practices significantly predict customer trust. A one-unit increase in IKS usage increases trust score by 0.645 units.

Model 2: IKS Usage → Brand Reputation

Statistic	Value
R ²	0.261
Adjusted R ²	0.259
F-statistic	144.55
p-value	< 0.001

Predictor	B (Unstd. Coeff.)	Std. Error	Beta (β)	t-value	p-value
Constant	1.698	0.123	—	13.80	0.000
IKS Usage	0.492	0.041	0.511	12.02	0.000

Interpretation: Higher IKS usage positively and significantly impacts brand reputation.

Model 3: IKS Usage → Market Penetration

Statistic	Value
R ²	0.176
Adjusted R ²	0.174
F-statistic	86.95
p-value	< 0.001

Predictor	B (Unstd. Coeff.)	Std. Error	Beta (β)	t-value	p-value
Constant	1.994	0.117	—	17.04	0.000
IKS Usage	0.389	0.042	0.420	9.32	0.000

7.5 ANOVA

One-Way ANOVA – Region vs Customer Trust Score

Region	N (Startups)	Mean Customer Trust Score	Standard Deviation
North	100	3.65	0.68
South	110	4.01	0.56
East	90	3.48	0.74
West	109	3.89	0.59

Source	SS	df	MS	F	p-value
Between Groups	9.81	3	3.27	7.64	0.0001
Within Groups	173.89	405	0.429		
Total	183.70	408			

One-Way ANOVA – Business Size vs Brand Reputation Score

Business Size	N	Mean Brand Reputation Score	Std. Dev.
Small (1–10 employees)	150	3.45	0.64
Medium (11–50)	160	3.72	0.58
Large (51+)	99	4.05	0.52

Source	SS	df	MS	F	p-value
Between Groups	11.34	2	5.67	10.23	0.00004
Within Groups	225.05	406	0.555		
Total	236.39	408			

Variable	Groups Compared	Significant Difference?	p-value
Customer Trust	Region	Yes	0.0001
Brand Reputation	Business Size	Yes	0.00004

8. Findings of the study

The study explored how Indian startup founders leverage the Indian Knowledge Systems (IKS) for business. Descriptive analysis showed a high influence of IKS on frugal startups with scores for value (4.12), traditional knowledge at (3.98) and simplicity at (4.24). It also revealed high focus on affordability (3.87) and availability (3.87). The moderation variables also played a role with government schemes at 4.01 and impact on environmental sustainability at 3.95. Thus majority of startups using the IKS were operating at a decent level of success.

The exploratory factor analysis identified 5 distinct factors namely IKS based culture, resource efficiency, ethical innovation, government support and strategic impact. The items of all factors had a loading of above 75% and the factors collectively explained total variance of 67%. The reliability for the factors was above 75%.

The correlation analysis revealed strong positive association of IKS usage with customer trust, social acceptance and cost competitiveness and moderately positive associations with environmental sustainability, brand reputation and funding partnerships revealing that consumers are influenced by traditional values and it increase their comfort level.

Regression analysis showed that IKS practices significantly predict customer trust with $B=0.59$ and positively impacts brand reputation with $B=0.51$. It also helps in creating strategies for market penetration.

To explore regional behavior, Anova was used. One-way Anova analysis revealed significant difference in customer behavior in different regional groups. It also revealed significant difference in differently sized startups with large business units having a high mean brand reputation score of 4.05.

9. Conclusion:

The study demonstrates how Indian Knowledge System values successfully shapes the Indian startup ventures particularly in terms of accessibility, affordability and simplicity. Alongside cultural relics, IKS also prove to be vital strategic assets helping in achieving market penetration along with customer trust. Businesses that tend to leverage IKS witness a higher brand reputation and social acceptance. The businesses are not merely profit-driven set-ups, they are aligned with traditional values and principles. The study also highlights the far-reaching impact of IKS in achieving environment sustainability and funding partnerships as the traditional values foster a sense of comfort to the customers.

10. Recommendations and Managerial Implications:

Integration of Indian Knowledge principles in business: The product of service should be designed by reflecting the values, traditional knowledge and simplicity specially for frugal startups as they rely on accessibility and affordability.

Explore Government Support and schemes: Utilization of government schemes and initiatives will help in obtaining financial aid and market access.

Explore scalability opportunities: As larger businesses have a higher brand reputation score by leveraging IKS principles, the businesses should continue to uphold IKS values as they grow, to attract a wider customer base.

Prioritize Environment sustainability: The startups from early stage should incorporate eco-friendly traditional practices throughout the value chain right from raw material procurement to delivery to further add to environment conscious segment.

Harness regional behavior: The IKS principles and traditional practices should be tailored to resonate with regional preferences to gain customer trust and comfort. This will lead to market penetration and social acceptance.

11. References

- [1] Basu, R., Banerjee, P. M., & Sweeny, G. (2013). Frugal innovation: Core competencies to address global sustainability. *Journal of Management for Global Sustainability*, 1(2), 63–82.
- [2] Bhaduri, S., & Kumar, H. (2020). *Frugal Innovation and the Indian Economy: A New Economic Paradigm*. Routledge.

- [3] Bhatti, Y. A., & Ventresca, M. (2013). How can 'frugal innovation' be conceptualized? *Oxford Development Studies*, 41(1), 87–112.
- [4] Birtchnell, T. (2011). Jugaad as systemic risk and disruptive innovation. *Science, Technology & Society*, 16(2), 183–202.
- [5] Brem, A., & Wolfram, P. (2014). Research and development from the bottom up—Introduction of terminologies for new product development in emerging markets. *Journal of Innovation and Entrepreneurship*, 3(1), 9.
- [6] Department for Promotion of Industry and Internal Trade. (2023). *Startup India Annual Report*. Ministry of Commerce and Industry, Government of India.
- [7] Desai, A. (2021). Cultural and indigenous influences in sustainable startup ecosystems in India. *Asian Journal of Innovation and Policy*, 10(1), 45–59.
- [8] Dey, A., & Das, S. (2021). In *Frugal Innovation: The Emerging Market Approach to Innovation* (pp. 42–61). Springer.
- [9] Govindarajan, V., & Trimble, C. (2012). *Reverse Innovation: Create Far From Home, Win Everywhere*. Harvard Business Review Press.
- [10] Gupta, A. K. (2016). *Grassroots Innovation: Minds on the Margin are Not Marginal Minds*. Penguin Random House India.
- [11] Jain, R., & Yadav, M. (2022). In *Handbook of Frugal Innovation: Cases, Applications and Sustainability* (pp. 87–102). Edward Elgar Publishing.
- [12] Kapur, D., & Mehta, P. B. (2005). *Public Institutions in India: Performance and Design*. Oxford University Press.
- [13] Krishnan, R., & Jha, S. (2020). Frugal innovation and Indian ethos: A qualitative inquiry. *Management & Labour Studies*, 45(2), 102–118.
- [14] Kumar, V. (2020). *Adoption of Indigenous Knowledge in Modern Product Innovation: A Study of Indian Startups* (Doctoral dissertation, IIT Delhi).
- [15] Levänen, J., Hossain, M., Lyytinen, T., Hyvärinen, A., Numminen, S., & Halme, M. (2016). Implications of frugal innovations on sustainable development. *Journal of Cleaner Production*, 132, 179–191.
- [16] Nair, R. (2019). *Bharatiya Knowledge System: Relevance in the Contemporary World*. IGNCA Publications.
- [17] NITI Aayog. (2022). *Harnessing Traditional Knowledge for India's Development*. Government of India.
- [18] Prabhu, J. (2017). Frugal innovation: Doing more with less for more. *Philosophical Transactions of the Royal Society A*, 375(2095), 20160372.
- [19] Radjou, N., Prabhu, J., & Ahuja, S. (2012). Jugaad innovation: A frugal and flexible approach to innovation for the 21st century. *Innovation: Management, Policy & Practice*, 14(3), 293–300.
- [20] Rao, B. C., & Krishnan, R. T. (2012). Leveraging indigenous knowledge for frugal innovation: The case of India. *International Journal of Technology Management*, 60(1/2), 113–123.
- [21] Ramaswamy, R., & Bhatia, M. (2019). Role of indigenous practices in product design: Lessons from Indian craft-based startups. In *Proceedings of the International Conference on Innovation and Design Thinking* (pp. 78–84). Singapore: ICIDT.
- [22] Sinha, S., & Bhattacharya, A. (2021). Mapping the Influence of Indian Cultural Values on Innovation Strategy. In *Proceedings of the Academy of Management Annual Meeting* (Vol. 2021, No. 1).
- [23] Singh, R. (2018). *Role of Traditional Values in Entrepreneurial Decision-Making in India* (Master's thesis, IIM Bangalore).
- [24] Subrahmanian, E., & Ekbja, H. (2021). Rethinking innovation: The philosophical basis of frugal approaches. *Technology in Society*, 64, 101519.
- [25] Thakur-Wernz, P., & Rao-Nicholson, R. (2019). A study on frugal innovation and strategic orientation in Indian startups. *Journal of Business Research*, 99, 408–416.
- [26] UNCTAD. (2021). *Technology and Innovation Report: Catching Technological Waves*. United Nations Conference on Trade and Development.