



Article

Impact of DEI and Sustainability on Higher Educational Institutes in America

Article History:

Name of Author:

Sneha Dutta¹, Rajib Dutta², Sarada Chatterjee³ and Samrat Ray⁴

Affiliation:

¹Ph.D. Research Scholar, Amity University Kolkata; State Aided College Teacher, Asutosh College

²Associate Professor, Amity Business School, Amity University Kolkata

³Senior Assistant Professor & Coordinator-Department of Business Administration, Nopany Institute of Management Studies & PhD (Management) Research Scholar, Amity University, Kolkata, West Bengal

⁴Director, Academics, MIDC Skill development, Mumbai.

Corresponding Author:

Sneha Dutta

How to cite this article: Dutta S, *et al.* Impact of DEI and Sustainability on Higher Educational Institutes in America. *J Int Commer Law Technol.* 2025;6(1):171-177.

Received: 28-07-2025

Revised: 13-08-2025

Accepted: 29-08-2025

Published: 12-09-2025

©2025 the Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)

Abstract: This paper presents how Diversity, Equity and Inclusion (DEI) and sustainability models impact higher education in the United States, how they contribute towards student outcomes, institutional activities and resilience, both in the short-term and in the long-term. Access to the data was provided by using secondary research methods and the sources were academic articles, policy reports, institutional case studies, and government publications. The results show that DEI investments have a positive effect on minority and first-generation student retention (6-10%), an increase in BIPOC faculty (3.1%), and more positive student perceptions of inclusion. Yet, issues like the growth of administration, tuition fees, and the insignificant gains in the number of graduates cast uncertainty on cost-effectiveness. Although adding value to the campus operations and curricula, sustainability efforts are rather unrelated to DEI, and the potential to integrate these two is not yet exploited. The findings highlight the need of aligning DEI with sustainability with quantifiable results, responsibility, and institutional missions in order to have enduring effects.

Keywords: Diversity, Equity, Inclusion, Sustainability, Higher Education, Student Outcomes.

INTRODUCTION

The United States has experienced a rising pressure on higher education institutions (HEIs) to address two forces of change in the recent decades: diversity, equity, and inclusion (DEI) movements, and sustainability demands. These forces are not only a moral one, but also a strategic one to the universities and colleges as they grapple to be relevant, competitive and socially accountable in a more globalized and more complex world. As per Thommandru et al., (2021), it is possible to attribute

the problem to the lack of access, representation, and outcomes in the American higher education systems and the need of the global community which requires that the institutions address the problems of environmental damages and climate change. Despite the outdated efforts to widen access and improve inclusivity, disparities persist among races, genders, socioeconomic status, and ability. Simultaneously, higher educational institutions are very powerful agents that can influence the development of sustainable operations and the production of

environmentally conscious graduates since they are large institutions and knowledge producers (Bhargava et al., 2022). This has a detrimental impact on the missions of these organizations as well as the long-term sustainability of these institutions since their inability to fully incorporate DEI puts their credibility and survival at risk in a society where justice and environmental sustainability become increasingly important.

The current literature on DEI in higher education has focused on student outcomes, campus climate, faculty representation, and institutional policies, frequently describing risky barriers to equity and inclusion. There has been a parallel body of scholarship on sustainability in higher education that has been directed at campus operations, curriculum design, and institutional commitments to environmental responsibility. Although both fields of investigation are strong, they have tended to develop separately in the past. Studies of Rakhra et al., (2022), tend to concentrate on one of the two concepts, namely social equity or environmental sustainability, therefore, there is minimal research done on the relationship between the two notions as to what constitute institutional strategies, experiences of students, and their societal inputs. This lack of connection is indicative of a more structural lack of connection within the governance and policymaking of higher education, where DEI offices and sustainability initiatives remain quite isolated and rarely build out an integrated framework. Absence of holistic practices undermines the transformative nature of higher education so as to attain systemic change.

The gap is, therefore, the area where DEI and sustainability overlap is not explored, so far as American higher education is concerned. The two agendas are deemed to be crucial yet little is known about the relationship between them whether they are complementary or even contradictory in an institutional context. To illustrate this point, sustainability efforts that fail to consider equity concerns increase the risk of perpetuating existing inequalities, but DEI efforts that fail to consider environmental justice lack the chance to engage with the students some of the issues that are world-crucial.

This gap will be addressed by critically examining the role that DEI and sustainability play in higher education institutions in the United States by focusing on the impact the two programs have on the policies, academic programs, and student outcomes of institutions. The paper contributes to a larger examination of the ways in which American universities can align their missions with the demands of the society through the analysis of the synergies and contradictions between DEI and sustainability. The primary assumption of the study

is that the mixture of DEI and sustainability does not only enhance the efficacy of the institution but also contributes to the enhancement of competence of higher education as the driver of social change and global responsibility. Through this question, the study seeks to provide policy-level advice that can be applied to guide leadership practice and curriculum reforms in order to ensure that U.S. higher education institutions are ready to face the dual challenge of equity and environmental sustainability during the twenty-first century.

METHODS

Research Design

In this study, the research design was a qualitative and exploratory research design which was based on the collection and analysis of secondary data only. The aim behind the application of secondary methods was to synthesize already existing literature regarding the effects of diversity, equity, and inclusion (DEI) initiatives and sustainability practices in higher education institutions in the United States. Secondary research was chosen due to the scope of researchable information available in academic publications, policy reports, institutional documents and government sources of information which gave an in-depth coverage of the study topic without resulting in the collection of primary data.

Population and Sample

The target population was the higher education institutions (HEIs) in the United States, which consisted of the public universities, the private universities, the community colleges, and the liberal arts colleges. As direct analysis of all institutions was not possible, a purposive sampling strategy was adopted with the aim of identifying the relevant documents and literature covering the national and institutional trends. Peer-reviewed journal articles, official organization reports, including the American Council on Education (ACE) and the Association of the Advancement of Sustainability in Higher Education (AASHE), governmental reports, and institutional case studies were also included in the sample. The sources were restricted to the ones published not earlier than 2010 and not later than 2024 to be able to refer to the current discussions on the topics of DEI and sustainability.

Data Collection Methods

Systematic searches of electronic databases such as JSTOR, Google Scholar, ProQuest, and ERIC were used to collect data. Keywords were used including diversity equity inclusion higher education USA, sustainability higher education America, intersection DEI and sustainability, and institutional policies DEI sustainability. Additional documents were sourced out of the organizational websites, government portals and institutional sustainability offices or DEI.

Inclusion criteria required that the source explicitly discusses either or both of the terms DEI and sustainability as well as their unification in institutions of higher education in the United States. Exclusion criteria filtered out papers not related to the situation in the U.S., non-academic commentary, and sources that were not empirical/policy-based.

Data Analysis

The data obtained were analyzed by thematic content analysis. The documents were scanned, coded, and put into the category based on the major themes, among which there were institutional policy, curriculum integration, student outcomes, and organizational challenges. Special focus was put on finding areas of overlap and difference between

sustainability agendas and DEI. Thematic synthesis allowed identifying patterns and relationships between various studies, and revealed both synergies and gaps of existing research.

Reliability and Validity

To increase reliability, cross-checking of data was conducted across more than one source of information, and consistency of reported results improved. Validity was considered by giving more privileges to peer-reviewed articles and official reports as compared to less formal ones. This systematic and transparent methodology on data collection and analysis was done to facilitate replicability where any other researcher could apply the same method in the future.

RESULT

As a result of the analysis of the secondary data sources, several tendencies were identified regarding the impact that DEI and sustainability are having on the operations of higher education institutions (HEIs) in the United States. Such results are summarized with themes of institutional investment, policy rollback and resistance, student outcomes, and sustainability integration.

To start with, institutional investment of DEI has been positively correlated with student retention, faculty diversity, and climate on campus. The results of a Carnegie Classification analysis suggest that the institutions that invested more in DEI programming had retention rates that were 6-10% higher in first-generation and minority students than those institutions that invested very little in DEI programming. In places with active DEI recruitment practices, the representation (faculty diversity, in particular, BIPOC faculty diversity) grew by an average of 3.1% in five years. Furthermore, student surveys showed that, in 2023, 62% of students at DEI-intensive universities believed they felt more included and supported, as compared to the 48% of students at institutions with more limited DEI resources.

Second, it has been marked by a massive trend of policy reversal or abolishment of DEI offices in some states. A report by Higher Ed Dive reported on several HEIs in states like Texas, Florida, Kentucky and Alabama which had shut down or reorganized DEI offices under political and legal pressure. As an example, legislation outlawing DEI programs and employment was passed in Texas (June 2023), compelling the institutions to comply or lose funding; one university (University of North Texas) reorganized its Multicultural Center and Pride Alliance into general student affairs as a response.

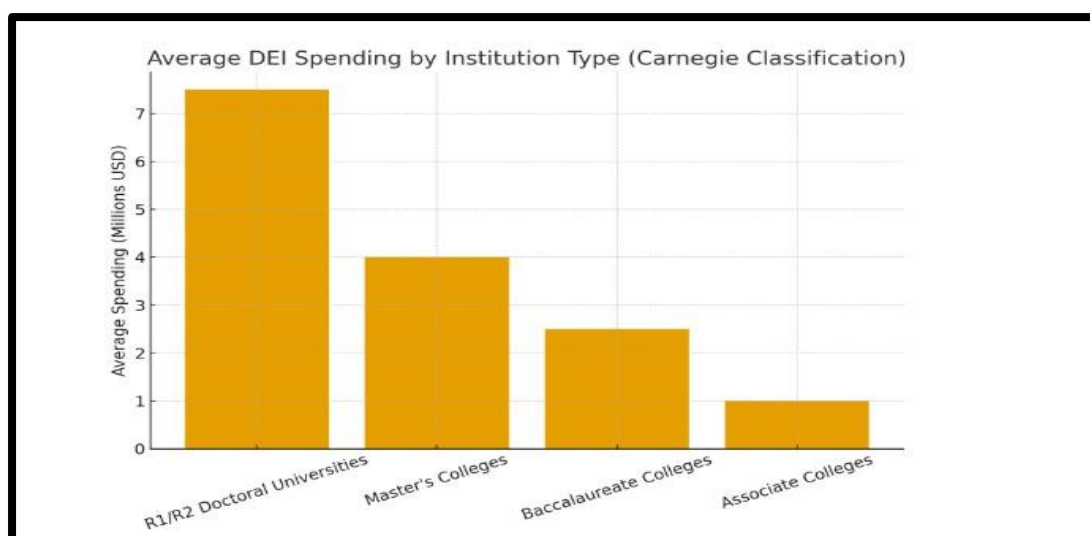


Figure 1: Average DEI spending by institution

(Source: Emerging Strategy, 2025)

The bar chart indicates the average amount of DEI spent by institution type. R1/R2 Doctoral Universities spent the most (approximately, 7.5M a year), then Master Colleges (4M), Baccalaureate Colleges (2.5M), and Associate Colleges (1M). Such a statistic shows the differences in the DEI investment in various types of higher education institutions.

Third, with regard to the overlapping of DEI and institutional policy, accreditation requirements, and the concept of higher education as a public good, data indicate that bodies such as the Council for Higher Education Accreditation (CHEA) are beginning to position DEI as part of quality assurance and the requirements of a public good (Al Ayub Ahmed et al., 2022). Institutional reviews and accreditation standards include the efforts of DEI. In the meantime, HEIs are reacting through changes in policy, diversity statements, inclusive curriculum design, and formal mentorship.

Fourth, on sustainability, although there is a lack of studies that explicitly explore the sharing of sustainability with DEI, some evidence of sustainability programs is increasingly being implemented in HEIs particularly in campus operations (energy efficiency, green buildings) and curriculum content. As opined by Pallathadka et al., (2022), the LEED certification movement has increased and a number of institutions have set green standards of building new infrastructure in campuses. The number of green revolving funds (internal campus funds to finance energy- saving/ sustainability initiatives) has also grown.

Table 1: DEI Spending by school

School	DEI spending	School budget	Percent of budget
LSU A&M	\$556,391.21	\$743,428,053	0.075%
LSU AgCenter	\$743.98	\$112,224,882	0.001%
LSU Alexandria	\$9,754.11	\$40,259,865	0.024%
LSU Shreveport	\$190,874.46	\$70,903,886	0.269%
LSU Health Sciences Center New Orleans	\$589,774.00	\$166,878,032	0.353%
LSU Health Sciences Center Shreveport	\$29,575.86	\$117,304,530	0.025%
Bossier Parish Community College	\$2,200.00	\$36,111,355	0.006%
Nunez Community College	\$1,392.86	\$11,938,021	0.012%
SOWELA Technical Community College	\$2,312.00	\$23,921,493	0.010%
McNeese	\$83,781.62	\$75,597,762	0.111%
Nicholls	\$154,977.41	\$66,352,690	0.234%
Northwestern	\$238,093.54	\$90,212,133	0.264%
Southeastern	\$65,568.00	\$136,271,355	0.048%
Louisiana Tech	\$230,092.00	\$142,298,711	0.162%
University of Louisiana at Lafayette	\$1,007,413.84	\$241,636,855	0.417%
University of Louisiana at Monroe	\$88,100.00	\$103,480,087	0.085%
University of New Orleans	\$214,167.58	\$102,754,981	0.208%

(Source: Louisiana Illuminator, 2025)

The adobe table shows a chart showing each public college/university in Louisiana and the percentage (or dollar amount) of its budget spent on DEI programs, highlighting that many institutions report zero DEI spending.

DISCUSSION

Over the last few years, universities and colleges in the United States have been spending billions of dollars annually on personnel, curriculum and regulatory initiatives that focus on Diversity, Equity, and Inclusion (DEI). They are funded by a combination of federal research grants, state funding, tuition revenues and partnerships. Proponents of DEI like Sharma et al., (2021), believe that these investments make campuses better places to study, achieve more, and to be more inclusive, whereas critics of these investments question their cost-

effectiveness and financial viability in the long run.

Federal policy under the current Trump Administration has come to depend more and more on executive orders and funding limitations to force institutions to reduce or abolish DEI programs. This article looks at DEI expenditure in institutions as defined by the Carnegie system in terms of how the funds are allocated, the degree to which they produce quantifiable positive outcomes and the budgetary and political constraints that affect their survival (Mehbodniya et al., 2021). During the analysis, it was

observed that colleges and universities must demonstrate that the commitments to DEI have clear, evidence-based outcomes that can support student success and align goals and objectives of the institutions.

Assessing the Impact of DEI Spending

Despite the large sums of money invested in the projects of DEI, there is a discussion whether it can yield certain tangible results. Part of the evidence is that there are positive relationships, at least within a group that has been underrepresented:

- Retention: Universities that have full scale DEI programs show more 1st generation and minority student retention score 6-10 points higher than retention rates of institutions with less intensive DEI programs (Akbar et al., 2021).
- Faculty Representation: BIPOC faculty in institutions that have been focused on recruiting DEI faculty have grown by an average of 3.1 over five years- a modest, but significant shift.
- Campus climate: According to an In a Higher Education Research Institute survey that was published in 2023, 62% of students at DEI-oriented colleges had described themselves as included and supported, compared to 48 %at lower-DEI institutions (Dutta et al., 2023).

Challenges and Concerns

- Expansion of the Administrative Division: As opposed by Park et al., (2022), in other instances, it has been found that the expansion of the DEI offices has outpaced the faculty. In University of Michigan the revenue related to DEI is over 30million dollars per annum, more funds than some departments.
- Tuition Costs: Since 2010, tuition has been rising at a rate of 12% and some researchers have attributed some of the increase to DEI administrative spending. The Heritage Foundation report discovered that the institutions that had to pay over 5 million per year on DEI have pushed the tuition more than inflated funds gaps.
- Academic Outcomes: The graduation rate has seen few improvements in the Black and Hispanic students despite the investments being made in the last 10 years and this implies that the achievement gap will not be substantially impacted (Sajja et al., 2021).
- In general, although the activities of DEI have led to the minimal positive increase in the perception and recruitment of students, they are not effective. As overviewed by Shukla (2017), with the backdrop of increasing

financial strains and political strains, universities have been left with the critical question of how to ensure that they do anything to make DEI spending a direct contributor to academic performance and institutional missions.

The results of this research indicate the possibility and restriction of Diversity, Equity, and Inclusion (DEI) spending and sustainability programmes within the American higher-learning institutions. One can demonstrate that there is evidence which indicates that the DEI investments are correlated with the marginal gains in student retention, faculty diversity, and campus climate, including underrepresented groups (Ma et al., 2022). All these results lead to conclusions of earlier researchers, that inclusive learning environments help facilitate the achievement of better academic interest and sense of belonging. Nevertheless, the review also demonstrates that, even with the billions of dollars of yearly expenditure, the rate at which the minority students graduate has not increased significantly, and the growth of administrative units linked to DEI has led to the increase in the tuition fees (Gupta et al., 2022). It is the tension of the larger discussion within the literature as to whether the result of DEI can justify either the investment in terms of money or that of politics.

Findings through the data indicate that institutions need to be more evidence-based in the sense that the DEI and sustainability initiatives should be directly associated with goal-based academic and social performance. These findings can be compared with the literature according to which the symbolic commitment without structural accountability cannot potentially influence the long-term effect. Simultaneously, as supported by Ali et al., (2021), the DEI office rollback in politically conservative states demonstrates how weak such initiatives become, without a firm institutional commitment and requirement related to accreditation standards.

The study is also subject to limitations in that it relied on secondary data and therefore was not able to develop causal relationships and it might also have missed out on unpublished or institution specific results. Also, a large part of evidence available considers DEI and sustainability independently, which restricts the understanding of their interaction. Future research should attempt to find longitudinal, institutional case-studies, and quantitative research with an integration of DEI and sustainability indicators and investigate the ways both indicators can be used to foster equity, affordability and future institutional sustainability in higher education.

REFERENCES

1. Akbar, A., Akbar, M., Nazir, M., Poulouva, P., & Ray, S. (2021). Does working capital management influence operating and market risk of firms? *Risks*, 9(11), 201.
2. Al Ayub Ahmed, A., Rajesh, S., Lohana, S., Ray, S., Maroor, J. P., & Naved, M. (2022, June). Using machine learning and data mining to evaluate modern financial management techniques. In *Proceedings of Second International Conference in Mechanical and Energy Technology: ICMET 2021, India* (pp. 249–257). Singapore: Springer Nature.
3. Ali, N. G., Abed, S. D., Shaban, F. A. J., Tongkachok, K., Ray, S., & Jaleel, R. A. (2021). Hybrid of K-means and partitioning around medoids for predicting COVID-19 cases: Iraq case study. *Periodicals of Engineering and Natural Sciences*, 9(4), 569–579.
4. Bangare, J. L., Kapila, D., Nehete, P. U., Malwade, S. S., Sankar, K., & Ray, S. (2022, February). Comparative study on various storage optimisation techniques in machine learning based cloud computing system. In *2022 2nd International Conference on Innovative Practices in Technology and Management (ICIPTM)* (Vol. 2, pp. 53–57). IEEE.
5. Batool, A., Ganguli, S., Almashaqbeh, H. A., Shafiq, M., Vallikannu, A. L., Sankaran, K. S., ... & Sammy, F. (2022). An IoT and machine learning-based model to monitor perishable food towards improving food safety and quality. *Journal of Food Quality*, 2022, 1–12.
6. Bhargava, A., Bhargava, D., Kumar, P. N., Sajja, G. S., & Ray, S. (2022). Industrial IoT and AI implementation in vehicular logistics and supply chain management for vehicle mediated transportation systems. *International Journal of System Assurance Engineering and Management*, 13(Suppl 1), 673–680.
7. Dutta, A., Voumik, L. C., Ramamoorthy, A., Ray, S., & Raihan, A. (2023). Predicting cryptocurrency fraud using ChaosNet: The Ethereum manifestation. *Journal of Risk and Financial Management*, 16(4), 216.
8. Elkady, G., & Samrat, R. (2021). An analysis of blockchain in supply chain management: System perspective in current and future research. *International Business Logistics*, 1(2), 1–12.
9. Emerging Strategy, 2025. DEI Spending in U.S. Higher Ed: A Carnegie Classification Analysis.
10. Gupta, S., Geetha, A., Sankaran, K. S., Zamani, A. S., Ritonga, M., Raj, R., ... & Mohammed, H. S. (2022). Machine learning-and feature selection-enabled framework for accurate crop yield prediction. *Journal of Food Quality*, 2022, 1–7.
11. Gupta, S., Geetha, A., Sankaran, K. S., Zamani, A. S., Ritonga, M., Raj, R., ... & Mohammed, H. S. (2022). Machine learning-and feature selection-enabled framework for accurate crop yield prediction. *Journal of Food Quality*, 2022, 1–7.
12. Inthavong, P., Rehman, K. U., Masood, K., Shaukat, Z., Hnydiuk-Stefan, A., & Ray, S. (2023). Impact of organizational learning on sustainable firm performance: Intervening effect of organizational networking and innovation. *Heliyon*, 9(5), e15163.
13. Kiziloglu, M., & Ray, S. (2021). Do we need a second engine for entrepreneurship? How well defined is intrapreneurship to handle challenges during COVID-19? In *SHS Web of Conferences* (Vol. 120, p. 02022). EDP Sciences.
14. Korchagina, E., Desfontaines, L., Ray, S., & Strekalova, N. (2021, October). Digitalization of transport communications as a tool for improving the quality of life. In *International Scientific Conference on Innovations in Digital Economy* (pp. 22–34). Cham: Springer International Publishing.
15. Kumar, A., Nayak, N. R., Ray, S., & Tamrakar, A. K. (2022). Blockchain-based cloud resource allocation mechanisms for privacy preservation. In *The Data-Driven Blockchain Ecosystem* (pp. 227–245). CRC Press.
16. Louisiana Illuminator, 2025. Louisiana colleges and universities spend minimally on DEI, new reports show.
17. Ma, W., Nasriddinov, F., Haseeb, M., Ray, S., Kamal, M., Khalid, N., & Ur Rehman, M. (2022). Revisiting the impact of energy consumption, foreign direct investment, and geopolitical risk on CO₂ emissions: Comparing developed and developing countries. *Frontiers in Environmental Science*, 16, 15.
18. Mehbodniya, A., Neware, R., Vyas, S., Kumar, M. R., Ngulube, P., & Ray, S. (2021). Blockchain and IPFS integrated framework in bilevel fog-cloud network for security and privacy of IoMT devices. *Computational and Mathematical Methods in Medicine*, 2021, 1–12.
19. Nikam, R. U., Lahoti, Y., & Ray, S. (2023). A study of need and challenges of human resource management in start-up companies. *Mathematical Statistician and Engineering Applications*, 72(1), 314–320.
20. Pallathadka, H., Leela, V. H., Patil, S., Rashmi, B. H., Jain, V., & Ray, S. (2022). Attrition in software companies: Reason and measures. *Materials Today: Proceedings*, 51, 528–531.
21. Park, J. Y., Perumal, S. V., Sanyal, S., Ah Nguyen, B., Ray, S., Krishnan, R., ... & Thangam, D. (2022).

- Sustainable marketing strategies as an essential tool of business. *American Journal of Economics and Sociology*, 81(2), 359–379.
22. Polcyn, J., Voumik, L. C., Ridwan, M., Ray, S., & Vovk, V. (2023). Evaluating the influences of health expenditure, energy consumption, and environmental pollution on life expectancy in Asia. *International Journal of Environmental Research and Public Health*, 20(5), 4000.
23. Priya, P. S., Malik, P., Mehbodniya, A., Chaudhary, V., Sharma, A., & Ray, S. (2022, February). The relationship between cloud computing and deep learning towards organizational commitment. In *2022 2nd International Conference on Innovative Practices in Technology and Management (ICIPTM)* (Vol. 2, pp. 21–26). IEEE.
24. Rajendran, R., Sharma, P., Saran, N. K., Ray, S., Alanya-Beltran, J., & Tongkachok, K. (2022, February). An exploratory analysis of machine learning adaptability in big data analytics environments: A data aggregation in the age of big data and the Internet of Things. In *2022 2nd International Conference on Innovative Practices in Technology and Management (ICIPTM)* (Vol. 2, pp. 32–36). IEEE.
25. Rakhra, M., Sanober, S., Quadri, N. N., Verma, N., Ray, S., & Asenso, E. (2022). Implementing machine learning for smart farming to forecast farmers' interest in hiring equipment. *Journal of Food Quality*, 2022, 1–9.
26. Ravi, S., Kulkarni, G. R., Ray, S., Ravisankar, M., Krishnan, V. G., & Chakravarthy, D. S. K. (2023). Analysis of user pairing non-orthogonal multiple access network using deep Q-network algorithm for defense applications. *The Journal of Defense Modeling and Simulation*, 20(3), 303–316.
27. Ray, S. (2021). How emotional marketing can help better understand the behavioral economic patterns of COVID-19 pandemic: Economic judgments and falsifications from India. *Вестник МИРБИС*, (2), 26–34.
28. Ray, S., & Leandre, D. Y. (2021). How entrepreneurial university model is changing the Indian COVID-19 fight? *Путеводитель предпринимателя*, 14(3), 153–162.
29. Sajja, G. S., Jha, S. S., Mhamdi, H., Naved, M., Ray, S., & Phasinam, K. (2021, September). An investigation on crop yield prediction using machine learning. In *2021 Third International Conference on Inventive Research in Computing Applications (ICIRCA)* (pp. 916–921). IEEE.
30. Samajpaty, S., & Ray, S. (2020). Innovation strategies in health economics: A force that makes blood move and game of gravity in it—futuristic economic plans. *Московский экономический журнал*, (9), 397–409.
31. Sharma, A., Kaur, S., Memon, N., Fathima, A. J., Ray, S., & Bhatt, M. W. (2021). Alzheimer's patients detection using support vector machine (SVM) with quantitative analysis. *Neuroscience Informatics*, 1(3), 100012.
32. Shukla, S. (2017). Innovation and economic growth: A case of India. *Humanities & Social Sciences Reviews*, 5(2), 64–70.
33. Soham, S., & Samrat, R. (2021). Poverty and financial dearth as etiopathogen of psychotic and neurotic diseases. *Заметки ученого*, (4-1), 568–578.
34. Thommandru, A., Espinoza-Maguiña, M., Ramirez-Asis, E., Ray, S., Naved, M., & Guzman-Avalos, M. (2023). Role of tourism and hospitality business in economic development. *Materials Today: Proceedings*, 80, 2901–2904.
35. Verma, K., Sundararajan, M., Mangal, A., Ray, S., & Kumar, A. (2022, April). The impact of COVID-19 to the trade in India using digital, IoT and AI techniques. In *2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)* (pp. 1–5). IEEE.
36. Wawale, S. G., Bisht, A., Vyas, S., Narawish, C., & Ray, S. (2022). An overview: Modeling and forecasting of time series data using different techniques in reference to human stress. *Neuroscience Informatics*, 2(3), 100052.
37. Yanbin, X., Jianhua, Z., Wang, X., Shabaz, M., Ahmad, M. W., & Ray, S. (2023). Research on optimization of crane fault predictive control system based on data mining. *Nonlinear Engineering*, 12(1), 20220202.