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Impact of Capital Expenditures on Academic Excellence and Institutional Growth in NIRF-Ranked Universities

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Abstract **- This investigation explores the influence of capital investments on library enhancements, faculty development, and sponsored projects at a top-ranked NIRF university. Despite varied expenditures, some universities exhibited unexpected performance outcomes. Strategies for improving performance are suggested, with an emphasis on the significance of research investment for enhancing overall rankings. The study highlights the impact of capital investments on academic excellence and institutional advancement, advocating for strategic resource allocation to ensure sustained growth and success. Data on annual capital expenditures for the library, seminar and workshop expenses, total faculty count, and sponsored project amounts from 2016 to 2019 were gathered from the NIRF website (https://www.nirfindia.org). The findings underscore the significant impact of capital investments on library enhancements, faculty development, and sponsored projects within a top-ranked university. These results highlight the importance of strategic resource allocation in fostering academic excellence and innovation. Moving forward, administrators should consider these insights when planning future investments to ensure continued growth and success.**
Keywords: **Capital Investments, Library Enhancements, Faculty Development, Sponsored Projects, Strategic Resource Allocation**

I. INTRODUCTION

Ranking systems help universities anticipate their position and work toward improving it (Alma, Coşkun, & Övendireli, 2016). Institutional ratings play a crucial role in gauging an institution's capabilities and intellectual prowess on both national and global scales. These assessments have become widespread, influencing the perception and competitiveness of universities and academic entities. Continuous evaluations contribute to identifying strengths and weaknesses, fostering a learning environment, and promoting national development.

The main challenge in examining the influence of capital investments on library advancements, faculty development, and sponsored systems in a top 20 NIRF-ranked university is determining the unproductive relationship between these investments and the advancements in these areas. While it is logical to assume that increased funding leads to better resources, faculty development, and research opportunities, isolating the specific impact of capital investments from the many other factors influencing university performance can be difficult. Additionally, defining and measuring the effectiveness of capital investments, especially in terms of tangible outcomes such as improved research output or faculty satisfaction, presents another challenge. Furthermore, variations in how universities allocate and use capital investments complicate the analysis, making it challenging to draw generalizable conclusions across different institutions.

The research gap identified in the article is the lack of comprehensive studies addressing the specific connection between capital investments and advancements in libraries, faculty development, and sponsored systems within the context of Indian higher education, particularly in NIRF-ranked universities. While existing literature examines the impact of capital investments on various aspects of university functioning, such as infrastructure development and research productivity, there is a dearth of research focusing on this relationship in the Indian context. Previous studies often emphasize Western educational systems, highlighting the need for research tailored to the Indian higher education landscape. Additionally, existing research may not sufficiently explore the unique dynamics and challenges faced by Indian universities, including regulatory hurdles, funding constraints, and regional disparities. Therefore, this study has the opportunity to fill this gap by providing empirical evidence and insights into how capital investments impact these specific areas within Indian higher education, thereby informing strategic decision-making among university administrators.

The research aims to understand how strategic resource allocation contributes to academic excellence and institutional advancement within the Indian higher education context. The motivation behind this study stems from recognizing the critical role that capital investments play in shaping various aspects of university functioning, including infrastructure development, faculty support, and research capacity. By examining the specific impact of capital investments on libraries, faculty development, and sponsored systems, the study aims to provide insights that can inform evidence-based decision-making among university administrators and policymakers. Additionally, with the increasing emphasis on rankings and performance criteria in the higher education sector, there is a need to better understand the factors driving institutional success within frameworks like NIRF. By exploring the relationship between capital investments and NIRF rankings, the study

seeks to identify strategies for enhancing university performance and competitiveness in national and global arenas. Ultimately, the goal is to contribute to the literature on higher education management and policy by providing empirical evidence and practical recommendations for optimizing resource allocation and promoting academic excellence.

II. NATIONAL INSTITUTIONAL RANKING FRAMEWORK (NIRF)

The National Institutional Ranking Framework (NIRF) was launched on September 29, 2015, and established by the Ministry of Education (formerly MHRD), with the official release of India Rankings on April 4, 2016. NIRF is a comprehensive tool for assessing and ranking educational institutions, shaping the landscape of higher education in India.

A. Key Parameters of NIRF Ranking

NIRF ranks higher education institutions based on five key parameters:

1. Teaching, Learning & Resources (T.L.R.) - assessing core activities within these institutions.
2. Research and Professional Practice (R.P.) - linking high-quality teaching to scholarly pursuits.
3. Graduation Outcome (G.O.) - evaluating the effectiveness of learning and teaching.
4. Outreach and Inclusivity (O.I.) - focusing on the representation of women and emphasizing outreach and inclusivity.
5. Peer Perception (P.P.) - highlighting an institution's reputation and underscoring its significance.

III. OBJECTIVES OF THE STUDY

1. To identify the top 20 universities and their NIRF rankings.
2. To examine the correlation between university ranks in NIRF and factors such as library expenditure, research student count, faculty numbers, and sponsored projects.
3. To compare library expenditure, number of research students, faculty numbers, sponsored projects, and associated funding agencies among the top 20 universities in the NIRF rankings.
4. To determine the geographical distribution of NIRF-ranked universities and their types.
5. To examine the importance of libraries and library professionals in influencing the ranking process.

IV. BACKGROUND AND LITERATURE REVIEW

This study investigates how international university rankings shape and influence university performance, with a focus on leading global ranking systems and their indicators related to input, production, and outcomes. It also highlights a predominance of exploitation indicators, indicating a bias toward evaluating outcomes rather than processes. This imbalance has important implications for management, potentially affecting strategic decisions and resource allocation within institutions. Addressing this disparity is essential for creating a more balanced and equitable method of assessing university performance on a global scale (Peris-Ortiz *et al.,* 2023).

Additionally, the study analyzed the Annual Rate of Growth (A.R.G.) of publications, which has demonstrated a steady increase, leading to a substantial accumulation of total publications. It examined the growth trends from 2015 to 2020. However, it also revealed that the majority of published articles were not freely accessible to users and were instead available for purchase (Ghani *et al.,* 2022).

This study explored the impact of open access (O.A.) on Indian students, revealing a concerning trend. It found that many students were unfamiliar with O.A. journals and deterred by high publication fees. However, there was optimism for future O.A. publishing if cost barriers were removed. Motivational factors for O.A. publishing included research grants, impact, and citations. Despite challenges, young researchers showed a positive attitude toward O.A. journals (Ishfaq *et al.,* 2022).

This study explored the relationship between library budgets and university rankings, revealing a strong correlation. Institutions allocating more funds to libraries tended to achieve higher national rankings. The study also highlighted spending disparities among different types of Indian higher education institutions, with universities allocating significantly more per user compared to colleges. Overall, the findings confirmed that higher library expenditure correlated with better national ranking scores (Vinit *et al.,* 2021).

This study examines five years of India Rankings data (2016-2020) to evaluate its effect on key performance indicators of higher education institutions (HEIs) related to research and professional practices. The analysis reveals a notable increase in the number of publications, citations, and highly cited publications among eligible institutions, reflecting their proactive efforts to boost research output. Although top-ranked institutions have experienced a slight decline in these metrics, there has been a noticeable rise among other institutions, indicating a broader enhancement in research activity. Furthermore, the trend shows increased research engagement, with fewer institutions having no publications. Overall, the findings suggest that India Rankings have effectively motivated institutions to amplify their research efforts, leading to improved research output across the country (Nassa *et al.,* 2021).

This study investigates the top 100 universities using data visualization to examine the relationship between rankings and various parameters. It reveals consistent scores in Teaching and Learning Resources (T.L.R.) across these institutions. However, scores in Research and Professional Practice (R.P.) vary extensively, significantly impacting overall rankings and showing a strong positive correlation

(R^2 = 0.746) with total scores. R.P also exhibits a strong correlation with Peer Perception (P.P.). Additionally, the study finds that the top 10 universities have an average annual library expenditure of ₹9.45 crore, with a positive correlation between library spending and R.P. The analysis also indicates that enhanced research productivity is associated with improved publication quality, as reflected in citation counts (Kumar *et al.,* 2020).

This study evaluates the Research and Professional Practices element of NIRF rankings by analyzing the research output of scientists from five Central Universities in India over the past three years. It finds that relying solely on international databases such as Web of Science and SCOPUS may not fully capture an institute's research performance, as these databases generally cover sciences and applied sciences, often overlooking social sciences, arts, and humanities. The study also notes that international collaboration is limited among the institutions examined, and research output generally appears in journals with moderate impact factors. Unexpectedly, despite having lower citation rates, Jawaharlal Nehru University (J.N.U.) continues to hold a top position in the NIRF rankings, suggesting that citations may not be the predominant factor in these rankings. The study underscores the need for robust institutional structures to improve research quality and highlights that certain universities, particularly those focused on sciences and applied sciences, exhibit notable research output (Mukherjee, 2019).

The study reveals that the parameters used by NIRF to evaluate Indian institutions are closely aligned with those of leading global university ranking agencies. Scholarly output, a critical parameter, plays a significant role in both NIRF and global rankings. Indian universities demonstrate high research productivity and consistently achieve top positions in the NIRF rankings, with many also performing well in global rankings. Notably, South Indian universities excel in NIRF assessments, emphasizing a strong correlation between scholarly productivity and institutional ranking. Additionally, the study finds that the factors impacting NIRF rankings are consistent with those in global ranking systems such as the Times Higher Education World University Rankings and QS World University Rankings (Mathew & Cherukodan, 2018).

This paper offers a comprehensive overview of university ranking systems, identifying 24 systems and evaluating 13 of them. Notably, six focus solely on research performance. It reveals that 76% of rankings are based on research indicators, while only 24% consider academic or teaching quality. Seven systems include reputation surveys and faculty/alumni awards in their criteria. Rankings heavily influence academic choices, with research performance carrying the most weight. However, there is a lack of universally accepted indicators for assessing academic quality across these systems. Overall, the paper provides valuable insights into the dominance of research measures and the need for standardized indicators in ranking academia (Vernon *et al.,* 2018).

The proposed two-stage hybrid deep learning-based collaborative filtering method explores user interests, facilitates communication between items and users, and offers personalized recommendations. A multilayer neural network is employed to handle nonlinearities in user-item interactions. Experimental results demonstrate that HBSADE outperforms existing methodologies across Amazon-b and Book-Crossing datasets. Furthermore, research trends within thirteen central universities established in 2009 were investigated. The study revealed a consistent increase in publications over nine years, with a focus on science, engineering, and social sciences. Collaboration in research extended beyond Indian institutes to foreign countries, highlighting the global reach of research collaborations (Vijayakumar *et al.,* 2018).

This study assesses the websites of 9 out of 11 Iconic Public Libraries in India using various metrics such as webpage count, domain authority, and link analysis. The National Library of India emerges as the top performer across multiple categories, including Page Authority and Total Linking Root Domains. It achieves an overall Web Impact Factor of 92.90, leading in both SWIF and EWIF. The Nehru Memorial Museum and Library secures the second position with significant SWIF and IWIF scores among the selected libraries (Verma & Brahma, 2017).

This paper analyses three major international university rankings, comparing their methodologies, criteria, and impact on stakeholders. It highlights a focus on research over teaching and learning environments. Rankings like QS and THE offer insights for universities to improve practices and enhance their positions globally. While they consider diverse indicators, they are heavily influenced by global surveys of faculty opinions on research strengths. Understanding these rankings' methodologies is vital for universities to stay competitive and enhance their practices (Pavel, 2015).

The study examined the landscape of higher education, influential research, and university rankings in India. Findings revealed India's 9th position for notable documents across all subject categories, with the United States leading at 1st and China at 2nd. The study pinpointed three key factors shaping high-impact research: individual contributions, university characteristics, and country-specific dynamics (Reddy, 2015).

This paper reviews global rankings, explores factors hindering India's visibility, and assesses government initiatives for world-class universities. It highlights challenges such as unrealistic objectives and insufficient planning. Bridging the gap between India's academic system and envisioned universities requires significant resources and a revaluation of strategies (Yeravdekar & Tiwari, 2014).

This study investigates linking patterns and evaluates the impact factor and content richness of national library websites across several countries. Results show that libraries in America, Australia, and Britain have higher visibility and

more extensive content compared to those in India, Namibia, and South Africa. A survey reveals that out of 163 countries with national libraries, 106 have active websites. Additionally, the Web Impact Factor of selected public library websites indicates that those from the USA, Australia, and Britain offer richer content and greater prominence compared to those from India, Namibia, and South Africa (Walia & Gupta, 2012).

University rankings have emerged as a widely recognized metric globally, significantly influencing institutional reputation. This study represents the first comprehensive examination of rankings from a global standpoint, providing valuable insights into the ranking phenomenon. It is contended that rankings establish a societal benchmark against which all institutions are judged (Hazelkorn, 2011).

V. METHODOLOGY

Web content analysis is the application of traditional content analysis techniques to the web (Herring, 2009). The data for this study were collected through web content analysis. The majority of the data were obtained from the official websites of NIRF, and the study is limited to university-wise rankings from NIRF. For this study, the top 20 universities were selected from the NIRF ranking list, which includes the top 100 universities in the university category. Data regarding annual capital expenditure on libraries, seminar and workshop expenses, total faculty count, and sponsored project amounts for the years 2016-2019 were gathered from the NIRF website (https://www.nirfindia.org). It should be noted that for all results presented here, the source of publications (2017-2020) is based on documents from conference proceedings, book chapters, and journals covered by Scopus. Subsequently, the extracted data were transferred to MS Excel for additional analysis.

VI. SCOPE AND LIMITATION

The study focuses on the top 20 universities within the NIRF system for the year 2021. The analysis specifically centers on annual capital expenditure on libraries, total faculty numbers, faculty quality, and sponsored project scores from 2017 to 2020.

VII. DATA ANALYSIS AND DISCUSSION

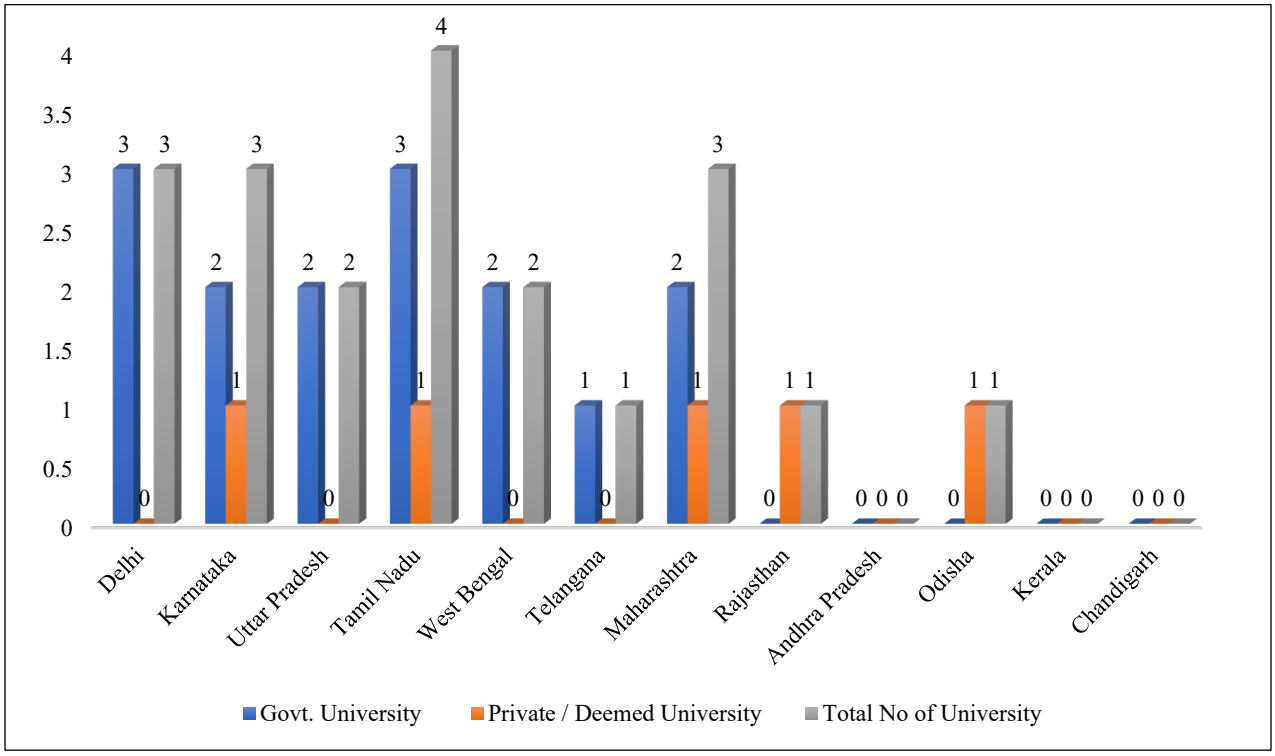

Fig. 1 State-wise categorizations of the top 20 universities participating in NIRF 2021

Observing Figure 1, it is evident that in 2021, among the top 20 universities, three are situated in the capital city of Delhi, all of which are government-funded. Furthermore, four universities from the state of Tamil Nadu secured positions in the top 20 rankings, three of which are government public universities and one is privately funded. In the same year, two government-funded universities in Uttar Pradesh also secured places in the top 20 rankings. Additionally, two universities from West Bengal secured spots in the top 50 universities in 2021, both of which are state government universities. Moreover, three universities from Karnataka, comprising two government-funded public universities and one privately funded university, are included in the top 20 rankings. Among the top 20 universities, 15 are government-run, while the remaining five are managed by private institutions in 2021.

TABLE I PERFORMANCE OF ANNUAL CAPITAL EXPENDITURE ON THE LIBRARY FOR THREE FINANCIAL YEARS

Top 20 Universities Under the University Category in NIRF 2021	Rank in NIRF	Annual Capital Expenditure on Library		
		Financial Years		
		2019-2020	2018-2019	2017-2018
Indian Institute of Science, Bengaluru (IISc-B)	1	154075611	153536378	178199675
Jawaharlal Nehru University, New Delhi (JNU)	2	6144391	35362309	6636803
Banaras Hindu University, Varanasi (BHU)	3	19257144	21474467	22128333
Calcutta University, Kolkata (CU)	4	142673911	141581070	112055474
Amrita Vishwa Vidyapeetham, Coimbatore (AVV)	5	183022216	182916282	85795418
Jamia Millia Islamia, New Delhi (JMI)	6	18369000	23928000	19802000
Manipal Academy of Higher Education, Manipal (MAHE)	7	211719933	162102473	145211241
Jadavpur University, Kolkata (JU)	8	74339184	118097388	105465843
University of Hyderabad, Hyderabad (UH)	9	47977003	47284077	41774834
Aligarh Muslim University, Aligarh (AMU)	10	48119763	47750661	48010373
Savitribai Phule Pune University, Pune (SPPU)	11	58720513	58574176	21718434
University of Delhi, Delhi (UD)	12	25655409	43520167	39997879
Vellore Institute of Technology, Vellore (VIT)	13	24321245	62060729	66419678
Bharathiar University, Coimbatore (BU)	14	3038872	1026806	12709000
Institute of Chemical Technology, Mumbai (ICT-M)	15	63791840	65469379	40065477
Anna University, Chennai (AU)	16	35241177	42372105	35501506
Birla Institute of Technology & Science, Pilani (BITS-P)	17	117032780	97142809	57315892
Homi Bhabha National Institute, Mumbai (HBNI)	18	351291193	448850431	440741112
University of Mysore (UM)	19	10667668	32271107	16383475
Siksha `O` Anusandhan, Bhubaneswar (SOA)	20	89001610	93053835	80887619

According to Table I, it is notable that among the top 20 universities, only one institution, Homi Bhabha National Institute, Mumbai (HBNI), consistently recorded the highest annual capital expenditure on its library and achieved strong performance over three consecutive financial years (2017-18, 2018-19, and 2019-20) but secured a relatively lower rank (18th) in IR 2021. Conversely, Manipal Academy of Higher Education, Manipal (MAHE), achieved the second-highest annual capital expenditure on its library in the financial year 2019-20 and attained an impressive rank (7^{th}) in IR 2021. However, the majority of universities performed sub optimally in terms of annual capital expenditure on their libraries, with only two or three exceptions.

The significant impact of capital investments on library enhancements emphasizes the importance of strategic resource allocation in fostering academic excellence and innovation. This highlights the need for universities to proactively enhance their annual capital expenditure on libraries within their budgets. Decisions regarding annual capital expenditure play a pivotal role in developing library resources, subsequently elevating the university's standards and rankings. This investment is crucial for research scholars, enabling them to utilize enriched library resources and contributing to the overall enhancement of the university's ranking.

Based on Table II, it is apparent that among the top 20 universities, only one institution, IISc, Bengaluru, has consistently maintained the highest total number of sponsored projects over three consecutive financial years (2017-18, 2018-19, and 2019-20), securing 1st rank in each of these years. Conversely, HBNI, Mumbai, recorded the second-highest total number of sponsored projects in two consecutive financial years (2018-19 and 2019-20) but obtained a lower rank (18^{th}) in the same years. Meanwhile, CU, Kolkata, achieved the third-highest total number of sponsored projects in two financial years (2018-19 and 2019-20) and the second-highest in the 2017-2018 financial year, ultimately securing an impressive 4th rank in IR 2021.

However, regarding the total number of sponsored projects, the performances of several universities, including SOA, Bhubaneswar, and AMU, Aligarh, were suboptimal, with only two or three exceptions. This underscores the necessity for universities to proactively undertake initiatives to enhance the total number of sponsored projects, fostering a conducive environment for research and innovation. Some universities should take more initiative to enhance their sponsored projects and funding agencies to promote academic excellence and standards in the global scenario.

TABLE II PERFORMANCE OF THE TOTAL NUMBER OF SPONSORED PROJECTS AND FUNDING AGENCIES FOR THE TOP 20 UNIVERSITIES OVER THREE FINANCIAL YEARS

Top 20 Universities in NIRF 2021	Total No of Sponsored Projects			Total no. of Funding Agencies		
	2019-2020	2018-2019	2017-2018	2019-2020	2018-2019	2017-2018
IISc, Bengaluru	1236	1001	1692	153	237	109
JNU, New Delhi	307	337	282	26	37	35
BHU, Varanasi	377	373	380	32	53	61
CU, Kolkata	683	676	602	76	69	67
AVV, Coimbatore	174	144	138	82	64	71
JMI, New Delhi	199	121	76	45	30	19
MAHE, Manipal	407	423	324	149	124	146
JU, Kolkata	262	318	197	46	62	55
HU, Hyderabad	319	370	360	43	54	58
AMU, Aligarh	81	88	90	43	82	31
SPPU, Pune	150	101	92	17	21	44
DU, Delhi	341	339	276	46	57	33
VIT, Vellore	105	171	146	19	34	23
BU, Coimbatore	153	48	48	34	29	24
ICT, Mumbai	170	200	153	100	90	89
AU, Chennai	91	108	153	39	45	44
BITS, Pilani	323	269	197	92	71	39
HBNI, Mumbai	943	929	556	186	169	123
MU, Mysore	110	83	84	15	7	15
SOA, Bhubaneswar	67	79	60	29	32	24

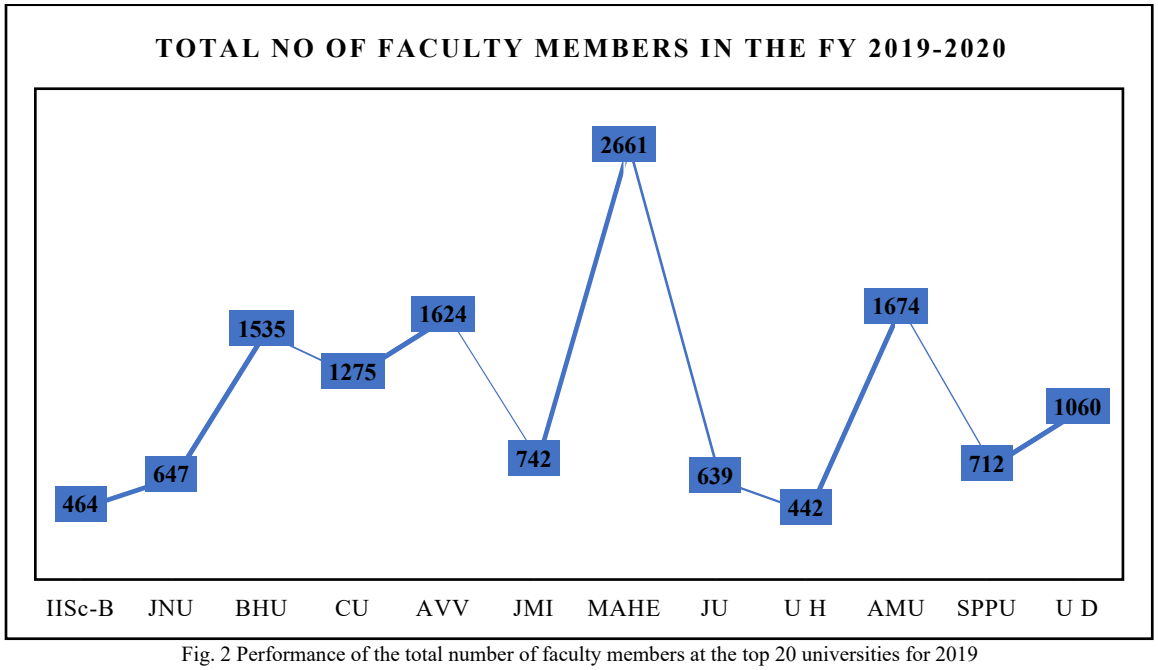

Fig. 2 Performance of the total number of faculty members at the top 20 universities for 2019

Based on Figure 2, it is clear that among the top 20 universities, Manipal Academy of Higher Education was the only institution to record the highest total number of faculty members in the financial year 2019-20. However, it secured a rank of 7th in the Institutional Ranking (IR) 2021. Conversely, Vellore Institute of Technology had the second-highest total number of faculty members in the financial year 2019-20 and achieved an impressive rank of 13th in IR 2021.

It is important to note that research conducted by universities, facilitated by their faculty from both the public and private sectors, plays a crucial role in elevating standards. This research often receives sponsorship from the government, contributing to numerous innovations. Such government-sponsored funding not only enhances global standards but also leads to the generation of patents. Additionally, this funding aids in the completion of projects, contributing to the development of infrastructure in universities over the three financial years.

Based on Table III, it is evident that among the top 20 universities, JNU, New Delhi, has the highest total number of Ph.D. students pursuing full-time (FT) studies, while DU, Delhi, ranks second in the financial year 2019-20, securing ranks of 2nd and 12th in IR 2021, respectively. Conversely, VIT, Vellore, recorded the highest total number of Ph.D. students pursuing part-time (PT) studies, with CU, Kolkata, ranking second in the financial year 2019-20, achieving ranks of 13th and 4th in IR 2021. Additionally, BHU, Varanasi, attained the highest total number of Ph.D. students awarded in full-time (FT) mode for three consecutive financial years but secured the 3rd rank in IR 2021. However, regarding the total number of Ph.D. students, the performances of many universities were suboptimal, with only two or three exceptions. This underscores the necessity for universities to proactively undertake initiatives to enhance the total number of Ph.D. students, as this contributes to quality research and elevates the standard of academic performance. These initiatives enhance the overall quality of learning among scholars, ultimately impacting the university's ability to effectively participate in the global research landscape.

TABLE III PERFORMANCE OF THE TOTAL NUMBER OF PH.D. STUDENTS PURSUING AND AWARDED BY THE TOP 20 UNIVERSITIES.

Top 20 Universities in NIRF 2021	Rank in NIRF	PhD (Pursuing) Students		Ph.D. Awarded Students					
		Financial Year		Financial Years					
		2019-2020		2019-2020		2018-2019		2017-2018	
		FT	PT	FT	PT	FT	PT	FT	PT
IISc, Bengaluru	1	2619	135	336	20	402	23	351	17
JNU, New Delhi	2	4251	0	476	0	805	0	622	0
BHU, Varanasi	3	3302	179	953	23	807	235	809	221
CU, Kolkata	4	2588	1192	611	489	323	276	529	234
AVV, Coimbatore	5	562	651	63	30	130	19	76	20
JMI, New Delhi	6	1483	0	345	0	360	0	309	0
MAHE, Manipal	7	1035	51	124	44	237	0	227	0
JU, Kolkata	8	2814	0	338	0	366	0	397	0
HU, Hyderabad	9	1758	15	264	0	210	4	229	0
AMU, Aligarh	10	3634	250	384	21	363	15	312	10
SPPU, Pune	11	1875	0	494	0	264	0	278	0
DU, Delhi	12	3700	0	539	0	592	0	607	0
VIT, Vellore	13	1589	1375	135	63	166	130	136	51
BU, Coimbatore	14	524	219	127	27	116	146	101	30
ICT, Mumbai	15	511	106	140	5	135	7	137	3
AU, Chennai	16	936	792	82	100	108	71	117	106
BITS, Pilani	17	954	283	9	20	76	77	105	8
HBNI, Mumbai	18	1992	0	295	0	275	0	269	0
MU, Mysore	19	1146	0	461	0	384	0	501	0
SOA, Bhubaneswar	20	826	179	89	8	79	9	82	8

Table IV illustrates the Scopus publications of individual universities compared to their total publications. VIT, Vellore, stands out with the highest number of Scopus publications (9,619), followed closely by IISc-Bangalore with 9,386. Other institutions, such as DU, Delhi; HBNI, Mumbai; MAHE, Manipal; ICT, Mumbai; JU, Kolkata; AU, Chennai; and BHU, Varanasi, also excel in Scopus publications among the twenty universities analyzed. However, BITS, Pilani; BU, Coimbatore; AVV, Coimbatore; HU, Hyderabad; SOA, Bhubaneswar; and MU, Mysore, have total publications lower than the average of their Scopus publications, indicating a need for proactive initiatives to increase the overall number of Scopus publications. This fosters an environment conducive to research and innovation, contributing to quality publications and elevating academic performance standards. Such initiatives improve the learning experience for scholars and enhance the university's ability to participate effectively in global research. Prioritizing

quality publications also aids in developing library resources, ultimately boosting the university's standards and rankings. Access to enriched library resources is crucial for research scholars, facilitating their academic pursuits and contributing to the university's overall advancement.

TABLE IV SCOPUS PUBLICATIONS OF THE TOP TWENTY NIRF-RANKED UNIVERSITIES OVER THREE FINANCIAL YEARS.

Top 20 Universities in NIRF	Scopus Publication				Rank
	2020	2019	2018	Total	
VIT, Vellore	3209	3208	3202	9619	1st
IISc, Bengaluru	3080	3081	3225	9386	2nd
DU, Delhi	2574	2386	2338	7298	3rd
HBNI, Mumbai	2450	2385	2118	6953	4th
MAHE, Manipal	2351	2154	1899	6404	5th
ICT, Mumbai	2195	2082	1986	6263	6th
JU, Kolkata	1934	1902	1992	5828	7th
AU, Chennai	1974	2023	1759	5756	8th
BHU, Varanasi	1788	1603	1550	4941	9th
AMU, Aligarh	1614	1573	1385	4572	10th
JNU, New Delhi	1278	1251	1199	3728	11th
CU, Kolkata	1344	1189	1194	3727	12th
JMI, New Delhi	1384	1215	1002	3601	13th
SPPU, Pune	1062	1046	1007	3115	14th
BITS, Pilani	1035	1012	989	3036	15th
BU, Coimbatore	1098	981	950	3029	16th
AVV, Coimbatore	1010	946	932	2888	17th
SOA, Bhubaneswar	981	985	856	2822	18th
HU, Hyderabad	947	961	910	2818	19th
MU, Mysore	827	962	975	2764	20th

VIII. MAJOR FINDINGS OF THE STUDY

This study shows that, among the top 20 universities, only IISc, Bengaluru, consistently excelled across these factors. Despite substantial library expenditure, HBNI, Mumbai, obtained a lower rank. The study underscores that quality publications positively impact rankings, highlighting the significance of research investment for overall university ranking enhancement. Furthermore, it found that the parameters set for assessing Indian institutions under NIRF align with those of other world university-ranking agencies. Universities scoring high for research productivity under NIRF also feature prominently in global rankings. Notably, universities from South India excelled in NIRF, indicating a close relationship between scholarly productivity and institutional ranking. Some important findings are discussed below:

1. Among the top 20 universities, three are situated in the capital city of Delhi, all of which are government-funded.
2. Homi Bhabha National Institute, Mumbai (HBNI), consistently recorded the highest annual capital expenditure on the library and achieved consistent performance over three consecutive financial years (2017-18, 2018-19, and 2019-20) but secured a relatively lower rank (18th) in IR 2021.
3. IISc, Bengaluru, has consistently maintained the highest total number of sponsored projects over three consecutive financial years (2017-18, 2018-19, and 2019-20), securing the 1st rank in each of these years. However, concerning the total number of sponsored projects, the performances of several universities, including SOA, Bhubaneswar, and AMU, Aligarh, were suboptimal, with only two or three exceptions.
4. Manipal Academy of Higher Education was the only institution to record the highest total number of faculty members in the financial year 2019-20. However, it secured a rank of 7th in Institutional Ranking (IR) 2021.
5. JNU, New Delhi, has the highest total number of Ph.D. students pursuing full-time (FT) mode, while DU, Delhi, ranks second in the financial year 2019-20, securing ranks of 2nd and 12th in IR 2021, respectively.
6. VIT, Vellore, stands out with the highest number of Scopus publications (9,619), followed closely by IISc-Bangalore with 9,386. Other institutions, such as DU, Delhi; HBNI, Mumbai; MAHE, Manipal; ICT, Mumbai; JU, Kolkata; AU, Chennai; and BHU, Varanasi, also

excel in Scopus publications among the twenty universities analyzed.

IX. ROLE OF THE LIBRARY IN INFLUENCING THE RANKING PROCESS

The correlation between scholarly output and institutional ranking holds significant implications for the field of library and information science. While libraries traditionally support scholars in accessing information, they now play a more direct role in influencing scholarly output through various programs and initiatives. These include selecting and acquiring databases from reputable publishers and highly researched resources, participating in consortia to expand resources, offering document delivery services, and organizing author workshops in collaboration with publishers and experts in the field.

Nowadays, libraries offer training in academic writing, reference formatting, and research tools. They help scholars understand institutional ranking processes and introduce them to online resources such as Scopus, Web of Science, Google Scholar, and Google Books. Additionally, libraries guide scholars on metrics like the h-index and citation patterns, as well as tools for plagiarism detection and strategies for avoiding plagiarism.

By participating in these initiatives, libraries not only boost scholarly productivity but also play a crucial role in their institutions' success in both national and global rankings. Through targeted programs and strategic collaborations, libraries enhance their institutions' research capabilities and visibility, thereby strengthening their position in the academic community.

X. CONCLUSION

Investing in libraries has a profound impact on university rankings, pressing the necessity for universities to increase their periodic budgets for library resources. The volume and quality of academic publications are crucial factors in enhancing a university's ranking, emphasizing the need to prioritize high-quality research activities. Libraries' operational expenditures on forums, conferences, and workshops facilitate knowledge exchange at both national and international levels. By adopting international norms, Indian universities can improve their rankings and benefit researchers. Both Central and State governments in India should consistently advocate for and implement the ranking process to emphasize the significance of educational institution rankings. Active participation from all educational institutions is essential for effectively showcasing their activities and expertise to the global community. Recommendations for improvement include aligning performance criteria with those established by bodies like the National Institutional Ranking Framework (NIRF). Emphasizing assessments and rankings from organizations such as NAAC, NBA, and NIRF can significantly boost opportunities for higher education and employment for graduates. As global competition and quality standards evolve, university rankings will continue to be a dynamic process. National ranking systems, like NIRF, are increasingly adopting global ranking criteria, including the number of scholarly papers and citations. Libraries, by supporting research and scholarly productivity, play a pivotal role in improving their institutions' standings in both national and global rankings through targeted programs and initiatives. In conclusion, our investigation highlights the significant impact of capital investments on library enhancements, faculty development, and sponsored projects within a top-ranked university. These findings underscore the importance of strategic resource allocation in fostering academic excellence and innovation. Moving forward, administrators should consider these insights when planning future investments to ensure continued growth and success.

XI. SUGGESTIONS FOR FUTURE RESEARCHERS

Future practitioners and researchers examining the impact of capital investments in top NIRF-ranked universities could focus on the following:

1. Comparative analyses across universities to identify best practices.
2. Qualitative insights to understand implementation challenges.
3. Case studies of successful interventions for practical lessons.
4. Developing impact assessment frameworks to measure outcomes.
5. Policy analysis to identify barriers and suggest reforms.
6. Cross-sector collaboration to maximize resource utilization and outcomes.

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