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Funding Agencies in Electric Vehicle Research on India and Global: A Scientometric Study

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ABSTRACT

This study examines the shifting landscape of scholarly output between India and the global research community from 2021 to 2025 research in Funding Agencies on Electrical Vehicles Research in India and Global. By analyzing publication volume, citation counts, and H-index metrics, we evaluate the comparative growth trajectories and scholarly impact of these two cohorts. The global Electric Vehicle (EV) research landscape is characterized by significant intellectual steering from China, the USA, and India, which collectively produce nearly half of the world's scientific discourse. This study analyzes a dataset of globally 81,256 publications, revealing that India contribution accounting for 10.3% of total output (8,375 papers) and out of 2,902 (34.65%) paper with 41,075 (75.91%) Citations funded through published. Even though more studies came out in 2024 and 2025 than ever before, many haven't been cited much just yet. Because newer papers take time to gain attention, their influence isn't fully visible at present. Unfunded work still forms a strong foundation for discovery, although grants tend to back efforts that last longer in scholarly view. Money flows mostly through one main channel - the Department of Science and Technology - though smaller groups and places like MAHE also play key roles. Support from DST often links to better staying power in how often findings are referenced later on. Most results show up in broad scientific journals or focused engineering publications. Titles such as the Journal of Energy Storage and Sustainability see above-average citations per article. That pattern hints at smarter returns when funding guides the direction. Over time, India's research scene has grown deeper roots. Now it stands ready to shape worldwide shifts in energy and ecological matters.

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KEYWORDS: Electrical Vehicles, Electrical Bike, Electrical Car, Funded, Funding Agencies, Scientometric, Web of Science, (WoS), H-Index, Citation, Country, India, Global.

1. INTRODUCTION

Researching funding agencies helps to match our project goals with their specific priorities, budget limits, and past success patterns. Knowing what a sponsor wants allows you to craft stronger proposals, save time, and secure the financial support needed for equipment, staff, and successful scientific innovation. Scientometrics looks at how science and technology grow and change, but it does it by crunching numbers. Peeling back layers, you start seeing numbers underneath studies - counting articles, following where ideas get referenced, noticing who tackles which topics, and from which corners of the globe. Almost mirrors bibliometrics, yet this field sharpens its lens: focused on output volume in academia, then tracing how discoveries move - not just between disciplines.

This field actually matters a lot to researchers, universities, and anyone making decisions about science funding. Here's why:

- It shows the impact. Universities and funding bodies rely on Scientometric stats like the h-index or Impact Factor to see how much influence a scientist or journal really has.
- It helps spot new trends. By pouring over publication numbers, you can see what topics are heating up and which ones are cooling off.
- Numbers guide choices on funding. When leaders see clear data, they shift resources to studies that deliver real results.
- Out there, connections start to show. Through Scientometrics, patterns emerge - researchers linking arms beyond borders, working together on worldwide challenges, piece by piece shaping how knowledge team's form.

Some Electric vehicles move without burning fuel, powered by electric motors that take energy from charged batteries. These machines come in different kinds, though most common are ones relying solely on battery power, plugged in to refill after use (Mathuria, et al., 2023).

Fig 1: Electric Vehicle Funding Agency Sructure

The Importance of EVs: Switching to electric vehicles is a big step toward a more sustainable future. Here's why it matters. Cities breathe easier when vehicles stop spitting fumes into the air. Tailpipe pollution vanishes with electric cars. Cleaner grids boost their benefit even further. Less smog shows up where people live. Power made from renewable sources lifts the advantage higher. Exhaust pipes fall silent, making room for quieter streets. Each charge replaces a tank of dirty fuel. Progress creeps in as energy systems shift. The sky reacts slowly but surely (Alanazi, 2023). Energy Efficiency: Electric motors are much more efficient than traditional engines-often more than three times as efficient as gasoline engines (Alanazi, 2023). Economic Security: Using more EVs means we depend less

on unpredictable oil markets, and over time, drivers spend less on fuel and maintenance (Holland, Mansur, Muller, & Yates, 2016).

Funding bodies sit at the heart of science worldwide, quietly shaping were exploration heads next. Not just handing out money, these groups set the course - spotting what matters most before others do. When issues like disease outbreaks or clean energy rise, their choices shift attention fast. Because every proposal gets picked apart by experts, weak ideas rarely slip through. Strength in design becomes the real gatekeeper here. What sticks is tested thinking, not flashy promises. Progress moves forward because scrutiny comes first. Decisions made behind closed doors ripple outward, unseen but steady. Trust builds slowly when only solid work wins space. Funding groups help turn big ideas into real-world uses. Because of them, curiosity-driven science gets a chance - even when profits aren't obvious right away. Think about discoveries like the web or reading DNA - those started without clear purpose, yet changed everything.

2. METHODOLOGY

This work uses numbers to map out EV research worldwide, along with India's role in it. Data gathering comes first, followed by cleaning up what's collected. Then comes the stage where patterns start showing through careful examination.

One way to start - data came mainly from the Web of Science Core Collection, known for covering many fields through citations. Instead of casting a vague net, the process used a tailored query built with Boolean logic and symbol shortcuts, aiming at precision. This method pulled in focused results without drifting beyond set boundaries:

- Global Search String: (TS=electr* vehic* OR electr* Car OR electr* Bike)
- India-Specific Search String: (TS=electr* vehic* OR electr* Car OR electr* Bike) AND CU=India

Refinement Parameters:

- ✓ Indices: SCI-EXPANDED, SSCI, A&HCI, and ESCI.
- ✓ Time Span: 2021 to 2025 (inclusive).

Data Sampling and Volume: The search strategy resulted in a robust dataset representing five years of scholarly output. The initial retrieval yielded:

- Global Records: 81,256 publications and Citation Impact: 10,71,089
- India Records: 8,375 publications and Citation Impact: 95,185.

Data Processing and Toolsets: The methodology follows a standardized workflow for bibliometric mapping:

- Export and Cleaning: The metadata, including authors, affiliations, keywords, and citation counts, were downloaded in Plain Text and Tab-delimited formats.
- Organization: Preliminary data cleaning and organization were conducted using Microsoft Excel to remove duplicates and categorize sub-niches (Cars vs. Bikes).
- Bibliometric Analysis: The curated data was imported into *HistCite*, a specialized software application used to generate chronological *historiography*. This tool was utilized to calculate.

From 2021 to 2025, tracking how fast electric vehicle studies expanded in India compared to worldwide patterns became a central piece of the review. Instead of working alone, many local scientists joined forces with peers abroad - those links were carefully traced. Key publications that shaped thinking during these years stood out through repeated citation across journals.

3. OBJECTIVES OF THE STUDY

1. To analysed country-wise distribution of research publications globally contributors in the field EV.
2. To conduct a comparative analysis of the year-wise publication trends between India and world.
3. To categorize and compare the year wise funded and un-funded publications in India.
4. To identify and rank the top ten journals publish the highest funded research papers.
5. To identify the top ten funding agencies contributing to research development on publication output.

4. RESULTS AND DISCUSSION

4.1 Country wise Publication filed of Electrical Vehicles

The global transition toward sustainable transportation has catalysed a surge in scholarly literature focusing on Electric Vehicles (EVs). This analysis examines the geographical distribution of research productivity over a five-year period from 2021 to 2025. During this timeframe, EV research was distributed across 171 countries, reflecting a diverse international interest in decarbonizing the transport sector.The research landscape is characterized by significant contributions from a few dominant nations. As shown in the table below, the top twenty countries account for the majority of the global output.

Table-1: Top 20 Country wise publication field of Electrical Vehicles

Countries	Papers	Percentage
China	21540	26.51
USA	9520	11.72
India	8375	10.31
Germany	2957	3.64
South Korea	2754	3.39
England	2598	3.20
Italy	2447	3.01
Canada	1997	2.46
Japan	1518	1.87
Australia	1492	1.84
Spain	1375	1.69
France	1347	1.66
Saudi Arabia	1315	1.62
Iran	1294	1.59
Poland	904	1.11
Turkiye	887	1.09
Sweden	832	1.02
Brazil	770	0.95
Malaysia	751	0.92
Netherlands	726	0.89
Others 151 Countries	15857	19.51
Total	**81256**	

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China emerges as the global leader, contributing over 21,540 (26.51%) of the total research papers published on Electrical Vehicles. This dominance is likely driven by massive state investment and a robust domestic EV manufacturing ecosystem. The USA 9,520 (11.72%) 2nd ranked and India follow as significant contributors. Notably, India holds the 3rd rank globally contributing 8,375 (10.31%) of the total literature. This underscores India's growing academic focus on EV integration, battery technology, and charging infrastructure.

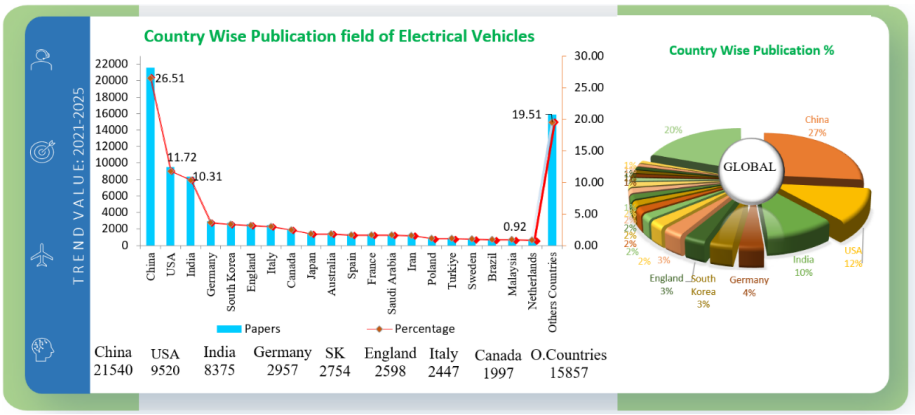

Fig 2: Top 20 Country wise publication field of Electrical Vehicles

After the top trio, things taper off fast. Germany, South Korea, then England - each lands just under or around 3% and 4%. Not one of the rest crosses above 3% on its own. Research strength leans heavily where industry and growth already run deep.

4.2 Year wise publications of India and Global

Electric Vehicle studies from 2021 to 2025, the numbers show a clear climb in research papers - both worldwide and within India. Though the world produces more overall, what stands out is how fast India has been increasing its share. Despite starting smaller, the pace there beats many expectations. Growth like this doesn't always mirror size; sometimes momentum tells the real story.

Table-2: Year wise publications of India and Global

Year	India			World		
	Papers	**Citations**	**H-Index**	**Papers**	**Citations**	**H-Index**
2021	1008	24019	75	13655	370733	201
2022	1421	23945	67	14962	288353	150
2023	1560	23730	65	14943	224037	126
2024	1997	16868	46	18857	145832	91
2025	2389	6623	28	18839	42134	39
Total	**8375**	**95185**	**106**	**81256**	**1071089**	**149**

The citation data reveals a standard "citation lag", here older papers naturally accumulate more citations over time. India achieved a total of 8,375 papers on Electrical Vehicles (EV) and 95,185 citations with a H-Index of 106. Globally Amassed over 81,256 papers and 10,71,089 citations with h-index 149.

Fig-3: Year wise publications of India and Global

India in the year 2021 total 1,008 papers and 24,019 citations with a peak H-Index of 75 and Globally in the year 2021 total 13,655 papers and 37,0733 citations with 201 h-index, maintaining a robust total H-Index of 149. While India's H-Index reflects a strong scholarly impact relative to its volume, the global H-Index highlights the enduring influence of international research networks.

4.2 Year Wise Funded and Un-Funded Publications

This study looks at how often funded and unfunded research gets published, along with how frequently each is cited, tracking changes between 2021 and 2025. Findings show clear differences in volume and influence, shaped by shifting support patterns across universities and fields.

Table-3: Funded and Un-Funded Publications

Year	FP	FP%	FTC	FTC%	UFP	UFP%	UTC	UTC%	TP	TC
2021	321	11.06	9789	23.83	687	12.55	**14230**	**26.30**	1008	**24019**
2022	495	17.06	**10723**	**26.11**	926	16.92	13222	24.44	1421	23945
2023	528	18.19	10179	24.78	1032	18.86	13551	25.04	1560	23730
2024	688	23.71	7473	18.19	1309	23.92	9395	17.36	1997	16868
2025	**870**	**29.98**	2911	7.09	**1519**	**27.75**	3712	6.86	**2389**	6623
Total	**2902**		**41075**		**5473**		**54110**		**8375**	**95185**

FP: Funded Papers, FTC: Funded Total Citations UFP: Un-Funded Papers, UTC: Un-Funded Total Citation, TP: Total Papers and TC: Total Citations

The total volume of papers (TP) shows a consistent upward trajectory, growing from 1,008 papers in the year 2021 to 2,389 papers in the year 2025. Interestingly, the distribution between Funded Papers (FP) and Un-Funded Papers (UFP) remains relatively balanced in terms of growth rates. Funded papers rose from 321 (11.06%) to a peak of 870 (29.98%) in the year 2025. Out of nowhere, unfunded research jumped from 687 to 1,519 publications. Even as official grants grow, plenty of studies still come from personal effort or institutional backing.

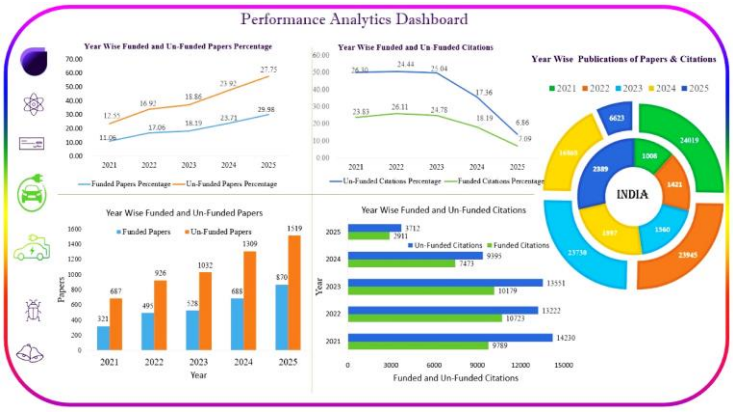

Fig-4: Year Wise Funded and Un-Funded Papers

Back then, papers were piling up fast - yet citation numbers climbed only so far. A peak arrived surprisingly quick, hitting 24,019 in 2021. After that? Numbers dropped hard, landing near just 6,623 by 2025. Older studies usually gather attention slower - but over time they add up. Fresh work, on the flip side, hasn't got those years behind it yet. Funded Total Citations (FTC) Peaked in the year 2022 with 10,723 citations (26.11%) of the total funded citation pool. Un-Funded Total Citations (UTC) started strong in the year 2021 with 14,230 (26.30%) of the un-funded pool but dropped significantly to 3712 by the year 2025. The data indicates that un-funded papers initially held a higher citation count, but funded papers showed a more resilient percentage share of citations (FTC%) in the latter years compared to the sharper drop in UTC%.

4.3 Top Ten Funded Journals

The research on Electrical Vehicles out of 1734 journals only 887 (51.15%) funded journals papers publication remain 847 (48.85%) unfunded journals, and this study evaluates the distribution and impact of research funding across various academic journals, based on a dataset of 2,902 funded papers and 41,075 citations. The data reveals a significant concentration of funded research within specific high-impact publications, primarily within the engineering and sustainability domains.

Table-4: Top Ten Funded Journals

SL. No.	Name of the Journal	Funded Papers	%	Citation	%	ACPP
1	IEEE Access	130	4.48	2784	6.78	21.42
2	Journal of Energy Storage	102	3.51	3044	7.41	29.84
3	Scientific Reports	97	3.34	766	1.86	7.90
4	IEEE Transactions on Industry Applications	74	2.55	1184	2.88	16.00
5	Energies	58	2.00	1123	2.73	19.36
6	IEEE Transactions on Transportation Electrification	42	1.45	536	1.30	12.76
7	Sustainability	32	1.10	882	2.15	27.56
8	IEEE Transactions on Intelligent Transportation Systems	30	1.03	511	1.24	17.03
9	Results in Engineering	28	0.96	385	0.94	13.75
10	IEEE transactions on consumer electronics	26	0.90	276	0.67	10.62
11	Others 877 Journals	2283	78.67	29584	72.02	12.96
Total		**2902**		**41075**		14.15

"*IEEE Access*" emerges as the leading venue for funded research, accounting for 130 papers (4.48%) and 2784 (6.78%) with average citations per paper 21.42. It is followed closely by the "*Journal of Energy Storage*" with 102 papers (3.51%) and 3044 (7.41%) with ACCP 29.84, Noticed that "*Journal of Energy Storage*" compare to previews journals low paper published but received high citations showing that good indicate and this journals high quality paper published. "*Scientific Reports*" with 97 (3.34%) papers and 766 (1.86) citations with ACCP 7.91. The presence of four "*IEEE Transactions*" in the top ten highlights the strong correlation between external funding and technical advancement in electrical engineering and transportation sectors.

The "*Journal of Energy Storage*" boasts the highest total citations among the top ten (3,044) and the highest ACPP (29.84), suggesting that funded research in energy storage is exceptionally influential. "*Sustainability*" also shows remarkable efficiency, maintaining an ACPP of 27.56, despite having fewer funded papers (32).

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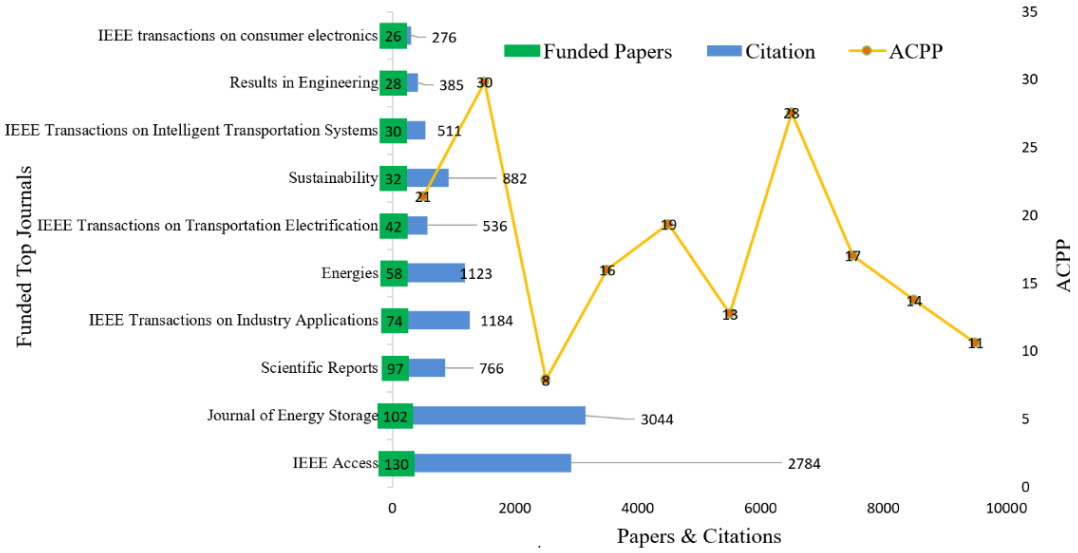

Fig-5: Top Ten Funded Journals

Scientific Reports, despite its high volume of papers, shows a lower ACPP of 7.90, indicating a broader but perhaps less specialized impact per individual paper compared to niche engineering journals.

4.4 Top Ten Funded Agencies

This Study evaluation examines the distribution of research output and academic impact among the leading funding bodies, based on a comprehensive dataset of 2,902 papers and 41,075 citations. The data highlights the dominant role of Indian governmental institutions in driving scientific research and fostering high-impact scholarship.

Funded Agencies it reveals how financial resources shape scientific discovery, national innovation capacity, and strategic economic priorities, investigating funding organizations enables to align our project objectives with their particular priorities, financial constraints, and historical performance trends. You can create more compelling bids, save time, and get the funding required for people, equipment, and successful scientific innovation if you know what a sponsor wants.

Table-5: Top Ten Funded Agencies

Name of the Funded Agencies	Papers	Citations	H-Index
Department of Science Technology India	393	5619	37
Council of Scientific Industrial Research India	118	1920	24
Science Engineering Research Board India	93	1572	21
University Grants Commission (UGC) India	90	1284	17
Goernment of India	74	1860	20
Manipal Academy of Higher Education Manipal	50	1851	20
Ministry of Education Government of India	39	1251	17
Department of Biotechnology India	36	942	15
Ministry of Human Resource Development Government of India	36	440	13
Ministry of Electronics and Information Technology Government of India	28	221	9
Others 124 Funded Agencies	1945	24115	169
Total	**2902**	**41075**	**221**

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The "*Department of Science and Technology (DST)",* India, stands as the most prolific contributor, funding 393 papers and also received 5619 citations with 37 h-Index, which accounts for a substantial portion of the analyzed output. It is followed by the "*Council of Scientific and Industrial Research (CSIR)*" with 118 papers and the "*Science Engineering Research Board (SERB)*" with 93 papers. These figures underscore the central role of national agencies in sustaining the research ecosystem. The "*DST*" not only leads in volume but also in impact, garnering 5,619 citations and achieving an H-Index of 37, the highest among individual agencies.

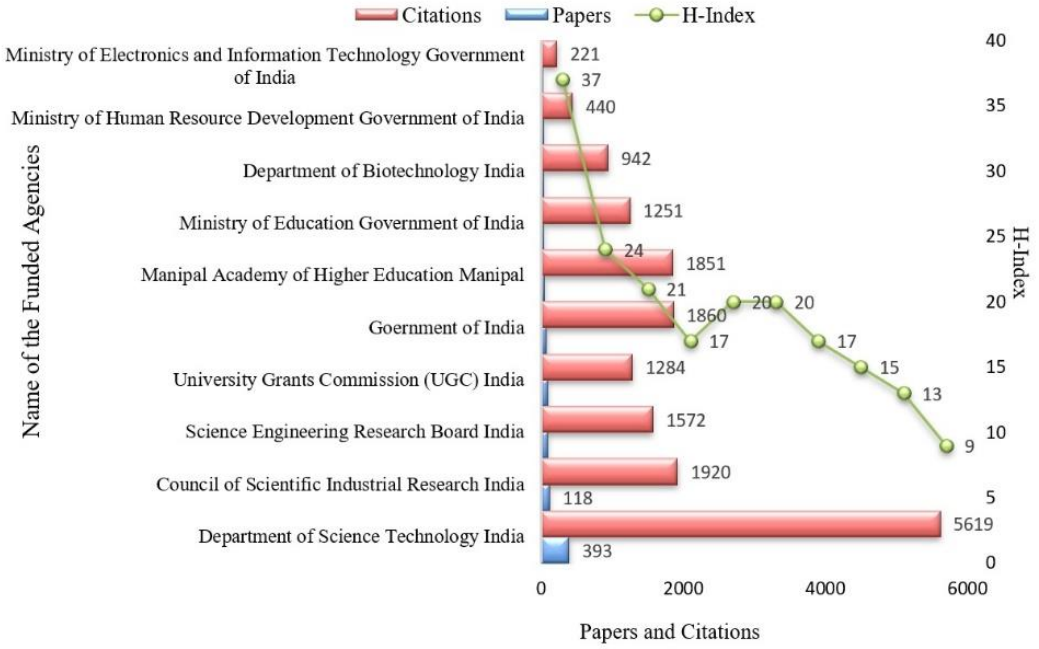

Fig-6: Top Ten Funded Agencies

Efficiency of Private/Autonomous Institutions notably, the "*Manipal Academy of Higher Education (MAHE)*" shows impressive efficiency; with only 50 papers, it achieved 1,851 citations and an H-Index of 20, rivaling much larger government departments in terms of per-paper impact. While "*Others (124 Funded Agencies)*" contribute the bulk of the papers (1,945), the top ten agencies represent the "engines" of high-impact research, significantly influencing the overall H-Index of 221 for the entire dataset.

FINDINGS

1. The intellectual output of Electric Vehicle (EV) research is highly concentrated, with China, the USA, and India producing nearly 50% of the global scientific discourse. India contribution accounting for 10.3% of total output (8,375 papers) and out of 2902 (34.65%) paper with 41075 (75.91%) Citations funded through published.
2. Productive times hit Indian academia hard these two years. Not since any recent stretch has output climbed so fast in this field. A surge built quietly now shows full force by 2025. Momentum started back in 2024 never really slowed down. This phase stands out only because work kept rising without pause.
3. Papers with financial backing now make up a growing share of published studies, their impact holding steady over time unlike those without support. Their citation rates stay consistent where others fluctuate.

4. Still running on empty, some studies manage to shape thinking - yet those with backing tend to stick around longer in scholarly circles. Though unsupported work feeds discovery, it often fades faster than its financed counterparts.
5. Almost 79% of articles show up in 877 journals, yet a handful - just ten - drive most of the attention. These leading titles pull more weight when it comes to influence.
6. Journals such as the "Journal of Energy Storage" and "Sustainability" show the highest Average Citations Per Paper (ACPP), indicating a high "Academic ROI" for funded projects in energy and environmental transitions.
7. The "Department of Science and Technology" (DST) remains the foundational pillar of support for Indian EV research.
8. The Out of nowhere, new agencies such as the Department of Biotechnology began showing up alongside strong academic institutions like MAHE. Their presence hints at deeper changes taking shape across fields that once stayed apart. Growth isn't loud - it shows in quiet collaborations, shared labs, overlapping goals. This blend of players didn't appear overnight; it grew from years of small steps forward.
9. One way to lift the visibility of those 124 agencies worldwide might be shared grant projects. Instead of working alone, pairing up could help raise how often their work gets cited. Right now, their research doesn't show up much in academic circles. Working together may slowly change that pattern over time. A shift like this wouldn't happen overnight. Still, small steps through joint funding might make a difference later on.

SUGGESTION

One way to grow reach worldwide is by backing fewer projects that meet strong standards instead of many weak ones. Pick journals with high ACPP scores more often than not. Smaller groups might link up with well-known centers, such as those backed by the "Department of Science and Technology". Focus moves toward better work, less counting. What matters grows slowly - trust, depth, shared goals. Strength hides in smart pairings, not big numbers.

CONCLUSION

Researching funding agencies helps to match our project goals with their specific priorities, budget limits, and past success patterns. The intellectual output of Electric Vehicle (EV) research is highly concentrated, with China, USA, and India producing nearly 50% of the global scientific discourse. India contribution accounting for 10.3% of total output 8,375 papers and out of 2,902 (34.65%) paper with 41,075 (75.91%) Citations funded through published. While nearly 79% of papers are spread across 877 different journals, the top 10 journals act as the primary engines for high-impact visibility. Journals such as the Journal of Energy Storage and Sustainability show the highest Average Citations Per Paper (ACPP), indicating a high "Academic ROI" for funded projects in energy and environmental transitions. The Department of Science and Technology (DST) remains the foundational pillar of support for Indian EV research. The emergence of specialized agencies (like the Department of Biotechnology) and top-performing academic institutions (like MAHE) signals a maturing, multidisciplinary ecosystem. To maximize global influence, future initiatives should prioritize funding quality over quantity, specifically targeting high-ACPP

journals and fostering collaboration between smaller agencies and established hubs like “Department of Science and Technology funded Agencies”.

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