A BIBLIOMETRIC STUDY OF Ph.D. THESES IN MECHANICAL ENGINEERING AWARDED BY UNIVERSITIES AND HIGHER-EDUCATION INSTITUTIONS IN MAHARASHTRA DURING 2021–2025

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Abstract :

The present study examines the bibliographic characteristics and research trends of Mechanical Engineering Ph.D. theses awarded in Maharashtra during 2021–2025. The analysis is based on the supplied Excel dataset containing 236 records with award years falling within the selected period. The study examines year-wise productivity, institutional contribution, research-area distribution, supervisor-wise contribution and the availability of keyword metadata. After normalization of obvious spelling and formatting variants in institutional names and supervisor names, the records were analysed using frequency and percentage techniques. The year-wise distribution shows 35 theses in 2021, 45 in 2022, 72 in 2023, 37 in 2024 and 47 in 2025. Savitribai Phule Pune University accounts for the largest institutional share in the supplied dataset, followed by Visvesvaraya National Institute of Technology, Nagpur and Shivaji University, Kolhapur. Thermal/Energy/Heat Transfer is the largest broad research-area group after classification of the supplied sub-domain field. Dr. Dinesh Namdeorao Kamble has the highest recorded supervisor count after normalization of an obvious name-order variant. A major limitation is that the keyword field is not sufficiently granular: 235 of the 236 records contain the same generic classification string, while one contains "THEARMAL". Therefore, meaningful keyword-frequency conclusions cannot be drawn from the supplied keyword field. The study demonstrates the value of structured thesis metadata for bibliometric analysis while also highlighting the need for complete and standardized repository metadata.

Keywords : Bibliometrics; Ph.D. Theses; Mechanical Engineering; Maharashtra; Shodhganga; IndCat; Research Productivity; Research Trends; Doctoral Research.

Introduction :

Doctoral research is a major component of scholarly communication and knowledge creation in higher education. Ph.D. theses provide detailed evidence of research problems, objectives, methodologies, experimentation, analysis and conclusions. They therefore constitute an important source for studying the direction and development of research in an

academic discipline.

Mechanical Engineering is a broad discipline encompassing manufacturing and production, thermal engineering, materials, design, energy systems, fluid mechanics, heat transfer, automotive engineering, industrial systems, automation and computational applications. Changes in industrial technology, sustainability requirements and digital engineering have expanded the range of topics investigated by doctoral researchers.

Bibliometric analysis provides quantitative techniques for examining patterns in scholarly output. In the context of doctoral theses, bibliometric analysis can identify productivity over time, institutional contributions, supervisor contributions, subject concentrations and thematic patterns.

The present study analyses the records supplied by the researcher for Mechanical Engineering-related doctoral theses with award years from 2021 to 2025. Shodhganga and university-repository records are represented in the source field of the dataset. The analysis is deliberately restricted to what is supported by the supplied data.

Background of the Study :

The digitisation of theses has improved the discoverability and accessibility of doctoral research. National and institutional repositories make it possible to identify records across universities and to analyse metadata such as thesis title, researcher, supervisor, university and year.

Shodhganga is the national repository of Indian electronic theses and dissertations maintained by the INFLIBNET Centre. IndCat is the Online Union Catalogue of Indian Universities and includes bibliographic records for theses. These resources provide a useful foundation for systematic studies of doctoral research.

The supplied dataset also illustrates a practical metadata challenge. Institutional names are recorded in different forms, supervisor names sometimes contain different punctuation or ordering, and the keyword field is largely generic. Such inconsistencies must be addressed before bibliometric counting.

Statement of the Problem :

The study is entitled “A Bibliometric Study of Ph.D. Theses in Mechanical Engineering Awarded by Universities and Higher-Education Institutions in Maharashtra During 2021–2025.” It seeks to determine the distribution and characteristics of the doctoral research records contained in the supplied dataset and to identify patterns in institutional productivity, research areas and supervisor contribution.

Objectives of the Study :

1. To examine the year-wise distribution of Mechanical Engineering Ph.D. thesis records during 2021–2025.
2. To identify the universities and higher-education institutions contributing to the records in the supplied dataset.
3. To classify the records according to broad Mechanical Engineering research areas using the supplied sub-domain field.
4. To analyse supervisor-wise contribution after standardizing obvious name variants.
5. To examine the availability and quality of keyword metadata.
6. To identify broad research trends from the recorded research-area information.
7. To assess the usefulness and limitations of the supplied repository-based metadata for bibliometric analysis.

Research Questions :

8. What is the year-wise distribution of Mechanical Engineering Ph.D. thesis records during 2021–2025?
9. Which universities or institutions contributed the largest number of records?
10. Which broad research areas are most represented?
11. Which supervisors have the highest number of recorded theses?
12. To what extent is the keyword field suitable for meaningful bibliometric analysis?
13. What broad research trends can be identified from the available sub-domain metadata?

Scope of the Study :

The study covers the records in the supplied Excel file whose Year of Award falls between 2021 and 2025 inclusive. The dataset contains 236 such records. The principal variables used are university, year of award, author, thesis title, research guide, mechanical sub-domain, keywords, source and selected metadata fields.

Limitations :

- The analysis is limited to the records supplied in the Excel dataset.
- Records without an award year were excluded from the 2021–2025 analysis.
- Institutional names were normalized only where the intended institution was clear from the recorded text.
- Research areas were grouped from the supplied Mechanical Sub-Domain field; this is an analytical classification and not an official university classification.
- The keyword field is highly incomplete/non-discriminatory in the supplied data, so meaningful keyword-frequency analysis is not possible.
- Supervisor names were normalized only for obvious variants; other identity matching may require manual verification against the original thesis records.
- The study measures bibliographic patterns and does not evaluate the scientific quality of individual theses.

Research Methodology :

1. Research Design :

A descriptive bibliometric research design was adopted. Records were filtered for award years 2021–2025 and analysed using frequency, percentage, ranking and cross-tabulation.

2. Data Source :

The supplied workbook is titled "PhD_Maharashtra_Mechanical_2010_2023_Data_Format (1).xlsx" and contains a worksheet named "PhD_Data_2010_2023". Although the file name refers to 2010–2023, the actual worksheet contains records with award years beyond 2023; the present analysis uses the recorded award year and therefore includes 2021–2025.

3. Data Cleaning :

Obvious whitespace, punctuation and capitalization variations were normalized. For example, variants of Savitribai Phule Pune University, Shivaji University, Rashtrasant Tukadoji Maharaj Nagpur University, Kavayitri Bahinabai Chaudhari North Maharashtra University and other institutions were consolidated where the intended institution was unambiguous. Supervisor names were similarly standardized for obvious variants, including the name-order variant of Dr. Dinesh Namdeorao Kamble and spelling/initial variants of Dr. Sujit S. Pardeshi.

4. Research-Area Classification :

The supplied Mechanical Sub-Domain field contains heterogeneous labels such as Thermal Engineering, Manufacturing Engineering, Heat Transfer, Tribology, Design Engineering, Renewable Energy Engineering, Automotive Engineering, Biomedical Engineering and others. These were grouped into broad analytical categories to facilitate comparison.

5. Statistical Techniques :

Frequency, percentage, ranking and year-by-area cross-tabulation were used. Percentages were calculated against the 236 records in the selected period.

Data Analysis and Interpretation

1. Year-wise Distribution

Year	Number of Theses	Percentage
2021	35	14.83
2022	45	19.07
2023	72	30.51
2024	37	15.68
2025	47	19.92
Total	236	100.00

Table 1 shows that the highest number of records was recorded in 2023 (72; 30.51%), followed by 2025 (47; 19.92%) and 2022 (45; 19.07%). The lowest number was recorded in 2021 (35; 14.83%). The pattern is therefore fluctuating rather than steadily increasing: output rose sharply through 2023, declined in 2024 and increased again in 2025.

2. University/Institution-wise Distribution

Rank	University / Institution	Number of Theses	Percentage
1	Savitribai Phule Pune University	107	45.34
2	Visvesvaraya National Institute of Technology, Nagpur (VNIT)	36	15.25
3	Shivaji University, Kolhapur	27	11.44
4	Rashtrasant Tukadoji Maharaj Nagpur University	16	6.78
5	Kavayitri Bahinabai Chaudhari North Maharashtra University	12	5.08
6	Sant Gadge Baba Amravati University	8	3.39
7	Punyashlok Ahilyadevi Holkar Solapur University	6	2.54
8	G H Raisoni University, Amravati	5	2.12
9	Chhatrapati Shivaji Maharaj University	4	1.69
10	Dr. Babasaheb Ambedkar Technological University, Lonere	4	1.69
11	University of Mumbai	3	1.27
12	Autonomous Institute Affiliated to University of Mumbai)	1	0.42
13	Indian Institute of Technology Bombay,	1	0.42

	India		
14	Not specified	1	0.42
15	Swami Ramanand Teerth Marathwada University,	1	0.42
	All 236 records	236	100.00

Savitribai Phule Pune University has the largest share in the supplied 2021–2025 dataset with 107 records (45.34%). It is followed by Visvesvaraya National Institute of Technology, Nagpur (VNIT) with 36 records (15.25%) and Shivaji University, Kolhapur with 27 records (11.44%). The presence of VNIT shows that the supplied dataset contains higher-education institutions in addition to entities formally described as universities; accordingly, the title and interpretation use "universities and higher-education institutions" where appropriate.

3. Research Area-wise Distribution

Rank	Broad Research Area	Number of Theses	Percentage
1	Thermal / Energy / Heat Transfer	96	40.68
2	Manufacturing / Production	63	26.69
3	Materials / Composites	23	9.75
4	Other / Unclassified	17	7.20
5	Design / Ergonomics	15	6.36
6	Automotive	8	3.39
7	Biomedical	7	2.97
8	Industrial / Systems	6	2.54
9	Computational / AI	1	0.42
	Total	236	100.00

Thermal/Energy/Heat Transfer is the largest broad analytical group with 96 records (40.68%), followed by Manufacturing/Production with 63 (26.69%) and Materials/Composites with 23 (9.75%). The classification indicates strong concentration in conventional core Mechanical Engineering areas, particularly thermal/energy and manufacturing research.

4. Keyword Metadata Analysis

Rank	Recorded Keyword/Keyword String	Frequency
1	Engineering and Technology Engineering Engineering	235

	Mechanical	
2	THEARMAL	1

The keyword field requires special caution. Of the 236 selected records, 235 contain the same generic string “Engineering and Technology Engineering Engineering Mechanical”, while one record contains “THEARMAL”. Consequently, the supplied keyword field does not provide a reliable basis for identifying substantive research themes. It would be inappropriate to report terms such as AI, CFD, optimization or renewable energy as keyword frequencies unless those terms are extracted and verified from the actual thesis metadata. For the present paper, research trends are therefore interpreted from the research-area/sub-domain field rather than fabricated keyword counts.

5. Supervisor-wise Contribution

Rank	Supervisor	Number of Theses	Percentage of 236
1	Dr. Dinesh Namdeorao Kamble	8	3.39
2	Dr. Sujit S. Pardeshi	7	2.97
3	Dr. D. N. MALKHEDE	3	1.27
4	Dr. S. S. Ohol	3	1.27
5	DR. AJIT A. BHOSALE	3	1.27
6	Dr. M.R.Nandgaonkar	3	1.27
7	Dr. Mangesh Kotambkar	3	1.27
8	Dr. Prashant M. Pawar	3	1.27
9	Dr. R. G. Desavale	3	1.27
10	Dr. Gaurav Tiwari	3	1.27
11	Bewoor, Anand K.	2	0.85
12	Dr. Chandrasekhar M. Sewatkar	2	0.85
13	Dr. W. S. Rathod	2	0.85
14	Dr. S.V.KARMARE	2	0.85
15	DR. VISHNU D. WAKCHAURE	2	0.85

Dr. Dinesh Namdeorao Kamble has the highest recorded contribution after normalization, with 8 theses (3.39% of all selected records). Dr. Sujit S. Pardeshi has 7 after combining the clearly related variants “DR. SUJIT S PARDESHI”, “Dr. SUJIT S. PARDESHI” and “Dr. S. S. Pardeshi”. Several other supervisors have three or two records. Supervisor-wise analysis should nevertheless be rechecked against the original thesis records before publication because initials and name variants can represent the same or different individuals.

6. Year-wise Distribution by Research Area

Research Area	2021	2022	2023	2024	2025	Total
Automotive	1	0	4	0	3	8
Biomedical	1	2	2	0	2	7
Computational / AI	0	0	0	0	1	1
Design / Ergonomics	3	3	4	3	2	15
Industrial / Systems	0	1	1	3	1	6
Manufacturing / Production	7	11	21	12	12	63
Materials / Composites	0	6	10	1	6	23
Other / Unclassified	4	2	4	3	4	17
Thermal / Energy / Heat Transfer	19	20	26	15	16	96
Total	35	45	72	37	47	236

The cross-tabulation shows that Thermal/Energy/Heat Transfer dominates the dataset across the selected period. Manufacturing/Production is the second-largest group and remains substantial in each year. The distribution also indicates that research-area activity fluctuates over time rather than following a uniform linear pattern.

Major Findings :

1. The selected dataset contains 236 records with award years from 2021 to 2025.
2. 2023 recorded the highest annual output with 72 theses (30.51%).
3. 2021 recorded the lowest annual output with 35 theses (14.83%).
4. Savitribai Phule Pune University contributed 107 records (45.34%) after normalization of obvious institutional-name variants.
5. Visvesvaraya National Institute of Technology, Nagpur (VNIT) contributed 36 records (15.25%) and Shivaji University, Kolhapur contributed 27 (11.44%).
6. Thermal/Energy/Heat Transfer was the largest analytical research-area group with 96 records (40.68%).
7. Manufacturing/Production was the second-largest group with 63 records (26.69%).
8. Dr. Dinesh Namdeorao Kamble had the highest normalized supervisor count with 8 records.
9. The keyword metadata is inadequate for substantive keyword analysis because 235 of 236 records share the same generic keyword string.
10. The dataset demonstrates the importance of metadata standardization for reliable

bibliometric analysis.

Discussion :

The year-wise distribution indicates a marked fluctuation in doctoral output. The increase from 35 records in 2021 to 72 in 2023 is followed by a decline to 37 in 2024 and a recovery to 47 in 2025. This pattern should not be interpreted as a statewide trend in the absolute sense without verifying repository coverage and award-year completeness, but it does describe the supplied dataset.

Institutional concentration is another important finding. Savitribai Phule Pune University accounts for nearly half of the selected records after consolidation of spelling and formatting variants. Such concentration may reflect the size of the doctoral programme, number of research supervisors, research centres, or differences in repository coverage. These explanations, however, require additional institutional evidence and should not be treated as causal findings from the dataset alone.

The research-area analysis shows that thermal/energy/heat-transfer topics constitute the largest group. Manufacturing/production also represents a substantial share, demonstrating the continuing importance of core Mechanical Engineering research. Materials/composites and design/ergonomics form additional clusters.

Supervisor analysis reveals a long tail of supervisors with one or two records and a smaller group with repeated doctoral supervision. Such a pattern can be useful for identifying active research groups, but accurate name disambiguation is essential before making claims about individual productivity.

The most important metadata limitation concerns keywords. Because the supplied keyword field is overwhelmingly generic, keyword co-occurrence or emerging-theme analysis cannot be validly performed from this field alone. A future version of the dataset should capture thesis-specific keywords from the repository record or thesis front matter.

Implications of the Study :

For Researchers :

The study provides a structured view of doctoral research concentration and can help identify areas represented strongly in the dataset.

For Research Supervisors :

Supervisor and research-area information can support identification of active research clusters and possible interdisciplinary opportunities.

For Universities :

Institutional productivity data can support research planning, repository management and monitoring of doctoral output.

For Libraries :

The findings demonstrate the importance of complete and standardized thesis metadata for bibliometric and research-support services.

For Policy Makers :

Aggregated evidence on doctoral research output can contribute to understanding institutional and disciplinary research activity, subject to complete coverage of the underlying repositories.

Suggestions :

1. Universities should ensure timely and complete submission of thesis metadata to national and institutional repositories.
2. Researcher and supervisor names should be recorded in a standardized form, preferably with persistent identifiers where available.
3. Thesis-specific keywords should be captured accurately rather than using only broad subject classifications.
4. Research-area labels should be standardized across institutions to facilitate comparative bibliometric analysis.
5. Duplicate records and spelling variants should be systematically identified before counting institutional or supervisor productivity.
6. Future studies should verify all records against the original repository pages before publication.
7. Keyword co-occurrence, thematic evolution and network analysis should be undertaken only after obtaining reliable thesis-specific keyword data.

Conclusion :

The study provides a data-grounded bibliometric analysis of 236 Mechanical Engineering-related Ph.D. thesis records in the supplied dataset for the period 2021–2025. The analysis identifies substantial year-wise fluctuation, strong institutional concentration and a high representation of thermal/energy/heat-transfer and manufacturing/production research.

The supervisor analysis identifies Dr. Dinesh Namdeorao Kamble as the highest recorded contributor after standardization of an obvious name-order variant. At the same time, the keyword analysis demonstrates a major metadata limitation: the available keyword field is almost entirely generic. This finding itself is important for library and repository management because bibliometric research depends on consistent and sufficiently granular metadata.

Overall, the supplied records provide a useful foundation for a Maharashtra-focused doctoral research study. Before formal journal or conference submission, the dataset should be checked against the original Shodhganga/IndCat or university records, particularly for institution names, award years, supervisor identity, duplicate records and thesis-specific keywords.

Future Scope :

- Extend the dataset to 2010–2025 for long-term trend analysis.
- Verify each 2021–2025 record against Shodhganga/IndCat and university repository pages.
- Extract thesis-specific keywords from actual records.
- Conduct keyword co-occurrence and thematic evolution analysis using VOSviewer or Bibliometrix.
- Analyse institutional and supervisor collaboration networks.
- Compare Mechanical Engineering doctoral research with Civil, Electrical and Computer Engineering.
- Link theses to journal publications and perform citation analysis.

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