J. Basic. Appl. Sci. Res., 6(11)15-25, 2016
© 2016, TextRoad Publication

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

Systematic Mapping: Database Tuning Progress in a Decade

[1]Saba Luqman, [2]Ejaz Ahmed

Department of Computer Science
National University of Computer and Emerging Sciences, Islamabad, Pakistan

Received: September 6, 2016
Accepted: October 29, 2016

ABSTRACT

Database tuning is the incremental process of tuning database and database applications to run more rapidly. With the help of tuning, transactions are executed efficiently in minimum time. A large number of published research articles are presenting database tuning but there is a deficiency of systematic research. Our focus is to provide a critical review of the nature of the systematic mapping which means performing survey on existing research of database tuning in order to identify useful approaches and map research characteristics. For the last many years, some researchers work has been carried out with different classification tuning schemes. Our results show unique and distinct percentiles of research, performed in the study of publications such as book chapters, conferences, journals, thesis reports and research articles related to database tuning in the last one decade. According to results of our systematic mapping, we find that how a significant tuning related research in terms of validation and evaluation has required?
KEYWORDS: Database Tuning, Systematic Mapping, Classification, Evaluation, Threats to validity, Research Focus

1. INTRODUCTION

Recent developments in science and technology depend on access of very large data in a shortest response time. This has created an immense opportunity for transactional data research to play an essential role in wide range of applications for database systems such as country's population databases, banks transactional systems, hospitals databases, and databases for macro scale knowledge discovery. In recent years, the database tuning has drawn a significant amount of interest due to an access of data with slow response. Data is drastically increasing in organizations with the passage of time and growth of business [4]. The organizations with very large data can be hospitals, banks etc., are using various tuning techniques to make data accessible fast [17]. Mainly database tuning is managed with the enhancements in DBMS, approaches and techniques, query processing and optimizations, industrial best practices, and hardware enhancements.

Most recent approaches such as columnar, cloud and grid databases are also enhancing database performance [10, 11, 12]. Database tuning defines a collective group of activities and these activities are altogether used to optimize the performance of database [1]. In general, database tuning includes design of physical database files, selection of DBMSs and the configuration of the database environment in terms of software and hardware amenities. The overall process of database tuning consists of making database application run faster, decreasing the response time for queries and transactions, and improving the turnout of overall transactions [13]. Database administrators (DBA) and database application developers are responsible for database tuning [2]. The main task of DBA is to perform tuning on large set of data. DBA activities related to database are state-of-the-art tuning domains consist of partitioning of physical schema, installing physical access structures such as indexes, views, partitioning of sub-databases or schemas, divide the main virtual partition into smaller independent virtual partitions for better data access, selection of databases with their versions/ features, query processing, optimizations and enhancements in other resources such as storages, operating systems and tools etc. Also, enhancements in methodologies (parallel, distributed, clustered), designs (ER, Object models) along with adoption of columnar, cloud and grid databases are defining another dimension of tuning. This means "database tuning tries to exploit the system resources to perform work as competently and quickly as possible" [3].

The need of database tuning is required for the substantial growth of business data in today's world. Data growths range from kilo byte to peta byte and more. Businesses are growing along with the growth of their data [5]. Today most of the industries have small or big database systems. Increasing trend of online business, websites and more application describe the importance of database tuning. There are many approaches and industrial tools available for database tuning. Some of the popular tools are AppSluth, eTuner [6], DTA [7] and tools with self-tuning characteristics. Some tools have automatic support for tuning called self-tuning. Self-tuning concept reduced the burdens of DBA as it tunes the physical design of database automatically [1]. Self-tuning tools are building upon single architecture but it is very difficult for single

Corresponding Author: Saba Luqman, Department of Computer Science, National University of Computer and Emerging Sciences, Islamabad, Pakistan. sabaluqman22@gmail.com

architecture to tune the physical design for dynamic workload [16]. Many recent versions of DBMS include self-tuning into their DBMS's for better performance.

In paper [1] authors covers the one decade research of database. Paper describes the challenges that are facing by the researchers and demands of industry. Authors concluded that active research areas are automated with physical design and automating monitoring of relational DBMS as they are working on **Auto Admin** research project. However, the significant problem was to make a database system fully tuned and it was a difficult task. As authors explained every tuning problem that has different types of solutions as well as to control internal components complexity was lengthy task. The paper gives insights that if we find some alternative architecture of database servers it would increase the whole performance. At the end they concluded up with some research problems: that scalable storage and application servers need more attention as claimed by the industries, newly server store are more demanding so the large number of data can be self- managed. Our work is different as we conduct a systematic mapping of one decade and classify the current literature while they looks up at the database self tuning domain. They review some research on database self tuning at that time and configured new areas that are active in research and development.

The study highlights that database tuning has a very wide scope but a very little survey work present in the particular domain [2, 6, 9]. This motivates us to perform the systematic mapping of the past ten years of research on database tuning so that our study gives a clear sight of what new areas were explored in the last ten years, what challenges and solution were proposed for the different nature of problems. We classify the selected studies into five major categories such as 1) Query optimization, 2) Database Performance, 3) Database Tuning cost 4) Physical Database Design and 5) Database Tuning. This study elaborates a detailed overview of one decade of research on database tuning.

This paper supports a systematic mapping by covering database tuning, classification of literature into main categories and problems which are not solved yet. This study gives a detail overview of research on database tuning managed during one decade. We try to find current and state-of-the-art knowledge in database tuning domains.

In actual, we first explain the nature of problem in section 2, which impart the basis for our review of tuning. In section 3, we describe research design and section 4 contains methodology of systematic study. Section 5 summarizes classification scheme and section 6 describes how the systematic mapping is applied. Finally, section 7 contains conclusions and future work.

2. Nature of the Problem of Database Tuning

Technically speaking, very large data exhibits its access or retrieval in a shortest response time, managed with the help of tuning [8]. However, common understanding in the community is that database tuning achieved on ad-hoc basis when needed, and in some cases apply it early as per expert basis. Researchers claimed that a few tuning approaches or techniques are better than others but no practical evaluation and validation are provided [1, 2].

In order to highlight the implications the tuning problem in the real world, we present an example from a case study of medical software application. Consider a case study "patient's diagnosis data set", collection of patients and their family dependents personal information, and their visits data in the form of diagnosis. Radiology data of patients may consist of non-textual data such as images and x-rays. From experience of a case study, one would expect the number of patients to exceed greatly their number of visits; this data set contains 35,000 numbers of patients and transactional 800,000 numbers of patients' visits in five years. This means transactional data increases with the rate of around 150,000 numbers of visits per years along with data of lab tests, radiology tests, emergency treatments and medications etc. This is all about transactional data acquired and accessed 24/7 by many users of medical staff. This shows patients and medicine data is available initially with certain quantity and increased very slow but transactional data such as patient visits starts from no record and increases drastically in millions of records. Preferably, we require practical tuning techniques that provide a fast data access of such data, stays for a degree of time. This means tuning techniques are set in such a way that rate of fast data accessing stays fine in the range of two years toten years and more.

In regards to validation of tuning using practical approach on large data sets, this is relatively new research topic that requires much needed attention in the data research and database community. Based on our systematic mapping survey on tuning, this type of approach is not adopted for the last two decades or before.

In this paper, we only briefly cover the enhancements and validation techniques in the state-of-the-art database tuning techniques adopted in research using systematic mapping of survey.

3. Research Design

In this section, we describe our research questions that cover the whole goal of paper. From research of our questions, we derive key terms. Collection of those key terms makes our Search Strategy and Query String. This follows how to setup and tailored selected papers before defining inclusion and exclusion criteria for manuscript or article selection. We prepare a final table for selected papers for our mapping. We describe following factors that support our research methodology.

3.1 Research Questions

First main goal from our surveying mapping study is to summarize all the possible relevant published studies on database tuning, techniques and tools. The objective of this study is to get a general idea of an existing research on database tuning. On the whole aim is defined in the following research questions.

1. To find current trend of research in the state-of-the-art database tuning domains?
   This will result in giving published book chapters, journal and conference papers as well as thesis and technical reports.
2. Which topic in database tuning is studied and investigated more in previous research, and how its study is extended?
   This means we are investigating which dimension of database tuning is studied more in the last 10 years as well as explore those areas that are not in the part of the research.
3. What areas of database tuning are addressed and how many articles covered the different areas?
   This means which database tuning areas are more addressed in the previous and current research, and summarizing the relevant articles to those areas.
4. What type of papers is published in the area with significant contribution or novelty?
   What type of manuscripts or papers has written with novelty, construct validity or some thesis report/ chapter only?

3.2 Search Strategy and Query String

We have a systematic mapping by including research performed between research years 2005 and 2015. In first stage, following query will run on Google scholar and found 36 papers. At second stage, we searched some important conferences and journals.

((“database tuning” OR “database index tuning” OR “database self-tuning”) AND (“SQL tuning” OR “database physical design” OR “database performance tool”)))

3.3 Selection Criteria

This section contains the inclusion criteria and exclusion criteria for the papers. IC and EC mean inclusion and exclusion criteria respectively. We are describing following ICs and ECs as follows.

Inclusion Criteria (IC)

- IC1 means all those papers that are published during 2005 to 2015.
- IC2 means that all the literature that describes database tuning; database tuning techniques all are included.
- IC3 means that we include all those papers that contain empirical studies, surveys, trend analysis or papers on development tools.
- IC4 means including all thesis report, technical report, workshops and experience papers.

Exclusion Criteria (EC)

This section describes Exclusion criteria for the papers that were excluded. EC means exclusion criteria.

- EC1: All those papers are excluded which are not published in the year span of 2005 to 2015.
- EC2: All the irrelevant studies excluded by reading abstract and title.
- EC3: All articles plus those papers which are not written in English were excluded.
- EC4: Papers which did not discuss database tuning techniques were excluded.
- EC5: Papers that did not include database tuning tool were excluded.
- EC6: Appendix is not included.

We included only those papers which are more relevant to our study. After applying IC and EC, we found 91 more related studies that we have searched. All the remaining studies were excluded on defined EC.

Table I: Exclusion Criteria

Exclusion Criteria	Total Papers = 346	Applying Exclusion criteria
EC1	295	51
EC2	195	100
EC3	159	36
EC4	133	26
EC5	98	35
EC6	91	7

Table I describes how our query string's total results are converted into 91 results? We applied every ECs to our total number of papers so that we exclude maximum papers, only related and useful research was targeted.

4. Methodology of Systematic Mapping Survey

Systematic mapping is alternative to systematic literature reviews [14]. Systematic mapping study is required when empirical evidence is too low [15]. The purpose of the study is to recognize gaps between the literatures. This section explains the particular methodology of the research as shown in figure 1. For the systematic mapping, we first make our research questions and from research questions we identify key terms for help in query string. This query string is used on different research engines to find most relevant literature. From the total set of literature, we applied inclusion and exclusion criteria to get more closely related papers to fulfill our claims.

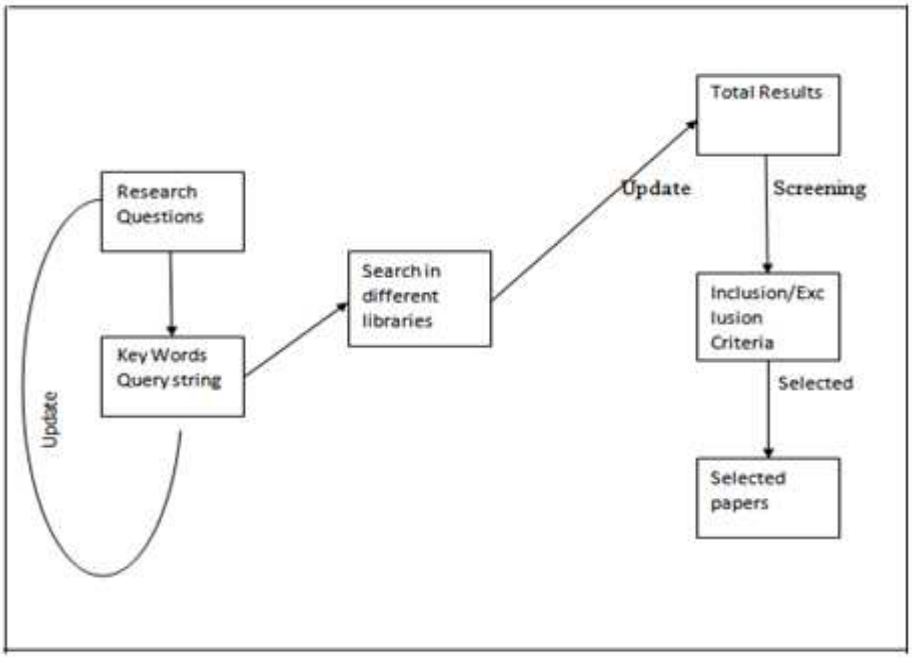

Figure 1: Flow process of systematic mapping

Systematic mapping tells that what the current and overall trend is? In database tuning what are different research areas? In our systematic mapping, there is a broader scope in which we are searching for the trends of database tuning. We searched in Google scholar by above mentioned query string and derive per year result rate of research in database tuning.

4.1 Construct Validity

This section describes the threats to validity of the mapping study are examine in terms of Construct Validity. This describes to what extent the aspect being studied really represents. What exactly the researchers have to investigate according to the prescribed research questions. The term construct validity defines that the keyword or search string is well established or not. In our case, we consider database tuning is well established. The second aspect of construct validity is searching complete literature on selected topic. We search with the query string as well as snow bowl in different conferences and journals to validate that no important paper is missed in this mapping study.

4.2 Reliability

This section describe threats to validity of the mapping study are also examine in terms of Reliability.This means how much of our data is reliable. Reliability in the sense that our results are repeatable or not when some other researcher performs the mapping on the same set of data resources. The inclusion and exclusion criterion for our mapping study is very generic, since it is not a systematic review so; classification scheme that discussed in this mapping study is another threat to reliability. Some other researchers can come up with the similar topic but having different classification scheme and different results.

Table II: Primary research studies

S#	Publication For a	Type	Number
1	Pervasive Computing (ICPC), International Conference, 2015	C	2
2	EDBT'13 Proceedings of the 16th International Conference on Extending Database Technology	C	5
3	IEEE conference on Data Eng. 2012	C	1
4	Oracle Database Performance and Scalability: A Quantitative Approach	BC	1
5	DBTest '09 Proceedings of the Second International Workshop on Testing Database Systems, 2009	W	1
6	ADBIS 2015 Short Papers and Workshops BigDap, DCSA, GID, MEBIS, OAIS, SW4CH, WISARD, Poitiers, France, September 8-11, 2015. Proceedings	W	2
7	Performance Evaluation and Tuning in an Oracle DBMS. na, 2010.	BC	1
8	Data Engineering Workshop, 2008. ICDEW 2008. IEEE 24th International Conference	C	4
9	ACM-SE 47 Proceedings of the 47th Annual Southeast Regional Conference	C	1
10	Progress in Informatics and Computing (PIC), 2014 International Conference	C	1
11	Elsevier	J	1
12	Springer The Big Picture and the Ten Deliverables	BC	2
13	Software Engineering Workshop (SEW), 2009 33rd Annual IEEE	W	1
14	Software Performance Engineering of Databases."	C	1
15	SBBD	W	1
16	OvGUniversitt Magdeburg (2010).	W	1
17	Database Tuning and Self-Tuning.	BC	1
18	PIKM '07 Proceedings of the ACM first Ph.D. workshop in CIKM	W	1
19	Issues in Informing Science and Information Technology	C	1
20	Data Storage and Data Engineering (DSDE), 2010 International Conference	C	1
21	Workshop on Self-Managing Database Systems (SMDB 2009)	W	3
22	Data Engineering Workshop, 2007 IEEE 23rd International	W	1
23	Computer and Information Science, 2008. ICIS 08. Seventh IEEE/ACIS International Conference	C	1
24	Proceedings of science	W	1
25	Advances in Intelligent Information and Database Systems. SpringerBerlin Heidelberg, 2010	BC	1
26	Evaluation Of SQL Performance Tuning Features In Oracle DatabaseSoftware	T	1
27	An architecture for automated index tuning." V Ph. D. and MS SBBD (2006).	T	2
28	Expert Oracle Database 11g Administration (2009)	BC	1
29	Data Engineering Workshops, 2005. 21st International	W	1
30	EDIC RESEARCH PROPOSAL	RP	1
31	Proceedings of the International Multi Conference of Engineers andComputer Scientists. Vol. 1. 2011.	C	1
32	Journal of Information and Data Management	J	1
33	IEEE Data Eng. Bull. 31.1 (2008)	C	1
34	ICDE '09. IEEE 25th International Conference	C	3
35	BharatiVidyapeeths Institute of Computer Applications and Management (2011)	BC	1
36	Workshop de Teses e DissertaesemBanco de Dados	W	1
37	Data Engineering Workshop, 2007 IEEE 23rd International	W	1
38	Oracle Applications DBA Field Guide	BC	1
39	Global journal of computer science and technology	J	1
40	SQL Server 2012 Query Performance Tuning.	BC	1
41	SIGMOD '11 Proceedings of the 2011 ACM SIGMOD InternationalConference on Management of data	C	9
42	Computer Supported Cooperative Work in Design, 2006. CSCWD '06. 10th International Conference	C	1
43	PETRA '08 Proceedings of the 1st international conference on PErvasive Technologies Related to Assistive Environments	C	1
44	PhD '12 Proceedings of the on SIGMOD/PODS 2012 PhD Symposium	T	1

45	Automatic Physical Design of Databases Systems: An OptimizationTheory Approach	T	1
46	Influential Parameters to the Database Performance A Study by Means of Design of Experiments (DoE)	BC	1
47	EDBT '10 Proceedings of the 13th International Conference on Extending Database Technology	C	1
48	27th International Conference on Computers and Their Applications(CATA)	C	2
49	International Journal of Database Theory and Application 8.1, 2015	J	1
50	Data Engineering Workshops, 2005. 21st International Conference. IEEE, 2005.	W	1
51	Systems, Man, and Cybernetics (SMC), 2011 IEEE International Conference. IEEE, 2011.	C	1
52	Proceedings of the 11th international conference on Extending Database technology: Advances in database technology. ACM, 2008.	C	1
53	Journal of Information and Data Management 3.3 (2012):	J	1
54	Encyclopedia of Database Systems. Springer US, 2009.	BC	1
55	proceedings of the 10th WSEAS international conference on Telecommunications and informatics and microelectronics, Nano-electronics, optoelectronics, and WSEAS international Conference on Signal processing. World Scientific and EngineeringAcademy and Society (WSEAS), 2011.	C	1
56	Computer and Automation Engineering (ICCAE), 2010 The 2nd International Conference on. Vol. 1. IEEE, 2010.	C	1
57	Proceedings of the 32nd international conference on Very large databases. VLDB Endowment, 2006.	C	3
58	Optimizer Based Recommendations for Physical Database Design	T	1
59	Proceedings of the Tenth International Workshop on Data Management on New Hardware. ACM, 2014.	W	1
60	Proceedings of the 25th International Conference on Scientific and Statistical Database Management. ACM, 2013.	C	1
61	Parallel & Distributed Processing, Workshops and PhD Forum (IPDPSW), 2010 IEEE International Symposium on. IEEE, 2010.	W	1
62	CoPhy: Automated Physical Design with Quality Guarantees. Technical Report CMUCS-10-109, 2010.	TR	1
63	Journal of Information and Data Management 5.3 (2014): 280.	J	1
64	Managing Data Center Chaos.	BC	1
65	Parallel Processing (ICPP), 2011 International Conference on. IEEE,2011.	C	1
	Total Results	-----	**91**
	BC: Book Chapter, J: Journal, C: Conference, TR: Technical Report, W: Workshop. T: Thesis, RP: Research Proposal		

In table II, we found 91 results including research papers, conference journal papers, workshops, technical reports, thesis reports and book chapters. All the papers are published between 2005 and 2015, and analyzed by the publication.

5. Classification

In this section, we explain the classification design for our literature. According to our research focus, we categorize our literature into five categories described in section 1.

Table III: Classification of literature

Category 1	Category 2	Category 3	Category 4	Category 5
Query Optimization	Database Performance	Database Tuning cost	Physical database design	Database Tuning

We introduce categories of classification to add published literature based on main focused area. We can easily map the published papers in each category of table III. Category Query optimization includes all those manuscripts, articles or papers that is focused on the large running time of query processing. For these queries, some mechanisms have recently proposed to overcome queries running time, and make the queries faster in terms of time and cost margins.The category Database Performance optimization includes the papers related to the performance enhancements and optimization of the database. Third category Database Tuning includes the paper related to index tuning, database physical and logical design that also covers fourth category which refers the papers of partitioning, block size, and extents management. Fourth category Database Tuning cost includes all those papers published on tuning cost. Fifth category includes physical database design includes all those papers related to the physical design of the database.

Table IV describes the year wise focused research of our classified categories. In this table the area named as database cost tuning is looking immature because of less research.

Table IV: Research focus of classified categories

	Research Focus											
Research Focus	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
Database Tuning	3	4	1	3	7	3	4	4	2	2	5	38
Physical Design	1	2	4	5	4	4	2	1	1	-	-	24
Query Optimization	-	2	-	1	4	3	1	2	6	3	1	22
Database Cost Tuning	-	-	2	-	-	-	1	-	-	-	-	3
Total												87

Table V describes the research focus in terms of type of publication. For example, how many book chapters, conference and journal papers, workshops thesis report, and technical report were published yearly?

Table V: Research focus in terms of publications

	Research Focus											
Types of Publications	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
Book chapter	-	-	2	-	2	5	-	2	-	-	-	11
Conference Paper	-	4	1	7	2	8	11	3	5	3	2	46
Journal Paper	-	-	-	-	-	2	1	2	1	1	1	8
Workshop Paper	1	-	4	4	5	3	-	-	-	2	1	20
Thesis Report	-	1	-	2	-	1	-	1	-	-	-	5
Technical Report	-	-	-	-	-	1	-	-	-	-	-	1
Total												87

Tables IV and V report 87 results as we have excluded peer reviewed papers including blogs and presentations.

5.1 Distribution over Research Focus

This section describes the research focus on database tuning during our mapping study. This category is divided into four sub categories: typical database tuning, physical & logical design, query optimization, and database tuning cost as shown in figure 2. Number of columns has different number of studies published during 2005 to 2015. However, table IV shows an overview of published results.

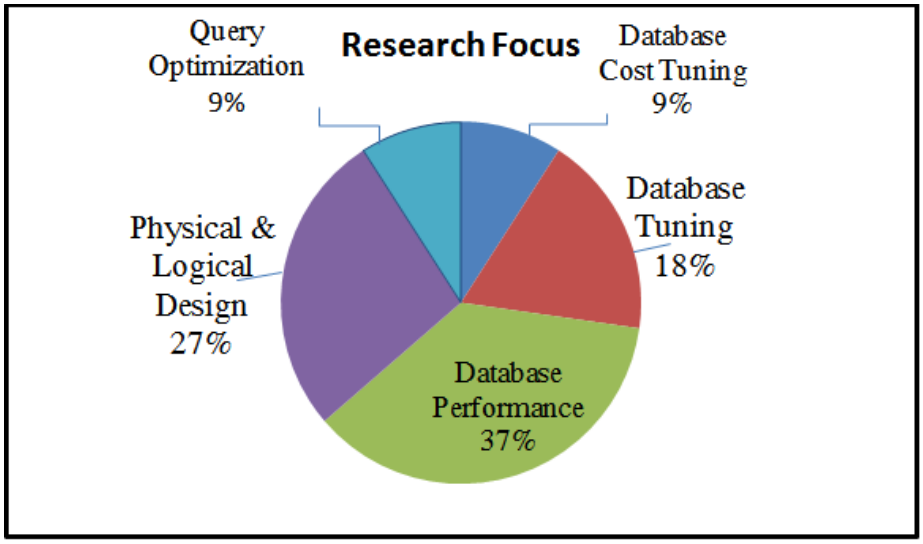

Figure 2: Research Focus

5.2 Distribution over Publication Types

This section describes the distribution over publication types. Publication types describe what type of research published? In this regard, we classify all literature into state-of-the-art six categories: book chapter, conference paper, journal paper, workshop, thesis reportand technical report. Table V gives an overview of categories. From the table IV, we can see easily how the trend is going on? We analyzed that 11% research is publish as a book chapter, 46% of the research is publish as in different conferences as shown in table V. Also, 20% workshops and only 8% journal research is published in the recent 10 years. As long as 5% thesis report from MS and PhD's conducted their research in this domain, and only 1% research is managed in the form of technical report. Figure 3 shows research type percentiles of research types of table V.

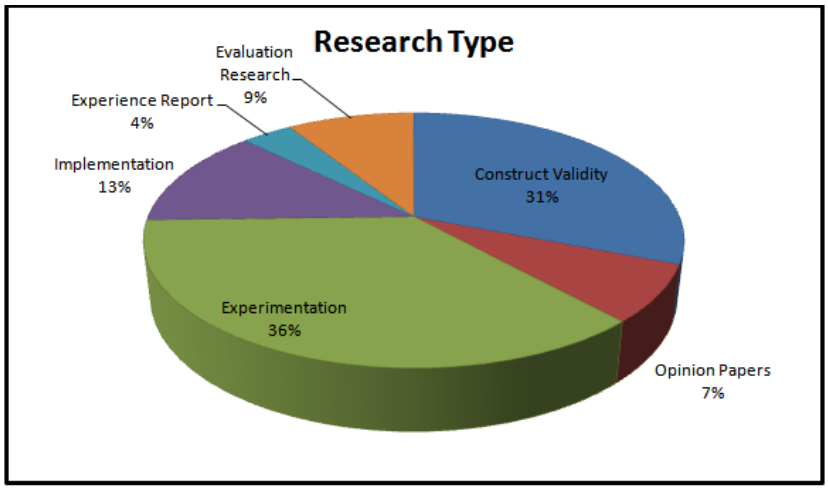

Figure 3: Research Type

6. Mapping Research on Database Tuning

Figure 4 shows a systematic map over the state-of-the-art research related to database tuning, types, methods and tools. Mapping consists of distributed research over time and type of contribution. The number of publications at each side is different from other. In some row number of studies has same size bubble means in this particular time span the proposed solution, and novel approach both are present in one research paper. So, these kinds of studies are in both sides. Figure 4 shows a bubble chart in three columns or portions, the middle portion stated as research focus mainly consist of the categories of classification. The other two categories are contribution type and research type. Contribution type is divided into: 1) Tool, 2) Method, 3) Model, 4) Metric and 5) Open items. All papers related to any proposed tool that supports database tuning are placed into this category. This category includes all prototypes as well as open source tools and on request tools. Methods include all those papers that explain database tuning process through some flowchart by specific or detail working procedures. Models are the abstract representation of information that is used in database tuning. Many researchers proposed their own models to reduce database tuning cost. All papers related to this are placed in the models category.

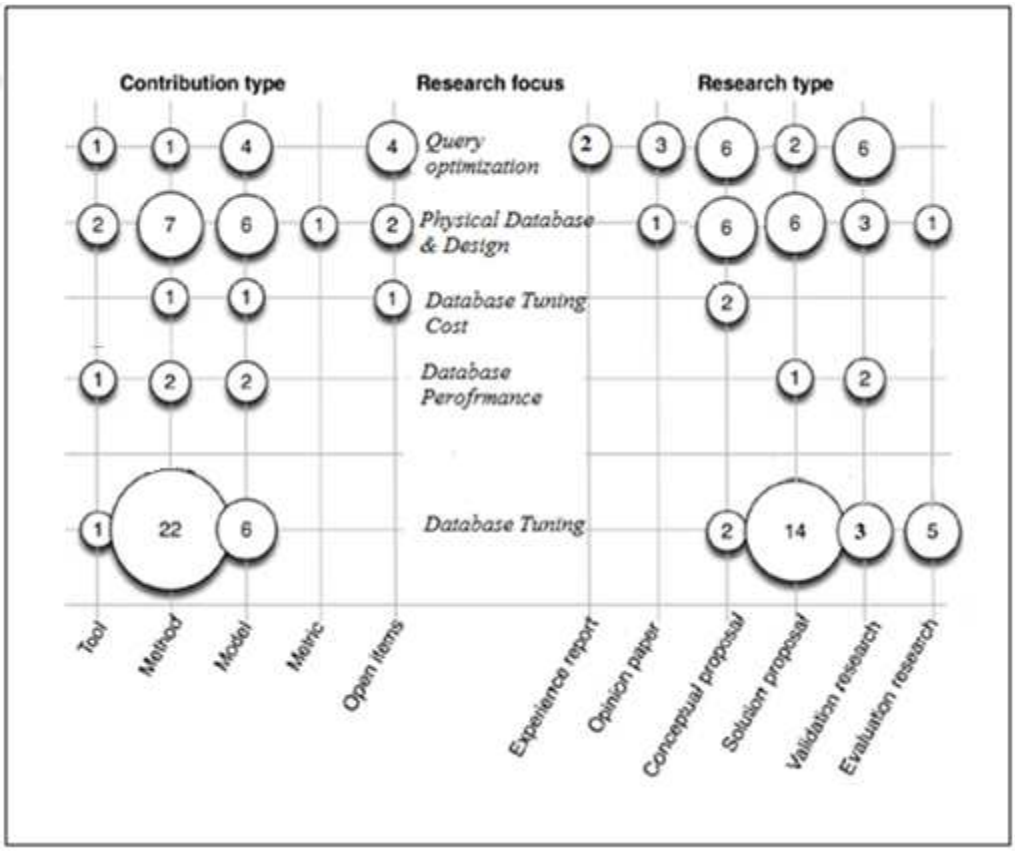

Figure 4: Bubble chart of studies on tuning

In figure 4, bubble chart shows research in the database tuning in three types such as contribution type, research focus, and research type.Bubble chart contains small and large bubbles. Each bubble contains their number. As the number of studies increases the bubble becomes bigger. Such as, the maximum studies published in database tuning with 22 research papers shown with bigger bubble.

Open items mean those papers that have some prototypes or on-request available tools for database tuning placed in this category. Some Tools are open source and freely available tools.

The last category of research type is Research Type comprised into six categories: 1) Validation Research, 2) Evaluation Research, 3) Solution proposals, 4) conceptual proposals, 5) Opinion Papers and 6) experience papers.

Validation research means revealing the proposed solution that is not been proposed earlier, or in other words novel research. Validation research is carried out by proposing some method, simulation, systematic analysis, conducting an experiment and mathematical proofs etc.

Evaluation Research means that finding a problem that is not yet solved and proposed some solution for that problem. After the proposed work their methodology is validated by applying solution on some case study, fields experiment etc.

Novel solution is described in Solution Proposal category to extend some existing approach or technique. A conceptual proposal is a form of solution proposal. Opinion papers reports the author's opinions means what is the current trend in the particular domain. Certain papers describe some real time experiences based on one or more author's experiences of their real life projects or industry.

6.1 Threats to Validity Affecting Results

This section provides threats that are directly or indirectly affect our study results. Our final bubble chart contains five main categories including database tuning, database performance, query optimization, physical & logical designand database cost tuning. Some papers have overlaps over two categories query optimization and database performance tuning. We include such papers in major category that is database tuning. So, the first category database tuning represents the bigger bubble. The automation category and tool support category represent the paper that published in the same context.

The research that is carried out in the context of database tuning cost is represented in the category of database tuning cost. These results are drawn from our primary studies shown in bubble chart.

The classification scheme is revised in two iterations by first and second author. However, there are also some criteria in which we excluded the papers. It might be possible that we may miss some relevant papers. We consider our systematic mapping as a repeatable study, reports same number of results.

7. Conclusion and Future Work

Database tuning is the process of building a database application run more rapidly. A large number of data that slows down the throughput of application manages by database administrator whereby tasks related to state-of-the-art configurations perform to speed up the execution time. These tasks are time consuming as well as very hectic for DBA. So, a new approach named as self-tuning appears, this supports automatically tuned the large data into separate logical partitions so the searching time is lower than before. This process of making a database application run quickly or automatically tuning is applied on data, it has some cost issues. Many researchers devoted their research in the recent years and proposed some models, approaches to enhance and minimize the cost of database tuning in certain domains. A large number of methods, approaches and tools are available but still there is a lack of empirical studies, validation research, construct validity, systematic mapping and general surveys etc. This study provides an opportunity of comprehensive systematic mapping to survey in existing research in the domain of database tuning. In our study reports some significant results are answering our research questions.

There is quite a scope to work and enhance database tuning techniques, as well as there is a need of comparative analysis between approaches. Our results show that there are 91 studies and are published in different conference, workshops and journals in one decade. These results show the overall papers have been published in different domains of database tuning, for example, query optimization, index, physical and logical tuning, and performance tuning. Furthermore, in order to produce upcoming research in this field, we also emphasize the major opportunities and challenges for learning from database tuning in terms of data integration best practices [18].

REFERENCES

1. Chaudhuri, Surajit, and Vivek Narasayya. "Self-tuning database systems: a decade of progress." Proceedings of the 33rd international conference on Very large data bases. VLDB Endowment, 2007.
2. Myalapalli, Vamsi Krishna, and Muddu Butchi Shiva. "An appraisal to optimize SQL queries." Pervasive Computing (ICPC), 2015 International Conference on. IEEE, 2015.
3. Liu, Lixia, and Xiaohua Qiu. "A database optimization method based on program business logic adjustment." Progress in Informatics and Computing (PIC), 2014 International Conference on. IEEE, 2014.
4. Fernandez, Ignatius. "Database Tuning." Beginning Oracle Database 12c Administration. Apress, 2015.
5. Cebollero, Miguel, Jay Natarajan, and Michael Coles. "Performance Tuning."Pro T-SQL Programmer's Guide. Apress, 2015.
6. Lee, Yoonkyong, et al. "eTuner: tuning schema matching software using synthetic scenarios." The VLDB Journal—International Journal on Very Large Data Bases 2007.
7. Agrawal, Sanjay, et al. "Database tuning advisor for Microsoft SQL server 2005: demo." Proceedings of the 2005 ACM SIGMOD international conference on Management of data. ACM, 2005.
8. Allano, Lorene, Bernadette Dorizzi, and Sonia Garcia-Salicetti. "Tuning cost and performance in multi-biometric systems: A novel and consistent view of fusion strategies based on the Sequential Probability Ratio Test (SPRT)."Pattern Recognition Letters 31.9 2010.
9. Kaufmann, Martin, et al. "Benchmarking Bitemporal Database Systems: Ready for the Future or Stuck in the Past?." EDBT. 2014.
10. Tyde, F. "Oracle Cloud Computing Strategy." Program Executive, High Performance, Grid, Cloud Computing Oracle ASEAN 2009.
11. Petcu, Dana, et al. "Portable cloud applications—from theory to practice."Future Generation Computer Systems 29.6 .2013.
12. Manoj, V. "Comparative study of nosql document, column store databases and evaluation of Cassandra." International Journal of Database Management Systems 6.4 2014.
13. Elmasri, Ramez. Fundamentals of database systems. Addison Wesley, 5th Edition, 2010.

14. Petersen, Kai, et al. "Systematic mapping studies in software engineering."12th international conference on evaluation and assessment in software engineering 2008.
15. Engström, Emelie, and Per Runeson. "Software product line testing–a systematic mapping study." Information and Software Technology 2011.
16. Belknap, Peter, et al. "Self-tuning for SQL performance in Oracle database 11g." 2009 IEEE 25th International Conference on Data Engineering 2009.
17. GUO, Zhong-nan, and Fan-rong MENG. "Research of optimizing relational database performance [J]." Computer Engineering and Design 2006.
18. J. Aliakbari, A. Hassanzadeh, A. Aliakbari, and M. Taherkhani, The Investigation of the Impacts of Advanced Consistency Mechanism on Organizational Process Integration, Journal of Basic and Applied Scientific Research, TextRead Publication, Vol. 3(5), pp. 27-33, (2013).