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"A Pragmatic Analysis of OLAP Technology Significance in Banking"

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Abstract

The current research study entitled "A Pragmatic Analysis of OLAP Technology Significance in Banking" was undertaken with the objective of finding out various factors which influence significance and importance of OLAP technology in various facets of banking in India. OLAP stand for Online Analytical Processing, based on multidimensional data model. The user analyst and managers easily and selectively extract and view data from different points of view by using computer processing technique i.e OLAP. The managers and user analyst get an insight of the information through fast, consistent, and interactive access to information. OLAP is an effective technology for data discovery that includes capabilities for limitless report viewing, complex analytical calculations, and predictive "what if" scenario (budget, forecast) planning. This technology is been used in many Business Intelligence (BI) applications. Exploratory and analytical research methodology for data collection and analysis was used in current research study on 100 respondents (bank employees) who are working under various domain of banking Information technology divisions as well as bank employees who uses the IT based OLAP domain for successful functioning of day to day banking. Respondents opinion were statistically analyzed with One Way ANOVA with the help of SPSS Software and the obtained P value was highly significant therefore the results concluded in rejection of null hypothesis and acceptance of alternate hypothesis which states that H_1 - There is a significant relationship between OLAP technology and successful functioning of banking. The paper concludes that OLAP technology, data mining technique and OLAP Cube are the best way of fast searching data from large amount of database with in fractions of seconds. Data cube store large banking data which are used by the administrator or customer. Thus OLAP holds an important significance in day to day functioning of banking operations.

Key Words: - *ANOVA, Banking, Data Mining, Data Warehousing, OLAP, Technology*.

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1. INTRODUCTION:

OLAP operations include rollup (increasing the level of aggregation) and drill-down (decreasing the level of aggregation or increasing detail) along one or more dimension hierarchies, slice-and-dice (selection and projection), and pivot (re-orienting the multidimensional view of data).

The different sources might contain data of varying quality, or use inconsistent representations, codes and formats, which have to be reconciled. Finally, supporting the multidimensional data models and operations typical of OLAP requires special data organization, access methods, and implementation methods, not generally provided by commercial DBMSs targeted for OLTP. It is for all these reasons that data warehouses are implemented separately from operational databases.

Data warehouses might be implemented on standard or extended relational DBMSs, called ***Relational OLAP (ROLAP) servers***. These servers assume that data is stored in relational databases, and they support extensions to SQL and special access and implementation methods to efficiently implement the multidimensional data model and operations.

In contrast, ***multidimensional OLAP (MOLAP)*** servers are servers that directly store multidimensional data in special data structures (e.g., arrays) and implement the OLAP operations over these special data structures.

There is more to building and maintaining a data warehouse than selecting an OLAP server and defining a schema and some complex queries for the warehouse. Different architectural alternatives exist. Many organizations want to implement an integrated enterprise warehouse that collects information about all subjects (e.g., customers, products, sales, assets, personnel) spanning the whole organization.

An OLAP (On-Line Analytical Processing) server enables a more sophisticated end-user business model to be applied when navigating the data warehouse. The multidimensional structures allow the user to analyze the data as they want to view their business – summarizing by product line, region, and other key perspectives of their business. The Data Mining Server must be integrated with the data warehouse and the OLAP server to embed ROI-focused business analysis directly into this infrastructure. An advanced, process-centric metadata template defines the data mining objectives for specific business issues like campaign management, prospecting, and promotion optimization. Integration with the data warehouse enables operational decisions to be directly implemented and tracked.

As the warehouse grows with new decisions and results, the organization can continually mine the best practices and apply them to future decisions. This design represents a fundamental shift from conventional decision support systems. Rather than simply delivering data to the end user through query and reporting software, the Advanced Analysis Server applies users' business models directly to the warehouse and returns a proactive analysis of the most relevant information.

These results enhance the metadata in the OLAP Server by providing a dynamic metadata layer that represents a distilled view of the data. Reporting, visualization, and other analysis tools can then be applied to plan future actions and confirm the impact of those plans.

Database applications in bank systems solve two basic spheres of problems:

1. To supply daily bank service (e.g., to maintain client accounts)
2. To perform a huge analysis for obtaining details for evaluation of a bank activity and for decision making

The first mentioned domain of problems represents a task for transaction processing in OLTP systems (On Line Transaction Processing). Recording new balance on client accounts in a bank is one example of this type of transactions.

A bank service can represent a work of several applications, where every one of them can operate on an independent OLTP database. For example, in our bank all data about client accounts and data from The General Ledger are processed by two applications and stored in separated databases.

The second mentioned problem is a task for DSS systems (Decision Support System). This kind of systems solves a role of data synthesis from various input databases and summarization of these data according to required criteria. This represents a base level for preparing details for large data analysis, which should be executed in real time (e.g., a balance on risky loan accounts, a comparison of expensive and cost accounts in the whole bank, individual branches or cost centers).

The original idea of RDBMS (Relational Database Management System) was to provide a solution of both mentioned tasks on the same database. At this time, Commercial DBMSs do not offer adequate support for simultaneous resolution for both problems.

This situation led to a necessity to use a different access to data presentation and their performance. This was a beginning of multidimensional databases, which allow preparing multidimensional views on the same data. OLAP systems (On Line Analytical Processing) are implementation of a multidimensional data access.

2. REVIEW OF LITERATURE

A detailed Literature has been reviewed to make the study relevant. Few key observations obtained from Literature cited are elaborated below:

Sivakumaran (2005), believes that adoption of technology has led to the following benefits: greater productivity, profitability, and efficiency; faster service and customer satisfaction; convenience and flexibility; 24x7 operations; and space and cost savings.

Berger (2003), the usage of information technology (IT)xx broadly referring to computers and peripheral equipment, has seen tremendous growth in service industries in the recent past. The most obvious example is perhaps the banking industry, where through the introduction of IT related products in internet banking, electronic payments, security investments, information exchanges, banks now can provide more diverse services to customers with less manpower.

Willcocks (1994), Information systems/information technology investment may be described as any acquisition of software or hardware which is expected to expand or increase the business benefits of an organization's information systems and render long-term benefits.

Jeffrey A. Clark; Thomas F. Siems (2007) investigate the importance of including aggregate measures of off-balance-sheet (OBS) activities. The results indicate cost X-efficiency estimates increase with the inclusion of the OBS measure. Profit X-efficiency estimates are largely unaffected. Further, the composition of banks' OBS activities appears to help explain interbank differences in cost and profit X-efficiency estimates.

Asiki et al (2005). presented a similar method that uses concept hierarchies; however, similar to, it does not contain a centralized tree structure. In another study by Asiki et al. in authors improved their previous work and implemented a decentralized concept hierarchy on a grid system. The new method is similar to the DC-tree and is able to perform updates and lookups simultaneously.

In another study by Doka et al. (2009) an online system was presented that is capable of performing online OLAP operations. Their method is based on concept hierarchies similar to other researchers; however, the method lacks a multi-dimensional data indexing structure such as R-tree. The method tries to integrate the concept hierarchies of different dimensions and use them to store input data. This is in contrast to the DC-tree method in which input data is stored in a single tree-like data structure. The most recent work by Doka et al. called Brown Dwarf which tries to build a distributed version of the originally centralized Dwarf method in peer-to-peer networks. The method is parallelized

over the network and provides online update and query transactions. A similar work based on the DC-tree is presented in which emphasizes on the temporal features of data warehouse. The method is called TiC-tree and provides extensions to the DC-tree to support temporal data warehouses.

In spite of the recent efforts, parallelization of Real-time OLAP on multi/many-core processors has not been addressed yet. However, as referred above, there have been few methods that parallelize Real-time OLAP for other parallel platforms such as peer-to-peer and grid systems. Yet, cloud platforms open a new area for parallelization of **Real-time OLAP.**

Apart from data warehousing methods, there have been a few studies for providing indexing structures on cloud systems. These efforts were usually for general data indexing in 1-dimensional and multi-dimensional spaces. B-trees and its variants are usually considered for 1-dimensional data indexing on cloud, while for multi-dimensional data indexing, R-trees are applied. In a research, global and local R-trees were used to index multi-dimensional data in a cloud environment. However, the method does not support hierarchical data present in OLAP and data warehousing systems. A similar multidimensional index was proposed in a research paper.

According to the study of Dr Harsh Dev and Suman Kumar Mishra (2010) "Combating with immense competition now a day's banks are focusing upon customer satisfaction rather than merely rendering their services in the Indian banking industry". Due to the tough competition in banking sector, paradigm changes are seen in this sector. Today, banking sector is bombarded with a large number of innovative facilities, which comprises of: Centralized banking system, Internet banking, Mobile banking, SMS Alert, Smart card, RTGS, E-banking, ATM and various other such wonderful facilities, which make the work faster & easier. They discuss presents decision support in banking sector which link up the strengths of both OLAP and Data Mining. The main objective of them is to develop enhanced model for banking sector for improving the efficiency and to check the emergence & creation of innovative ways in this field. They discuss the implementation of data cube and mention how the combination of OLAP and Data mining effectively provide advanced decision support. This is not possible using OLAP or data mining alone. They concluded that for large amount of databases, data cube design & implementation technique is suitable for faster search of data within a fraction of second. Cubes store large amount of banking data which can be used by the administrator/customer, who can search the desired record online in an efficient way.

3. RESEARCH METHODOLOGY

RESEARCH METHODOLOGY	
Objectives of Research	• To elucidate various factors of OLAP technology which helps in Banking . • To analyze significance of OLAP in various facets of Banking.
Hypothesis of Research	H_0: - There is no significant relationship between OLAP technology and successful functioning of banking.
Research Design	Exploratory – To know the parameters and formulate the hypotheses. Analytical – To analyze the parameters found out.
Selected Universe	Back office (IT) based offices of banking service providers.
Sampling Design	Stratified Random sampling Method
Sample Size	Employees of banking who are using OLAP in various domains and IT technologists providing OLAP support for banking
Data collection Techniques	Primary Data collection – A framed set of questionnaire Secondary Data Collection – Research reports of Banking, IT Companies, Annual reports, Computer, IT books, journals, research papers etc.
Analytical tools For Pilot Study	Cronbach's alpha for reliability and Kaiser Meyer's Rank Test for Variability
Statistical Analysis for hypothesis testing	Chi Square Test, Multivariate ANOVA, Students't' test.

4. RESULTS AND ANALYSIS

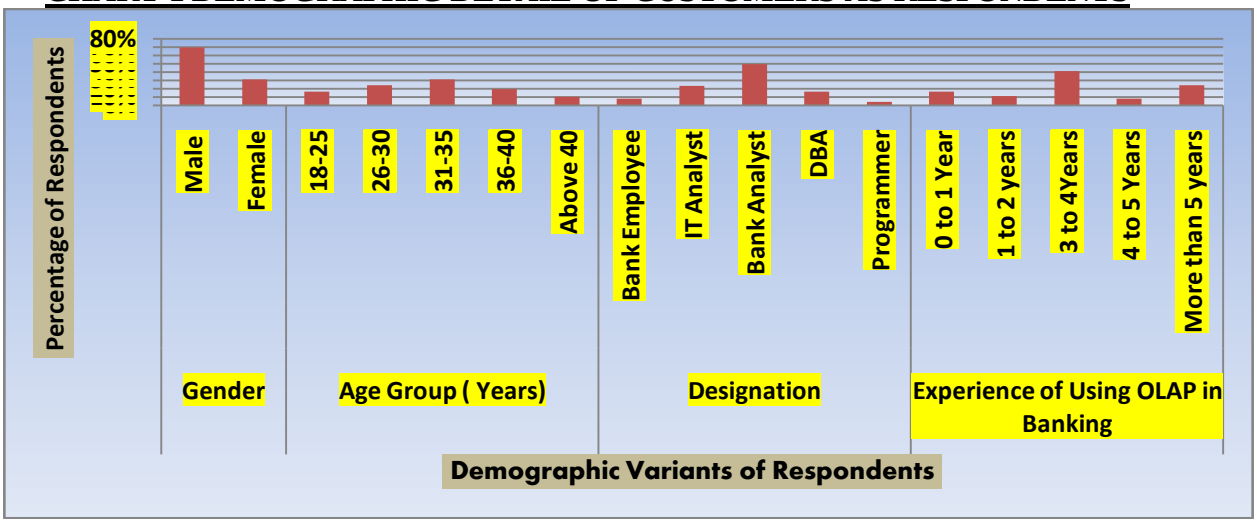
4.1 DEMOGRAPHIC DETAILS OF RESPONDENTS

Demographic study means study of both quantitative and qualitative aspects of selected human population. Quantitative aspects include composition, age, gender, size, and structure of the population. Qualitative aspects are the research specific factors such as Type of OPLA usage by banking personnel etc. Demographic variables of current research study are evaluated in table 1 below.

TABLE 1 DEMOGRAPHIC DETAILS OF CUSTOMERS AS RESPONDENTS

Sample characteristic	Category	No of Respondents (N=100)
Gender	Male	69%
	Female	31%
Age Group (Years)	18-25	16%
	26-30	24%
	31-35	31%
	36-40	19%
	Above 40	10%
Designation	Bank Employee	8%
	IT Analyst	23%
	Bank Analyst	49%
	DBA	16%
	Programmer	4%
Experience of Using OPAL in Banking	0 to 1 Year	16%
	1 to 2 years	11%
	3 to 4Years	41%
	4 to 5 Years	8%
	More than 5 years	24%

CHART 1 DEMOGRAPHIC DETAIL OF CUSTOMERS AS RESPONDENTS



Both Male and Female bank employees who deal with various facets of OLAP were analyzed as respondents of current study. 69% of respondents were male whereas 31% of respondents were female. All age group of respondents acted as respondents of current research study, which makes the study more reliable. 18 to25 years of respondents are 16%, 26 to 30 years are 24% and 31 to 35 years of respondents who utilize OLAP technology are maximum i.e 31%.

Another important demographic parameter which correlates with current research study is designation of respondents. This correlates with the usability of OLAP technology in daya to day functioning of Banking. 8% of respondents are general bank back end employees who wr indirectly correlated with OLAP. 23% are IT analyst from various IT firms but working under various bank project domain of OLAP.49% i.e maximum are

bank analysts who are using OLAP in various determinants.16% are DBA and 4% are bank programmer.

Usage of OLAP justifies its significance as many respondents have varied experience for using OLAP tools, as 11% have one year experience, 41% have 3 to 4 years of experience.

4.2 CORRELATION PARAMETRS FOR EVLAUATIING OLAP TECHNOLOGY IN BANKING

In current research parameters for evaluating OLAP technology in banking was analyzed for selected respondents. Results are depicted in table 2 below:

TABLE 2 CORRELATION PARAMETRS FOR EVLAUATIING OLAP TECHNOLOGY IN BANKING

Q.No	STATEMENT	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
VARIABLE - OLAP UTILITY						
LIKERT SCORE →		**1**	**2**	**3**	**4**	**5**
1.	OLAP provides Multi-Dimensional Conceptual View	8	11	16	37	27
2.	OLAP provides Higher Transparency	4	16	10	32	38
3	OLAP provides Easy Accessibility	15	18	19	38	10
4	Consistent Reporting Performance is significant with OLAP	18	11	14	46	11
5	OLAP products are capable of operating in a client-server environment.	17	27	12	37	7
VARIABLE- GENERIC DIMENSIONALITY OF DATA IN OLAP						
1	OLAP have Structural Data Dimensionality	10	19	18	42	11
2	OLAP have Operational Data Dimensionality capabilities - In basic data structures	5	19	20	44	12
3	OLAP have Operational Data Dimensionality capabilities - In formulae	9	17	14	38	22
4	OLAP have Operational Data Dimensionality capabilities - In reporting formats	10	16	15	47	12
5	Generic Dimensionality of Data in OLAP is not biased.	12	21	16	41	10

The OLAP tools' physical schema must adapt fully to the specific analytical model being created to provide optimal sparse matrix handling. For any given sparse matrix, there exists one and only one optimum physical schema. This optimal schema provides both maximum memory efficiency and matrix operability unless of course, the entire data set can be cached in memory. The OLAP tool's basic physical data unit must be configurable to any subset of the available dimensions, in any order, for practical operations within large analytical models. The physical access methods must also be dynamically changeable and should contain different types of mechanisms which can be assed for desired research below in table 3

TABLE 3 OLAP TOOLS' PHYSICAL SCHEMA

Q.No	STATEMENT	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
VARIABLE- DYNAMIC SPARSE MATRIX HANDLING THROUGH OLAP						
LIKERT SCORE →		**1**	**2**	**3**	**4**	**5**
1.	Direct Calculation	10	15	6	36	33
2.	B-trees and derivatives	13	14	8	37	28
3	Hashing	14	16	7	49	24
4	The ability to combine these techniques where advantageous	19	17	14	34	16
5	Sparseness	10	18	15	45	12
VARIABLE- MULTI USER SUPPORT BY OLAP						
1.	Satisfied with OLAP multi User Support system	2	21	15	37	25
2.	OLAP provides Concurrent access - retrieval	10	24	10	39	17
3	OLAP provides Concurrent access - Update	16	12	14	45	13
4	OLAP provides multi user Integrity	14	18	16	39	13
5	OLAP provides multi user Security	11	12	15	55	07

HYPOTHESIS TESTING

In current research study on table 3 and 5 OLAP correlation parameters and OLAP tools' physical schema of respondents the values were statistically analyzed above Likert's scale values with one way ANOVA by using SPSS and results are as mentioned :

ANOVA							
GROUP			**Sum of Squares**	**df**	**Mean Square**	**F**	**P Value (Sig)**
BANK RESPONDENTS / IT ANALYST/ DBA	**OLAP UTILITY**	**Between Groups**	**1.472**	**5**	**.294**	**1.010**	**.023**
		Within Groups	**58.610**	**5**	**.292**		
		Total	**60.082**	**5**			
	GENERIC DIMENSIONALITY OF DATA IN OLAP	**Between Groups**	**5.322**	**5**	**1.064**	**3.746**	**.003**
		Within Groups	**57.118**	**5**	**.284**		
		Total	**62.440**	**5**			
	DYNAMIC SPARSE MATRIX HANDLING THROUGH OLAP	**Between Groups**	**.580**	**5**	**.116**	**.546**	**.071**
		Within Groups	**42.710**	**5**	**.212**		
		Total	**43.290**	**5**			
	MULTI USER SUPPORT BY OLAP	**Between Groups**	**1.493**	**5**	**.299**	**.947**	**.051**
		Within Groups	**63.364**	**5**	**.315**		
		Total	**64.858**	**5**			

Respondents opinion were statistically analyzed with One Way ANOVA with the help of SPSS Software and the obtained P value was highly significant therefore the results concluded that null hypothesis H_0: - *There is no significant relationship between OLAP technology and successful functioning of banking* is rejected and alternate hypothesis which states that H_1 :There *is no significant relationship between OLAP technology and successful functioning of banking* is accepted and proved.

6. CONCLUSION AND RECOMMENDATIONS

We know that OLTP system support data modeling or for recording based business transaction. All the information are view in 2-D. To access this information typically we use SQL (Structured Query Language) and then process information comes with the result in the form of "reports". OLAP uses multidimensional tables called data cubes or OLAP cube. To search for relevant information user can filter, slice and dice, drill-down and roll-up the data. Nowadays OLAP is playing a very important role in banking sector in India. In India banks are providing various services to attract their customers due to tough competition. There are a lot of changes seen in recent years in the field of banking industry. Now banks are adopting innovative ideas for improving their services and to get the faith of their customer .These innovative services comprise of: centralized banking system, mobile banking , internet banking , NACH, SMS alert , RTGS, smart card, ATM and many more. This paper presents OLAP & data mining strengths which link up the decision support system of banking sector. The objective of this paper is to Pragmatic Analysis of OLAP Technology Significance in Banking" was undertaken with the objective of finding out various factors which influence significance and importance of OLAP technology in various facets of banking in India. OLAP stand for Online Analytical Processing, based on multidimensional data model. . Respondents opinion were statistically analyzed with One Way ANOVA with the help of SPSS Software and the obtained P value was highly significant therefore the results concluded in rejection of null hypothesis and acceptance of alternate hypothesis which states that H_1 - There is a significant relationship between OLAP technology and successful functioning of banking. The paper concludes that OLAP technology, data mining technique and OLAP Cube are the best way of fast searching data from large amount of database with in fractions of seconds. Data cube store large banking data which are used by the administrator or customer. Thus OLAP holds an important significance in day to day functioning of banking operations.

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