Financial Data Management and Innovations – New Trends in Corporate

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ABSTRACT
Financial data management is a set of processes and policies — usually assisted by specialized software — that enable an organization to consolidate its financial information, maintain compliance with accounting rules and laws, and produce detailed financial reports. This paper presents the chronological development of the database management system, role of artificial intelligence and machine learning in near future and the challenges in database management. The emerging trends in database management system covered mainly the focus of the corporate world on developing the systems to face forthcoming challenges of competition and security.
Keywords: Data management, financial data management, innovations in data management, trends in data management.

I INTRODUCTION

The data are a set of values of qualitative or quantitative variables about one or more persons or objects. In the present context, Database is any collection of electronic records that can be processed to produce useful information. The data can be accessed, modified, managed, controlled and organized to perform various data-processing operations. The data is typically indexed across rows, columns and tables that make workload processing and data querying efficient.

The user organizations require technology solutions to maintain, secure, manage, and process the data stored in databases. Here comes the role of Database Management Systems (DBMS) which refers to the technology solution to optimize and manage the storage and retrieval of data from databases. It offers a systematic approach to manage databases via an interface for users as well as workloads accessing the databases via apps. Figure 1 shows the basic elements of a database management system.

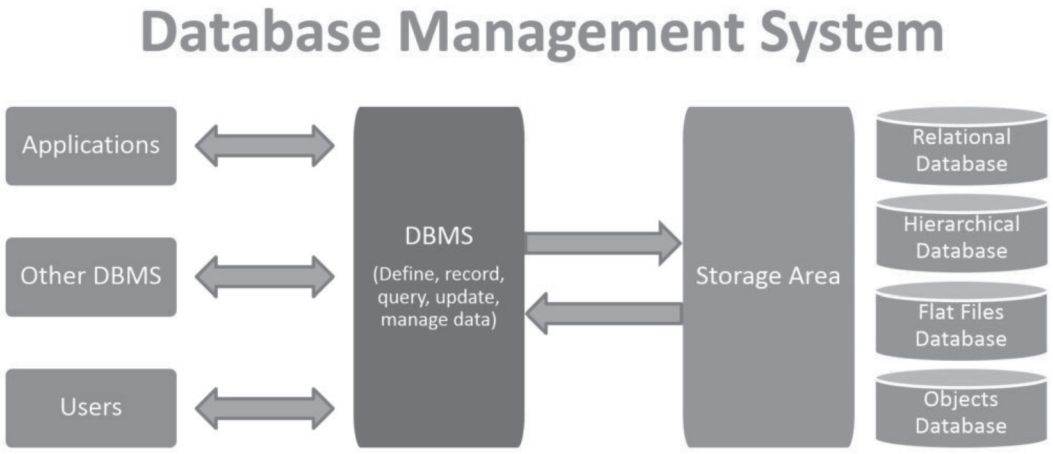

Fig. 1 Database management system [1]

This paper deals with the development of the DBMS since the inception of the large memory based fast computing systems.

II A TIMELINE OF DATABASE HISTORY

(a) Overview -Human began to store the information long ago. Even during mid-1950s, data used to be maintained by government offices, libraries, hospitals, and business organizations and some of the basic principles of these systems are still in used. Table 1 presents an overview of the chronological development of database management system.

Table 1
Development of database management [2]

Duration	Developments
1960s	The database first started computerization in the private sector when the use of computers offered a cost-effective option. In the beginning, data models were namely, a network model CODASYL and a hierarchical model IMS. However, commercially success was the SABRE system owned by Sabre Corporation to help American Airlines in first online reservations system.
1970 to 72	E.F. Codd proposed the relational database model in which the database's schema, or logical organization, is disconnected from physical information storage. Gradually it became the standard basic principle for database systems.
1970s	Two major relational database system prototypes were developed during 1974 to 1977. The Ingres was developed at UBC whereas System R. was created at IBM San Jose. Ingres used a query language, QUEL which led to the development of systems such as Ingres Corp., MS SQL Server, Sybase, Wang's PACE, and Britton-Lee. System R used the SEQUEL query language which to led the development of SQL/DS, DB2, Allbase, Oracle, and Non-Stop SQL. The term RDBMS (Relational Database Management System) became popular during the decade.
1976	P. Chen proposed a new database model, Entity-Relationship (ER). It was made feasible by this model for the designers to concentrate on data application in place of logical table structure.
1980s	The adoption of Structured Query Language (SQL) and Relational database systems resulted in rapid growth in the database market. The database product DB2 of IBM and the introduction of the IBM PC resulted in induction of new database companies and development of products such as PARADOX, RBASE 5000, RIM, Dbase III and IV, OS/2 Database Manager, and Watcom SQL etc.
Early 1990s	New client tools for application development were released, and these included the Oracle Developer, PowerBuilder, VB, and others. A number of tools developed included ODBC and Excel/Access. Prototypes for Object Database Management Systems (ODBMS) were created.
Mid 1990s	The advent of the Internet led to exponential growth of the database market. The use client-server database systems to access computer systems started that contained legacy data.
Late 1990s	The demand for Internet database connectors, such as Front Page, Active Server Pages, Java Servelets, Dream Weaver, ColdFusion, Enterprise Java Beans, and Oracle Developer 2000 increased rapidly. The open source solution to the intrnet was offered by the use of cgi, gcc, MySQL, Apache etc. The online transaction processing and online analytic processing witnessed the drastic change with the increased use of point-of-sale technology.
2000s	The database applications, mainly the interactive type, continue to grow. In the western world, the leading database companies are Microsoft, IBM, and Oracle.

(b) Present Scenario - Today, databases are used in our routine life mainly due to databases. Many companies offer the non-relational database space based tailor-made specific solutions. The giant relational databases include Oracle, MySQL, and DB2. The emerging trends focus on developing user friendly technology with accessibility to everyone. There is an online database platform namely Quickbase which is built on a relational database which is very simple and user friendly and has ability to create custom applications.

III AI AND MACHINE LEARNING IN DATABASE MANAGEMENT

(a) Use of AI – Traditionally speaking, Artificial Intelligence (AI) is an artificial creation of human-like intelligence that can learn, reason, plan, perceive, or process natural language. AI is a rapidly expanding technology that may substantially affect our daily life.

One of the most important applications of AI is in the field of data management. AI-based data management possess out of the box thinking which offers more intelligent ways to manage business needs. AI can drive efficient search and discovery of data to help extract value from it more efficiently, even at today's massive scale of data.

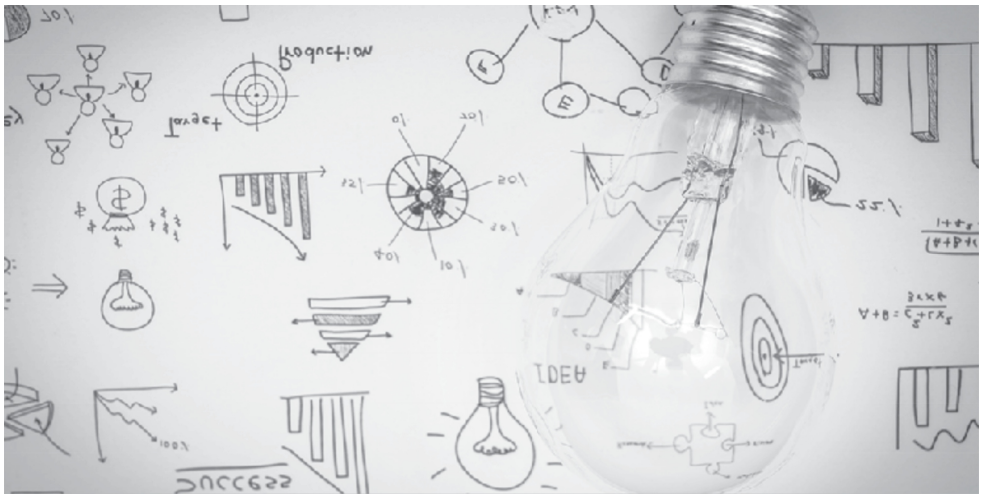

Fig. 2AI and Machine learning [3]

(b) Machine Learning - Practically all of the achievements mentioned so far stemmed from machine learning, a subset of AI that accounts for the vast majority of achievements in the field in recent years. When people talk about AI today they are generally talking about machine learning.

In simple terms, machine learning is where a computer system learns how to perform a task, rather than being programmed how to do so. The term machine learning was coined in 1959 by Arthur Samuel, a pioneer who developed the world's first self-learning systems known as the Samuel Checkers-playing Program.

To learn, these systems are fed huge amount of data, which are used to learn as to how to carry out a specific task, such as understanding speech or captioning a photograph. The quality and size of this dataset is important for building a system able to accurately carry out its designated task. For example, if you were building a machine-learning system to predict house prices, the training data should include more than just the property size, but other salient factors such as the number of bedrooms or the size of the garden.

(c) Neural Networks in Data Management- Key to success in machine learning depends on neural networks. These mathematical models are able to tweak internal parameters to change what they output. During training, a neural network is fed datasets that teach it what it should spit out when presented with certain data. In concrete terms, the network might be fed greyscale images of the numbers between zero and 9, alongside a string of binary digits – zeroes and ones – that indicate which number is shown in each greyscale image. The network would then be trained, adjusting its internal parameters, until it classifies the number shown in each image with a high degree of accuracy. This trained neural network could then be used to classify other greyscale images of numbers between zero and 9. Such a network has been used by the US Postal Service to recognise handwritten zip codes.

The structure and functioning of neural networks is very loosely based on the connections between neurons in the brain. Neural networks are made up of of interconnected layers of algorithms, which feed data into each other, and which can be trained to carry out specific tasks by modifying the importance attributed to data as it passes between these layers. During training of these neural networks, the weights attached to data as it passes between layers will continue to be varied until the output from the neural network is very close to what is desired, at which point the network will have 'learned' how to carry out a particular task. The desired output could be anything from correctly labelling fruit in an image to predicting when an elevator might fail based on its sensor data.

A subset of machine learning is deep learning, where neural networks are expanded into sprawling networks with a large number of sizeable layers that are trained using massive amounts of data. It is these deep neural networks that have fuelled the current leap forward in the ability of computers to carry out tasks like speech recognition and computer vision.

IV CHALLENGES IN CORPORATE WORLD DATABASE MANAGEMENT

In this wonderful world of technology where everything is done online, e.g. we shop, bank, and even find dates through the Internet. Whereas once upon a time, businesses had rows upon rows of client files, the brilliant minds of software experts have made our lives easier by coming-up with facilities like cloud. The information can be accessed from anywhere through internet.

However, these innovative wonders are not foolproof as some important data may be lost. In the spirit of making database management as efficient as possible. Some of the most common challenges are discussed next.

(a) **Scalability -** With the growing business, the database has to be scaled-up accordingly. The scaling-up may be vertically or horizontally depending on specific business needs of the business.

(b) **Cyber security -** There is always room for improvement in security measures. Only allow access to employees who have an actual need to view the data. *Always* encrypt your information. Update your cyber security software on a regular basis. Do regular database health checks to see if you have to patch any vulnerability. There should be occasional surprise checks.

(c) **Back-up the database -** The giants like Equifax and Yahoo have suffered major security breaches. Even small business may land into a similar situation. It results not only in the financial loss but also the loss of reputation or may even compel to close down your business. It necessitates back-up the data. Have duplicate copies of documents for storing at separate places which will help in smooth running of business.

(d) **Speed -** The computer systems should be optimized with proper indexing. If required, the bandwidth should be increased. The regular database health checks should be treated mandatory.

(e) **Integration -** Maybe a fortnight and some time ago, your database management was pretty simple, but as you scaled your databases, new complexities emerged, and now you're stumped as to how to modify your DBM accordingly. If you provide omni-channel services, now you also have to integrate data from all of your many sources. You can do so with software specifically designed for this purpose.

V DATABASE MANAGEMENT IN BANKS: EMERGING TRENDS

Banks and financial services institutions are the engine of 21st century economies and data is undoubtedly the fuel of this engine. With the revolution of digital transformation over the past decade, banks have been generating more and more diverse data than ever before. Businesses of every shape and size are being impacted by the forces of an ongoing global digital transformation. According to the April 2017 *McKinsey & Company* report, Analytics in banking: Time to realize the value, "by 2020, about 1.7 megabytes a second of new information will be created for every human being on the planet."

With this explosion of data availability, there are several challenges that banks must address e.g. rising data volumes, data pervasiveness and user demands for data– in order to become the data-driven enterprises they need to be. Banks are swamped with data on customers, from financial transactions, customer purchase histories, marketing campaigns, social media streams, third-party sources, text messages and more. As data continues to explode, several data management technologies are developed to help companies achieve improved organizational consistency, increased productivity, greater collaboration & communication and lastly but not the least, applicability of data in faster, more knowledgeable business decisions.

Some of the technologies which are shaping the way we handle the data onslaught are given next:

(a) **Big Data [5, 6] -** Big data in finance refers to the petabytes of structured and unstructured data that can be used to anticipate customer behaviors and create strategies for banks and financial institutions. Data is generated from various sources and gets categorized as structured and unstructured. Structured data is information managed within an organization in order to provide key decision-making insights. Unstructured data exists in multiple sources in increasing volumes and offers significant analytical opportunities. Big data analytics can help companies take very informed decisions, no matter how big or small the decision is. Banks and financial institutions today are making the best use of the data they possess so that they can improve their levels of services to their customers. They are taking steps in this direction so that fraud can be detected and prevented. Some of the salient benefits of using big data by financial and banking institutions are given below (Sources:

(i) **Optimized and Enhanced Risk Management:** Big Data can effectively improve the ways companies' use predictive modeling in the field of risk management. Banks utilize business intelligence tools to identify potential risks related to lending money and proactively detect fraud. Big data analytics also assists banks in evaluating market trends and position them to take informed decision of offering competitive interest rates to their clients.

(ii) **Personalization of Banking Solutions:** Clients today do not appreciate the traditional one-size-fits-all approach to banking. Banks needs to understand their needs and present sensible solutions. Insights from big data analytics can help marketers to identify the type of products customers already have and what they would possibly want. Based on this information, they can provide tailored services and products to their clients and stop losing them to their competitors.

(iii) **Employees Engagement:** One of the biggest benefits of employing big data in banking is employee engagement. Big data solutions if implemented properly can help them track analyze and share metrics that relate to employee performance. Big Data tools enable company to measure team spirit, collaborations, morale, and individual performance enabling them to streamline the work process.

(b) Autonomous Databases - Emerging technologies and automation permeate every aspect of our work and lives. The opportunity of these technologies which include Artificial Intelligence (AI), Machine Learning (ML), Internet of Things and human interfaces – is to enable us to embrace innovation on a scale never seen before. From self-driven cars to personalized medicine to precision agriculture and smart cities, technologies are changing the way we experience our world. Autonomous opens a new world of opportunities for enterprises. It allows them to move from operations to innovation. It enables new ways to develop and deliver apps and services. Enterprise can harness the abundance of data to gain predictive insights into their businesses and ultimately drive better outcomes for their customers.

Relational databases have made tremendous improvements in performance, availability and security over the past couple of decades. They can run up to 100 times faster, can be configured for zero data loss and have hardened security capabilities that can protect against malicious internal and external threats. So, what's missing? The degree of manual intervention required to manage today's cloud databases and all these attributes inhibits true "Database as a Service (DbaaS). As a result, enterprises are unable to truly realize the full operational and financial benefits of the cloud.

Autonomous databases leverages AI and machine learning to provide full, end-to-end automation for provisioning, security, updates, availability, performance, change management, and error prevention for a database offering and covers mainly these characteristics: self-driving, self-securing and self – repairing.

(c) AI-enabled Data Management [8] - In today's data guzzling world, data management systems and AI technologies have become synergistic in nature and go hand in hand. Data management systems when coupled with AI capabilities has enormous potential to impact an entire data value chain. **AI-enabled data management** helps in automating repetitive and complex tasks. It improves the performance, accuracy, and productivity in an enterprise.

More than 80% of time is spent by data scientist on manual data preparation, feature engineering, and model selection. Large amount of time spent on manual data management task can be saved by augmenting data management system with AI/ML capabilities. AI processes when implemented across the whole data value chain enables organizations to automate data preparation process, key aspects of data science and implement ML/AI modelling techniques and narrate relevant insights for customers using NLP and conversational analytics. As data continues to grow, there is more than ever need to collect, index and analyze as much data in real-time. Hence, leveraging continuous data streams from disparate sources using AI driven solution allows the companies to continuously gather insightful information for their businesses and helps widen their revenue and bottom line.

VI CONCLUSION

Data Management Systems have emerged as very important tool for banking sector and financial institutions. The chronological development of DMS is presented. The challenges associated with DMS and future trends have been discussed. The economic impact of COVID-19 may have some similarities to the 2007–09 financial crises. However, the implications for financial firms' performance are likely to be different and hence its impact needs to be analyzed in banking sector for corrective measures, as required.

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