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Review Article

Information Flow Theory

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Abstract

Data is a critical commodity in today's business climate. Information can be presented in a variety of forms: structured, unstructured, and semi-structured. There is a global information revolution happening, with more data being produced than ever before and conventional database management methods unable to manage the massive amounts of information being produced by organizations from legal businesses, healthcare organizations, financial institutions, government businesses, etc. Most businesses are turning to Big Data analytics for database management in the current information revolution. The most responsible businesses currently use a theory in the underlying application of database management systems (DBMS). In this paper, we discuss DBMS, the theories underlying the DBMS, and Information Flow Theory, a common theory used to support and brace DBMS.

Keywords: Information Flow; Database Management; Database Management Systems (DBMS); Business Intelligence

Introduction

In the current business climate, data is an essential commodity. There is an information revolution happening globally which is affecting business in a variety of ways. Information is moving quicker, there is more data than ever, and conventional methods of Database Management Systems (DBMS) cannot process the data. Data must be shared to increase business development. The use of Big Data analytics to manage high stream data, noisy data, structured, semi-structured, and unstructured data is critical to helping businesses remain competitive and profitable. Furthermore, data must be interactive and shared competitively. DBMS must be available to those looking for information, easy to access, and resistant to cyberattacks [1].

Since the 1990s, Business Intelligence (BI) and DBMS have been a rising issue among business leaders. Many of these issues have been converted into theoretical analyses and conceptual issues leading to the main theories of database management. The most typical viewpoints of BI are illustrated in figure 1 [2]. Several complex theories including, complexity, density-functional theory, insertion-intensive database, accelerating pace of change, internationalization, information flow, networking, new economy, etc. have changed society's worldview. Now, in addition, novel achievements in technology and data management have applied great strength on traditional models of business and operations [3,4]. According to master builders who say models build better houses, up-to-date information is a strategy for competitiveness. However, running a business is harder than now than ever before because of the many complications and greater complexity, as well global competitiveness requiring a strong DBMS and theory behind it [2].

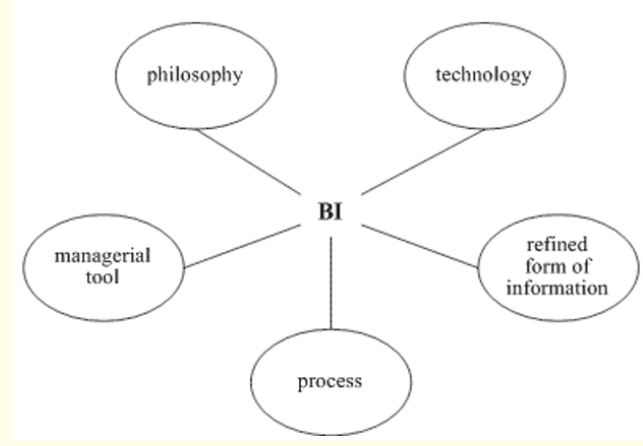

Figure 1: Main areas of BI.

Because businesses base management on theory and organizational competitiveness, theory and individualism are evaluated as a great value. Theory is based on both intangible and tangible resources. Therefore, it is important to understand the value structure of any organization by radicalization of organizational improvement. DBMS have failed to embrace added value on the information it's losing in specific enterprises; however, the robust organizations that are able to take advantage of this situation and have a trajectory are the ones that have a theory-based DBMS. Theory is a strategic generator of competitive advantage. This is where decisions can be made and is vital for the growth of any company [5].

Because information is the basis of everything; it is also the foremost global commodity. Naturally, however, information appears in various shapes and conditions such as intellectual property, analytics, other types of data, etc. The study of gap theory has quite often been associated with the study of information and its flow. Gap Theory should be very important for database management because intelligence follows the flow of business information and the concept of information theory, whether for competitiveness or for drive [6]. However, since the beginning of global trade, global advantage, and competitiveness, etc.; scholars and policymakers have used specific latent principles which have kept tabs on the information. The term output gap or gap theory is interchangeable with a reference to the difference between actual output and potential output. Therefore, the difference between reality and gap theory is practice and productive [7].

The purpose of this paper is to discuss database management theory and how it affects DBMS, competitiveness, rivalry, and information flow. The theory to be discussed is Information Flow Theory. There will be a discussion of the gap between theory and practice, the root cause of this gap, and its impact; whom does it impact and is the effect positive or negative. Section I begins an overview of Information Flow Theory.

Information flow theory

With the rapid flow of cyberattacks, there is an ever-growing demand for cybersecure information and data. Cybersecurity is critical to information flow as data in smartphones, laptops, PCs, etc. are all at risk for attacks. Financial institutions, government organizations, legal businesses, healthcare organizations, and others are data driven; data flow is essential for the success of these businesses. Cyberattacks can be debilitating or even legally devastating as cybercriminals take over the data flow from these organizations. A solid DBMS and underlying theory are critical in these cases [8]. However, due to limited resources and limited knowledge, collaborative and computational resources have been developed on a limited basis. Many security problems, however, have been solved using various methods, such as: a) anti-spam; b) anti-malware; c) bot-net detection; and d) insider attacker identification. For better performance, it is key to have each enterprise share the security-related information in a collaborative security scheme [9]. Mass data transfer is of the most important capabilities of a DBMS. However, second to that, security and privacy considerations must be part of the main points of information flow [1]. For example, Intrusion Detection Systems (IDSs) which can share observations with business allies for more effective decision-making but does not consider privacy. It is software or a device which monitors for malicious which monitors for malicious activity or policy violations. Any intrusion activity is reported to either a network or event management system. Unfortunately, these systems are also predisposed to false positives. A good IDSs works by locations of signatures for known attacks or deviations of normal activity. One good example SNORT; another is OSSEC, both have good functions for IDSs but poor privacy protection. Several of its main activities include monitoring for intrusions, auditing system configuration for intrusions, etc. Each activity is lacking in privacy protection required for good Information Flow Theory [10].

By spying on some of the shared information in a network, an attacker may be able to extrapolate attacking the security-related information [9]. Despite literature recommendations, repeated use of privacy-preserving techniques or utility security methods, can also degrade information flow quite severely [11]. These methods also only temporarily consider the added security as the properties cannot be quantified properly, nor do the measures generally have the flexibility necessary for full-scale defense, and finally only these methods consider the interplay in response to an IDS [9].

Databases hold information as high priority. For example, healthcare institutions depend critically upon DBMS to store, access, and retrieve information and meet organizational goals and business objectives. DBMS can be exposed to systematic flaws and security risks without cybersecurity interventions. High-profile data breaches can forego appropriate security briefs and consent to risky data transfer with the DBMS. Security strategies can involve anything from password protection, bar-coding, facial recognition, awareness of internal and external threats and prioritizing vulnerability remediation [11].

It is important to address growing vulnerabilities which may lead to systemic exposures [12]. Thus, database management may lead to functional defenselessness. It is critical for professionals to protect data breaches and using technological and human threats

and must implement various security flows to maintain different weakness strategies within the DBMS [11]. The businesses and individuals who are affected by the need for secure data in DBMS are healthcare organizations, legal organizations, government businesses, financial organizations, etc. These businesses conduct data transfer from DBMS with the need for secure data because privacy and confidentiality are the two biggest concerns for these businesses. Not only is healthcare bound by the law to keep information secure and private, there are government businesses and legal businesses that depend upon keeping information flow private in such matters as lawsuits and voting [12].

The gap between theory and practice

To quantify leakage, Shannon's information theory can be used, which will quantify inference and indicate security needs for the organization. Some organizations have fewer sensitive data, such as demographic data, etc., while others are responsible for the security of patient data, financial data, legal data, etc. [12]. Deep convolutional neural networks (CNN) are critical to information flow theory. CNNs are best for storage of image data. A CNN is a multilayered architecture with fewer pixels that allow better security of data. Despite the success of medical imaging and computer vision, the theory detailing this is lacking [13].

Information is in everything, technology, engineering, healthcare, finances, etc. However, what is done with that information is not always backed by theory. Therefore, there is a gap between theory and practice that many scholars are looking to breach. The foremost concept of gap theory is the idea that there exists a gap between theories that underlie concepts and the concepts as they are practiced in business. The multiplicity of information theories contributes to conceptions of information and gaps between those theories and practice. Many scholars continue to look for solutions for the frequent gaps between information theories and practice. While information can be an organization's biggest commodity, the underlying gap in theory and practice widens that financial benefit that can be gained from the commodity of information. Because most fields or domains depend upon being data driven, the ever-widening gap between theory and practice can do much to hurt rivalry, competitiveness, costs, profit, gain, etc. It makes it hard for companies to be progressive and for information to make sense because the backbone behind it is lagging or nonexistent. For example, a few years earlier, scholars tried to determine if Information Flow Theory is the same for all domains. After an experiment in which several domains were compared, it was determined that the gap between theory and practice prevented information from being classified as the "same" in different situations although the domain and practice was similar. Therefore, there was no oneness or similarity for the information flow. This presented a negative situation for all concerned in these businesses and in general. A lack of similarity and "sameness" can be disabling or crippling when a business is trying to be competitive [6].

Root cause and effect of the gap

The term "gap" is interchangeably referred to as actual output and its potential; between actual output and its permanent component; and actual output gap and its trend. Clearly, without statistically solid components, information flow gets lost and affects the business. Without a consensus on what the information is, the gap between theory and practice widens. Therefore, it is critical that organizational leaders and employees continue to maintain the components behind the theory, such as data, quantitative statistics, Big Data analytics, etc. It is also important that organizational leadership understand underlying theory and base methods associated with the Information Flow Theory if that is the organization's chosen theory. No matter the chosen theory, organizations need to choose one and define it, and continue to use it to define the components that make up the business so that the effect of gaps will be reduced or minimized. The root cause of any gap between business practice and theory is a clearly undefined theory, no named components, and few base methods associated with the theory [7].

Conclusion

Organizations are dependent upon information. Most domains are data driven. For example, healthcare, finance, legal business, government organizations, etc. are data driven and dependent upon information security to keep data private and secure. Information Flow Theory depends upon the security of information for businesses and determines how well businesses can be competitive in the corporate world. Information is key to many domains. Information Flow Theory acknowledges this and shares the concepts among all its domains. There is sometimes a gap between theory and practice caused by lack of definitions, use of theory, and defined components. The root cause of this could be that organizational leaders are most unconcerned about theory and more concerned with making money, however the two are inseparable. Profit and competitiveness are products of good theory-based practice.

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Conflict of Interest

Any financial interest or any conflict of interest does not exist.

Bibliography

1. Liu Xiangyue., *et al*. "The diatomic molecular spectroscopy database". *Journal of Cheminformatics* 12.1 (2020): 1-8.
2. Pirttimaki VH. "Conceptual analysis of business intelligence". *South African Journal of Information Management* 9.2 (2007): 1-1.
3. Choudhary Kamal., *et al*. "Density Functional Theory based Electric Field Gradient Database". arXiv preprint arXiv:2005.09255 (2020).
4. Zeighami Sepanta and Raymond Chi-Wing Wong. "Bridging the Gap Between Theory and Practice on Insertion-Intensive Database". arXiv preprint arXiv:2003.01064 (2020).
5. Monsalve EJ Barrientos., *et al*. "Theorization on case studies in business intelligence management on intellectual capital". *Journal of Physics: Conference Series* 1160.1 (2019).
6. Bawden David and Lyn Robinson. "Still minding the gap? Reflecting on transitions between concepts of information in varied domains". *Information* 11.2 (2020): 71.
7. Canova Fabio. FAQ: How do I extract the output gap?. No. 386. Sveriges Riksbank Working Paper Series (2020).
8. Fichte, Johannes K., *et al*. "Exploiting Database Management Systems and Treewidth for Counting". arXiv preprint arXiv:2001.04191 (2020).
9. Jin Richeng., *et al*. "On the Security-Privacy Trade off in Collaborative Security: A Quantitative Information Flow Game Perspective". *IEEE Transactions on Information Forensics and Security* 14.12 (2019): 3273-3286.
10. Hao Dong., *et al*. "A distributed in-memory database solution for mass data applications". *ZTE Communications* 8.4 (2020): 45-48.
11. Ogbonna Leonard. Technical Strategies Database Managers Use to Protect Systems from Security Breaches. Diss. Walden University (2020).
12. Xi Ning., *et al*. "Distributed Quantitative Information Flow Evaluation for Service Composition in Clouds". 2019 18th IEEE International Conference On Trust, Security And Privacy In Computing And Communications/13th IEEE International Conference On Big Data Science And Engineering (TrustCom/BigDataSE). IEEE, (2019): 200-207.
13. Chaddad Ahmad., *et al*. "Deep radiomic analysis based on modeling information flow in convolutional neural networks". *IEEE Access* 7 (2019): 97242-97252.