Data Warehouse as an Influence Factor in Information Sharing in Public Organization

Mohammed Abdulameer Mohammed, Huda Ibrahim and Maslinda
School of Computing, Universiti Utara Malaysia, Kedah, Malaysia

Abstract: In public sector, information is considered as the most important resource. Information Communication Technologies (ICTs) have been used long time ago to enhance the government research. Thus, in order to have better advantages of ICT in public organization processes, organizations have to share and integrate their information. Electronic Information Sharing (EIS) among public organizations is the ability of public organizations to obtain, apply and process information in society with citizens. However, the most important barrier in EIS is the technical. One of EIS technical problems is public organizations store their information in Different Databases (DB). This study suggests using Data Warehouses (DW) instead of traditional databases in public organization. Moreover, it contributes to utilize data warehouse as of the EIS factors. Finally, it accordingly investigates the usefulness of data warehouses in enhancing EIS among agencies in public organization.

Key words: Data, public, information, factor, technology

INTRODUCTION

According to Dawes (1996) information sharing is exchanging information within and across government agencies or otherwise giving them access to information. There is limited of EIS among government organizations (Akbulut *et al.*, 2009; Bigdeli *et al.*, 2013; Jing *et al.*, 2014). According to Jing and Pengzhu (2009), Yang and Maxwell (2011) and Bigdeli *et al.* (2013) the limitation of EIS has negative effects on the decision making in the public organizations. Moreover, EIS can reduce work processes and time (Calo *et al.*, 2012). However, EIS has many issues, such as technical, organizational and environmental (Calo *et al.*, 2012). One of EIS technical problems is public organizations store their data and information in different DB (Yang *et al.*, 2012). Multi-DBs in government systems lead to limit EIS among the government organizations because separated DB allow the information to become available in one agency, while the availability of this information in other agencies of the same organization is not guaranteed (Bhanti *et al.*, 2011; Yang *et al.*, 2012). Moreover, separated DBs are created many limitations, such as avaliblity and accessiblity of data and information. Multi-DBs make technical incompatibility, such as different data format, different data definitions, standards of data transmission and integration of information as well as quality of information (Pardo and Tayi, 2007; Akbulut-Bailey, 2011; Bigdeli *et al.*, 2013).

However, according to Akbulut-Bailey (2011) "EIS can be accomplished directly (e.g., electronic mail) or indirectly through an information repository (e.g., data warehouse)". Moreover, the central information systems (as a data warehouse) can assist government agencies in increasing information sharing among them (Xu and Sun, 2011; Yang *et al.*, 2012). Nevertheless, these EIS studies never mention about the use of common data warehouse as factor instead of traditional databases to increase sharing the information electronically (Garcia *et al.*, 2005; Jing and Penzhu, 2009; Akbulut-Bailey, 2011, Yang and Maxwell, 2011; Bigdeli *et al.*, 2013; Jing *et al.*, 2014). Most of the researches investigate the use of DW in sharing information technically without any theoretically focus. However, this study suggests the use of DW instead of separated databases because a common storage can save a huge amount of information in one place and is accessible to any authorized staff. Moreover, it accordingly investigates the usefulness of DW as a factor in order to enhance the EIS in government organization.

LITERATURE REVIEW

Electronic information sharing: In public sector, information is considered as the most important resource (Yan *et al.*, 2009). Governmental information sharing is the ability of government public organizations to obtain, apply and process information in society with citizens (Estevez *et al.*, 2010). The first definition of information sharing was by Dawes (1996) when she defined it as exchange of information among employees within and outside an organization or giving them access to information in order to effective decision making. Information sharing provides many benefits such as

Corresponding Author: Mohammed Abdulameer Mohammed, School of Computing, Universiti Utara Malaysia, Kedah, Malaysia

integrate services, enhance policy making, improve decision making, high product quality, reduce process work, develop the formulation and implement and evaluate the organization's policies (Yan *et al.*, 2009). EIS means share the information electronically by using ICT devices such as, internet, email, phone, mobile, websites and so on (Akbulut *et al.*, 2009). EIS increases the information amount which can help the decision makers to make better decisions (Akbulut-Bailey, 2011; Yan *et al.*, 2009). According to Estevez *et al.* (2010) EIS has different categories of benefits, such as technical, organizational, inter-organizational and environmental.

Databases vs data warehouse: According to Inmon (2005) who is considered as the father of data warehousing, defines a data warehouse as "subject-oriented, integrated, time-varying, non-volatile data collection which is used primarily in organizational decision-making process". Data warehouse integrates government data and enhances the mode of accessing these data with little amount of time (Liu and Li, 2009). It addresses the question of how to perfectly use the huge amount of current and historical data to support the decision-making process (Mohammed *et al.*, 2012). Data warehouse likewise helps government organizations decrease cost, increase activities and become more effective (Velicanu and Matei, 2007; Mohammed *et al.*, 2012). Thus, it is ready to organize the requirements of information services and deal with the dynamic information of the government which can improve the e-service level within the organization (Liu and Li, 2009). Data warehouses and traditional DBs differ in many aspects, such as in size, price, data transfer and features. They especially differ in the processes they support. That is data warehouses support OLAP whereas

traditional Dbs support OLTP (Huang *et al.*, 2007). Table 1 shows the differences between data warehouses and DBs.

The data used in data warehouses are different from those used in operational DBs. Data warehouses use an ETL tool to collect clean data from DBs. Moreover, database data are generated from daily system operations (Levene and Loizou, 2001). Data warehousing involves more managed, better integrated and clearer data than DBs that make data in data warehouse has different data table because DW uses proper data structure model (Santhi and Jigeesh, 2010). Table 2 shows the difference between operational DBs and DW in terms of data.

The data can be stored in a portion of one DW. The introduction of DW in the government system has boosted the level of government information system services. It has also established a strong base for the personalization of government system information services through DB technology (Liu and Li, 2009). The proposed method is extremely important in enhancing the standard and quality of government system information services. Table 3 compares the information services

Table 1: Difference between DW and DB (Mohammed *et al.*, 2012)

Criteria	Data warehouse	Operational database
End user access	Queries can write direct	Queries can be generated by the user by using intermediate application
Read-only	Data can read only there is no update or delete	Data can be deleted, updated and read
Ability	Located in different system components	Located for limited data components
Storage	Very huge storage	Small and medium storage
Environment	Has been designed for complex system needs	Has been designed for different business needs
Data transfer	Take data from DB	Provide DW with data

Table 2: Data in DB versus DW (Tao *et al.*, 2003; Liedes and Wolski, 2006; Song *et al.*, 2008; Mohammed *et al.*, 2012)

Operational data	Data warehouse data
Application oriented	Subject oriented
Detailed	Summarized, otherwise refined
Accurate as of the moment of access	Represents values over time, snapshots
Assist the office community	Assist the managerial community
Can be updated	Is not updated
Run repetitively and non-reflectively	Run heuristically
Requirements for processing understood before initial development	Requirements for processing not completely understood before development
Compatible with the software development life cycle	Completely different life cycle
Performance sensitive (immediate response required when entering a transaction)	Performance relaxed (immediacy not required)
Accessed a unit at a time (limited number of data for a single record)	Accessed a set at a time (many records of many data elements)
Transaction driven	Analysis driven
Control of update a major concern in terms of ownership	Control of update no issue
Semi-availability	High availability
Managed in its entirety	Managed by subsets
Non redundancy	Redundancy is a fact of life
Static structure; variable	Contents flexible structure
Small amount of data used in a process	Large amount of data used in a process
High speed performance with the complex data	Slow speed performance with the complex data
Ability to deal with the multi system patterns	Difficulties to deal with the multi system patterns such as complex business grid
To monitor and feedback several business tasks	To assist the planning and decision making
Short and fast inserts and updates initiated by end users	Periodic long-running batch jobs refresh the data

Table 3: Comparison between government information that store in DB and in DW (Liu and Li, 2009)

| Government information with DB	Government information with DW
Multi data formats, less consistency and data redundancy	Data format without data redundancy and scalability are highly
Multi sources of information and the lack of management and integration	Common source of info. and greatly managed and integrated information
Transaction processing information with details about information	Analytical information with several size of information
Resources of information are inadequate and lack of analysis, mining applications	Resources are available and analysis is strong with powerful applications,
Services are response passively in general	Services have extra value
Record timely and store the current results	Time variant information and store current with historical results
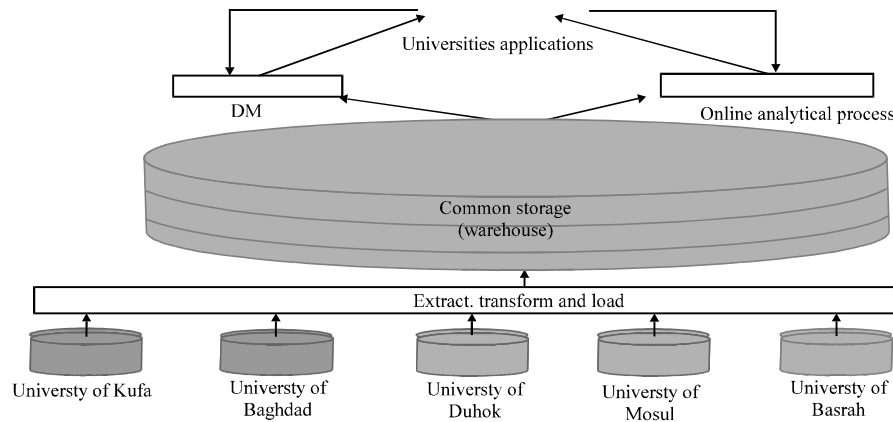
Fig. 1: DW to share information in higher education (Abdulameer *et al.*, 2012)

provided by a government system that uses DBs and those that are provided by a government that uses DW.

Separated databases issues: The limitation of data security and privacy is reducing public trust and confidence in a department because of the disability of sharing personal information (Bellamy and Raab, 2005). Information quality can improve the collaboration among departments and can enhance the quality of service that delivery to the public (Klischewski and Scholl, 2006). Information quality has been studied in many fields, such as e-Commerce and e-Government (Corradini *et al.*, 2006; Klischewski and Scholl, 2006). Interoperability framework refers to compatibility standards of adopting information system among organizations (Santos and Reinhard, 2007). Moreover, information sharing bases on sharing and accessing information from multi data sources, such as several DBs, documents, images and text files. Therefore, this diversity of resources would cause many critical problems. In turn to solve these problems organizations should develop data standards, construct ontology systems and design interoperable applications to provide a structure to across heterogeneous and unstructured resources (Lam, 2005; Pardo and Tayi, 2007). One of the big challenges in information sharing is happened when different agencies in different location share huge amounts of data and information that have different format and store in different platform this situation causes many kinds of factors which called information quality, security, accuracy, consistency and completeness factors.

Data warehouse to share information: Data warehouses are effective platforms for EIS (Ji *et al.*, 2006). Data warehouse technology can solve the issues on EIS for agencies because this technology can establish a sharing platform for government systems (Ji *et al.*, 2006). Government systems that depend on data warehouse techniques can enhance the effectiveness of large amounts of government data, improve information sharing and support decision-making processes (Huang *et al.*, 2010). The proper integration process, modeling data structure and common storage that data warehouses provide can add extra value to information and knowledge sharing among these agencies (Nimmagadda and Dreher, 2007). The use of data warehouse technology is compulsory (Xu and Sun, 2007). Take China for example. The data warehouse framework in this country is designed and implemented for electronic information sharing (Ji *et al.*, 2006).

Data warehouse to share information in higher education: The data warehouse acts like an enterprise information infrastructure dealing with the exchange of information among systems (Wagner *et al.*, 2013). e-Government has accessibility, transparency, efficiency and impact and therefore enabling e-Government services to be automatically evaluated in order to generate vast amount of data (Mohammed *et al.*, 2013). Figure 1 shows architecture of data warehouse for higher education. The huge storage in data warehouse namely warehouse which
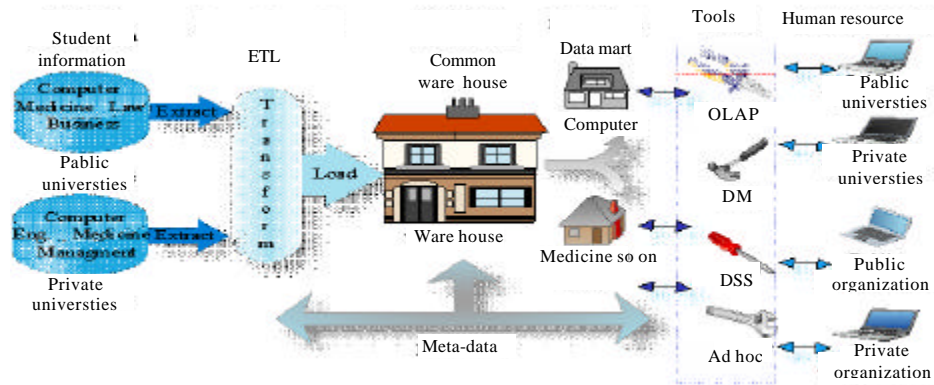
Fig. 2: Data warehouse for human resource (Mohammed and Anad, 2014)

is useful to save the universities' information according to the type and time that is the current information and historical information.

Common warehouse provides the ability to enhance sharing of information among universities and their departments itself. Additionally, it improves the communication among agencies in these universities, since all the information of all universities will be stored in a particular and huge repository. These data assist to produce essential reports and information to the departments of the universities. Moreover, it sustains the multidimensional view to observe the data. In addition, the warehouse has Data Mining (DM) which mines information to provide information to universities. The last stage is the interface of e-Government. e-Government applications help agencies in the universities to easily access the warehouse and obtain all their required information which is available.

Data warehouse for human resources: This study enables endorsed access to human resource of the government and non-government organizations to locate the most eligible student for their organizations. Government should adhere to six steps in order to create data warehouse for human resource systems as illustrated in Fig. 2. The data warehouse is useful for the storage of students' information from all universities. In the warehouse, the information must be modeled and devised as per the star schema. The data warehouse of the human resource system shall be present as an authorization gate so as to access the students' information and thus, allowing only permissible persons to utilize the tools and techniques of this project. In addition, Mohesr can allow the students to add on new information to their folder so that their files are up to date for the future.

Information sharing problems exist because of separated DBs. According to Yang *et al.* (2012), the central information system of government agencies can assist in improving information sharing. Moreover, most

of databases cannot be shared or are shared with a small group of repositories but the results of sharing are extremely high cost (Jiang, 2010). Therefore, most recent studies have mentioned that the use of data warehouses can increase the availability of data and information for users as well as it can increase the information sharing (Akbulut *et al.*, 2009; Ariyachandra and Watson, 2010). These studies (Cuiling *et al.*, 2006; Thomas *et al.*, 2010; Xu and Sun, 2011) serve as basis of the present research. As data warehouses can provide monumental data, structural data and designed data, they are considered as a good platform for information sharing. According to Huang *et al.* (2010), DW can improve the efficiency of data largely, achieve the maximum information sharing and support decision-making because it is better than the relational database in the field of integrating data and collecting the information. Based on these studies of DW this study can identify the most important features that DW can provide to support electronic information sharing these features as follow.

Huge information can be available to the users, information can be accessible to every authorized person, provide high quality information, integrate information by using standard format, provide compatibility of software and hardware, decrease the interruption of information, historical data and information can be shared, provide real time information to get high timeliness, decrease the costs of information sharing and provide tools to increase the information.

Data warehouse as information sharing factor: Data warehouse provides solutions for issues regarding EIS because the DW establishes a platform for achieving EIS (Ji *et al.*, 2006). The information sharing platform provides an environment of distribution and sharing, which recognizes data management, query statistics, information publishing, user management and system maintenance (Xu and Sun, 2011). Government systems that rely on data

warehousing techniques likewise enhance the effectiveness of huge government data, increase information sharing and support decision making (Huang *et al.*, 2010). The DW provides users with data availability. Furthermore, DW information is expected to be available for staff and accessible for dealers and clients (Connolly and Begg, 2010). Inmon stated that the most proper DW design ensures the quality of information which increases user satisfaction, moderates the development and decreases the cost of maintenance. Data warehousing tools are used for extracting clean data because any data quality issues should be solved prior to loading to the DW (Turban *et al.*, 2007). Moreover, data warehousing tools provide high quality information (Turban *et al.*, 2007). The proper integration process, modeling data structure and common storage that the DW provides add value to information sharing and knowledge among government agencies (Nimmagadda *et al.*, 2005; Nimmagadda and Dreher, 2006, 2007; Huang *et al.*, 2010). According to Akbulut *et al.* (2009), "EIS can be accomplished directly (e.g., electronic mail) or indirectly through an information repository (e.g., data warehouse)". The central information systems (as a data warehouse) can assist government agencies in increasing information sharing among them (Xu and Sun, 2011; Yang *et al.*, 2012; Jaber *et al.*, 2014, 2015; Mohammed *et al.*, 2012). Moreover, access of common repository (as a data warehouse) increases information sharing indirectly (Akbulut *et al.*, 2009; Akbulut-Bailey, 2011). Thus, the present study suggests the DW to be one of the factors that can be used to increase EIS between government organizations (Mohammed *et al.*, 2013, 2014, 2015). Hence, it is hypothesized that:

- H: Data warehouse will have a positive effect on EIS among public organization

CONCLUSION

Public organizations use multi separated DBs to store its data and information. The separated DBs allow the information to become available in one agency while the availability of this information in other agencies of the same organization is not guaranteed. Researchers mention that DW can provide indirect information sharing by allowing the users to access the repository in order to increase the EIS. Thus, this study suggested using DW as one of EIS among public organizations. This usage can reduce the technological barriers that EIS faces because of store the information in multi databases. The next study will be quantitative research in order to find the result of this factor by analyzing the collected data from the questionnaire of the survey. Finally, the public universities will be the scope of the next research, thus, the questionnaires will be distributed among employees in some public universities.

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