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THE IMPACT AND PERSPECTIVE OF BUSINESS INTELLIGENCE IN URBAN LOGISTICS

Key Words
Business intelligence
Big data
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Urban logistics
Sustainability

Abstract
Effective and efficient decision making based on business intelligence (BI) is essential to ensure competitiveness for sustainable growth in urban logistics. The rapid development of information and communication technology has made collection and analysis of big data essential, resulting in a considerable increase interesting for academic studies on big data and urban logistics. However, many of these studies are not linked to BI concept in an integrated manner. Therefore, the goal of this research is twofold. First, a substantial amount of research has been devoted to establishing and developing theories concerning big data, big data analysis (BDA) and BI to address this need. Second, the BI, big data, and BDA are not analyzed as separate methods but as integrated decision support systems. Operational staff is able to use these tools themselves and access timely and relevant data and information to make effective decisions as sustainable urban logistics practices.

1. INTRODUCTION

Sustainability has become an important objective of urban logistics management. The urban logistics deals with the physical distribution of goods to the final destination at urban areas, with respect to a set of objectives such as effective services, cost-effectiveness, and sustainable development [1]. Much more precisely, urban logistics mainly deals with two major physical flows: forward and reverse flows [2].

The main objective of urban logistics is to improve the effectiveness and efficiency for shippers, service providers, and customers. Since the last decade, sustainable development has become a contemporary and significant objective to urban logistics stakeholders. Under the paradigm of sustainability, the goal is to reduce the negative externalities of logistic activities, while ensuring service coverage and improving quality of life of all inhabitants at the city level. The latter mainly deals with waste and collection of recycled materials and returns of goods.

Both forward and reverse flows must be effectively and efficiently managed, despite the complexity in the operational processes [3]. The former e-commerce objectives, in the highest level of abstraction, could be shown as: Business-to-Business (B-to-B) flows from a supplier's site to a retailer' site; Business-to-Consumer (B-to-C) flows from a seller's site to a consumer's location; and Consumer-to-Consumer (C-to-C) flows between individual consumers. All the highest level of abstraction could be managed with effective and efficient decision making software tools. These concepts were developed in different ways, and software vendor companies have also great influence on these developments and deployments [4].

Effective and efficient decision making based on business intelligence (BI) is essential to ensure competitiveness for sustainable growth in complex urban logistics. The rapid development of information and communication technology has made collection and analysis of big data essential, resulting in a considerable increase in academic studies on big data and urban logistics. However, many of these studies are not linked to business intelligence, as companies do not understand and utilize the concepts in an integrated way. Therefore, the goal of this research is twofold. First, the business intelligence, big data, and big data analysis (BDA) are not reviewed as separate methods but as integrated decision support systems. Second, a substantial amount of research has been devoted to establishing and developing theories concerning big data, BDA and BI to address this need, though it is still challenging for a company to find, understand, integrate, and use the findings of these studies, which are often conducted independently and cover only select aspects of the business subject. Although BI and BDA are generally studied independently, it is challenging and often unnecessary to distinguish between the two concepts when performing business tasks. Recent research has found that BI plays an important role in implementing and monitoring strategies such as sustainable urban logistics practices. Operational staff is able to use these tools themselves and access timely and relevant data and information to make effective decisions.

2. BUSINESS INTELLIGENCE, BIG DATA AND BIG DATA ANALYSIS

At the beginning of 1990s, the concept of data warehouse (DW) was introduced for strategic decision support. Independently, W. H. Inmon [5] and R. Kimball [6] created two very similar approaches based on multidimensional databases. The basic and simplified data warehouse architecture proposed by R. Kimbal is presented in Fig 1 [6]. These concepts were developed in different ways, and software vendor companies had also great influence on these developments and deployments.

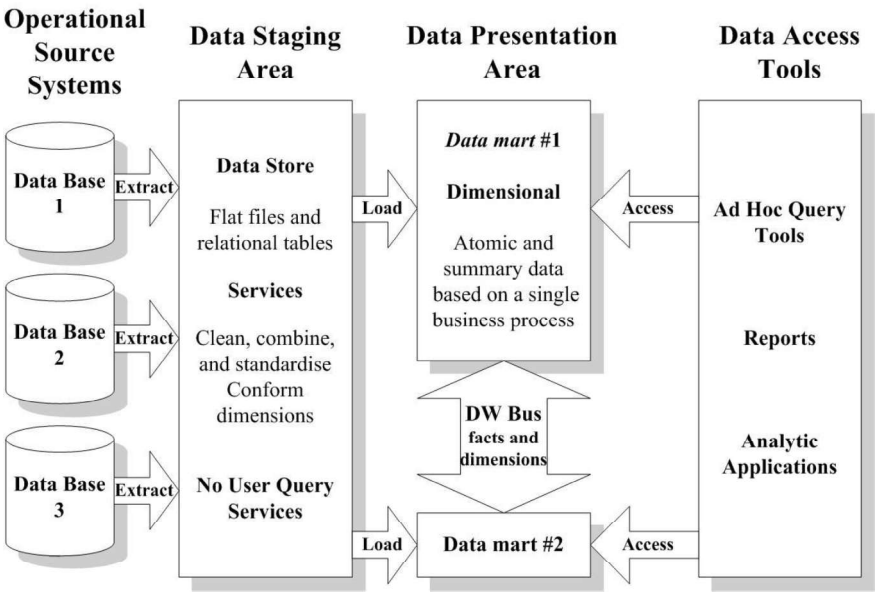

Figure 1. Simplified data warehouse architecture (Adapted from [6])

At the beginning of the 21st century, software vendors offered customers a new terminology and software tools they called business intelligence, which presented nearly the same concept as DW. Business Intelligence is a set of technologies and processes that allow business managers at all levels of an organization to access and analyze data. BI meets the requirements of business systems because it can get information quickly, reliably and in an appropriate form.

The development of information technology – IT has enabled the development of modern platforms to help work with large amounts of data – big data. On one hand, the volume of data being generated and stored in business systems is constantly growing, and on the other hand, there is an increasing number of users and their needs for high-quality information and new knowledge.

Big data can also simply refer to a huge amount of complex data, but their type, characteristics, scale, quality, and depth vary depending on the capabilities and purpose of each company. Previous studies generally agree on three main properties that define big data, namely: *V*olume, *V*elocity, and *V*ariety, or the "*3Vs*" [7], which have recently been expanded to "*5Vs*" with the addition of *V*eracity/*V*erification and *V*alue [8].

BDA refers to the overall process of applying advanced analytic skills, such as data mining, statistical analysis, and predictive analysis, to identify patterns, correlations, trends, and other useful techniques [9]. BDA contributes to increasing the operational efficiency and business profits, and is becoming essential to businesses as big data spreads and grows rapidly.

3. BUSINESS INTELLIGENCE, BIG DATA AND URBAN LOGISTICS MANAGEMENT

The role of urban logistics is enhanced by the recent rapid growth of e-commerce sales and, especially, the new business environment of omni channel retailing which stresses both online and offline channels [10]. To advance the competitiveness of services, retailers and logistics service providers have devoted significant efforts to deploy express fulfillment services, e.g., same-day or next-day delivery. This results in new logistics challenges, such as fragmented and downsized shipments, higher delivery frequency, shorter delivery time, highly fluctuant and uncertain demands, and returns. Such challenges are particularly impacting parcel markets. On the one hand, this is a huge challenge to the flexibility and agility in product distribution and delivery. On the other hand, this will also challenge the capacity and cost-effectiveness of the reserve logistics systems. Collecting and recycling the packaging materials (cardboard boxes, plastic packaging) is another sustainable issue of importance [11].

There are numerous multi-dimensional methods for choosing how much data to gather and how to analyze and utilize the data. In brief, the methodology for extracting valuable information and taking full advantage of it could be more important than the data's quality and quantity. A substantial amount of research has been devoted to establishing and developing theories concerning big data, BDA, and BI to address this need, but it is still challenging for a company to find, understand, integrate, and use the findings of these studies, which are often conducted independently and cover only selected aspects of the subject.

Some areas of BI and BDA, such as data analysis and data mining, overlap. This is to be expected, as the raw data in BI have recently expanded to become big data in volume and scope. This has necessitated reorganization of the field and concepts of BI to provide business insights and enable better decision making based on BDA [12]. Although BI and BDA are generally studied independently, it is challenging and often unnecessary to distinguish between the two concepts when performing business tasks.

4. PRACTICAL URBAN LOGISTICS BUSINESS APPLICATION AND BUSINESS INTELLIGENCE

Traditionally, logistics was considered a support industry for manufacturing and consumption and was mainly perceived as a cost. However, manufacturing corporations with supply expansion based on ICT meet consumers' demands as a key growth strategy, and the courier service industry has shown remarkable increase in the need for parcel transportation.

A courier service is generally defined as comprising the entire process of transportation, from receiving a parcel to packaging, transporting, and delivering the parcel to the final destination. Courier service companies are normally large operational organizations that deal with large amounts of cargo, hub terminals,

general information systems, and a wide range of transportation vehicles and consist of a complicated network of labor and equipment.

Given consumers' increasing focus on personal service and convenience in consumer products, as well as global economic development, the manufacturing sector is converting from mass production of limited items to multi-item, small-scale production. This is rapidly increasing the volume and sales of courier services as more consumers buy online purchases.

CJ Logistics company is the largest logistics service provider in Korea with the highest market share and sales revenue of KRW 7110.3 billion in 2017 [13]. This company examines the sorting process, especially regarding decisions about loading/unloading docks and hub terminals, which are at the core of courier services. In order to improve business effectiveness and efficiencies in every level of decision-making big data, big data analyses through BI are used. In addition, the company is an innovation leader in the logistics industry. It is traditionally considered a 3D business that uses BI based on high-tech automation-oriented technology, engineering, and solution, while actively and rapidly adopting big data/BDA at the same time.

This company is a market leader equipped with cutting-edge logistics technologies, including real time tracking of freight, an integrated courier and freight tracking system that enables users to view customer information and requirements, satellite vehicle tracking, and temperature control systems. With five hub terminals, more than 270 sub-terminals, and more than 16,000 vehicles, the company processes more than 5.3 million packages per day [13]. Its mega hub terminal in Gwangju with an investment of more than KRW 400 billion, will utilize convergence technologies such as big data, robots, and Internet of Things (IoT) to expand its services for the convenience of its customers across Korea. This will include same-day delivery, same-day return, and scheduled delivery services.

This is a very brief example on urban logistics company, though in general some conclusions can be made. Business activities that are believed to be sufficiently empirical and productive to ensure efficiency can benefit from different perspectives and breakthroughs upon acquiring and analyzing big data, and can be realized through business intelligent system. The value of big data depends on the types of data extracted and how they are utilized. The crucial factor, however, is the method of turning raw data into valuable information, and not the quality or quantity of the data. Therefore, it is vital to identify the type and scope of data to be collected according to their purpose and focus area.

The efficient use of big data may provide an opportunity to a small or medium enterprise to become a large corporation or market leader by taking advantage of meaningful information, and for a large corporation to maintain its market share and ensure sustainable growth and competitiveness. Many studies have been conducted on BI, big data, and BDA so far; nevertheless, for enterprises to implement changes, it is necessary for them to understand intuitively that BI, big data, and BDA cannot be separated, but should rather be integrated and utilized in the management decision support system as a whole. As the brief case of CJ Logistics shows, the

process of collecting and analyzing big data and applying it through business intelligence is separated neither individually nor progressively.

5. CONCLUSION AND FUTURE WORK

Business organizations today are the part of global and dynamic business environments characterized by continuous competition and change, uncertainty and customer needs, as well as radical advances in technology development. The goals of this paper are: (1) the business intelligence, big data, and big data analysis are not separate methods but integrated decision support system; (2) it is still challenging for a company to find, understand, integrate, and use these technologies which are often conducted independently and cover only selected aspects. The brief description of one Korean's logistics company is a good example for an enterprise which implemented changes necessary to understand that BI, big data, and BDA cannot be used separately in corporate decision making.

Future research will focus on experience and practical knowledge by collecting and sharing similar experiences in companies in Serbia including: volume management through production of boxes for each customer, as well as the classification of customers based on volume densities, which are established on practical business applications in order to build integrated knowledge.

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