

Lecture Notes on Data Engineering
and Communications Technologies 161



Leonard Barolli *Editor*

Advances in Internet, Data & Web Technologies

The 11th International Conference
on Emerging Internet, Data & Web
Technologies (EIDWT-2023)

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Lecture Notes on Data Engineering and Communications Technologies

161

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Leonard Barolli
Editor

Advances in Internet, Data & Web Technologies

The 11th International Conference on Emerging
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Editor

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Welcome Message of EIDWT-2023 International Conference Organizers

Welcome to the 11th International Conference on Emerging Internet, Data and Web Technologies (EIDWT-2023), which will be held from February 23 to February 25, 2023.

The EIDWT is dedicated to the dissemination of original contributions that are related to the theories, practices and concepts of emerging Internet and data technologies yet most importantly of their applicability in business and academia toward a collective intelligence approach.

In EIDWT-2023, topics related to Information Networking, Data Centers, Data Grids, Clouds, Crowds, Mashups, Social Networks, Security Issues and other Web implementations toward a collaborative and collective intelligence approach leading to advancements of virtual organizations and their user communities will be discussed. This is because Web implementations will store and continuously produce a vast amount of data, which if combined and analyzed through a collective intelligence manner will make a difference in the organizational settings and their user communities. Thus, the scope of EIDWT-2023 includes methods and practices which bring various emerging Internet and data technologies together to capture, integrate, analyze, mine, annotate and visualize data in a meaningful and collaborative manner. Finally, EIDWT-2023 aims to provide a forum for original discussion and prompt future directions in the area.

An international conference requires the support and help of many people. A lot of people have helped and worked hard for a successful EIDWT-2023 technical program and conference proceedings. First, we would like to thank all authors for submitting their papers. We are indebted to Program Area Chairs, Program Committee Members and Reviewers who carried out the most difficult work of carefully evaluating the submitted papers. We would like to give our special thanks to Honorary Chair of EIDWT-2023 Prof. Makoto Takizawa, Hosei University, Japan, for his guidance and support. We would like to express our appreciation to our Keynote Speakers for accepting our invitation and delivering very interesting keynotes at the conference.

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EIDWT-2023 Keynote Talks

Fueling the Data Engine to Boost the Power of Analytics

Wenny Rahayu

La Trobe University, Melbourne, Australia

Abstract. Data analytics is often considered in isolation. The attractiveness of the problems that need to be solved, the sophistication of the solutions, and the usefulness of the results are certainly the significant strengths of work on data analytics. However, the input data is often too simplistic, or at least the assumption that the data is already readily prepared for data analytics often neglects the fact that preparing such an input data is in many cases, if not all, actually the major work in the data life cycle. The pipeline from the operational databases that keep the transactions and raw data to the input data for data analytics is very long; it often occupies as much as 80% (or sometimes even more) of the entire life cycle. Therefore, we need to put much effort to this preparation and transformation work in order to value the work and the results produced by data analytics algorithms. Having the correct input data for the data analytics algorithms, or in fact for any algorithms and processes, is critical, as the famous quote “garbage in garbage out” had said. Even when the original data is correct, but when it is presented inaccurately to a data analytics algorithm, it may consequently produce incorrect reasoning. This talk will present a systematic approach to build a data engine for effective analytics.

Impact of Uncertainty Analysis and Feature Selection on Data Science

Ricardo Rodriguez Jorge

Jan Evangelista Purkyně University, Ústí nad Labem, Czech Republic

Abstract. Data science applications usually need a previous preprocessing stage for feature extraction and data validation. The data needs to be preprocessed and analyzed to minimize the dataset while preserving variance and patterns in order to find the optimal feature vector configuration. The feature selection algorithm allows finding the feature vector configuration to ensure minimal uncertainty in mapping the corresponding outputs and feature vectors. In data science, feature vector designs can be performed by different techniques and the validation can be performed by uncertainty analysis. These considerations are timely because wearable devices are increasingly being used on a large scale in different scientific fields. This talk will contribute to recommendations for the use of signals and data as a means of informing the impact of different uncertainty analysis and feature selection methods for data science applications. Using this new knowledge together with machine learning, data science applications can be evaluated with more confidence.

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Business Intelligence: Alternative Decision-Making Solutions on SMEs in Indonesia

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Abstract. In this modern and digital era, digital transformation is echoed as one of the organization's efforts to survive through Business Intelligence (BI). BI has become a buzzword even among business actors or organizations, not least for Small and Medium Enterprises (SMEs). SMEs are one of the sectors affected by the COVID-19 pandemic, namely the number of SME players who have lost their income and are finally forced to go out of business. BI is a combination of techniques and methods in terms of fulfilling access to information and a concise data management mechanism to be able to have a positive influence on SME business activities. It is because the strength of BI significantly impacts strategic decision-making using processing tools from Microsoft, namely SQL Server Integration Services (SSIS) and SQL Server Reporting Services (SSRS). This study aims to see the extent of BI as an alternative solution in decision-making by all SMEs in Indonesia. This research contributes to SMEs through the implementation of BI; SMEs get explicit knowledge about the factors that affect the performance of SMEs to help SMEs in making decisions.

Keywords: Business intelligence · SQL server integration services · SQL server reporting services · SMEs Indonesia

1 Introduction

This The development of information technology integrated with work processes is a necessity that an organization must carry out. It helps to improve the ability to analyze

problems faced by the organization and the decision-making process by management. Nowadays, the application of the Business Intelligence (BI) system assists the data collection, information, and analysis. It also opens access to sources of information and company performance. It also opens the possibility of measuring the strength of competitor growth.

BI is defined as a set of theories, methodologies, processes, architectures, and technologies that transform raw data into meaningful and useful information for business purposes [1]. As BI system can provide meaningful information, it can assist a company in designing a strategic plan. Therefore, BI system implementation is significant in building a competitive advantage and a company's sustainability.

BI combines techniques and methods to fulfill access to information and a concise data management mechanism [1]. The BI approach will facilitate data access collection, storage, analysis, and provision. Then, the information will assist the company in making decisions on problems or even predicting the long-term possibility of the company's mission [2]. The data generally collected in one access to information are transaction data, warehouses, reports, and visualization tools (prediction analysis and modeling) [2]. With the development of the times, existing technology provides convenient opportunities for various aspects in answering the problems that arise. For every choice that is based on processed data in SMEs, which manage complex and uncertain condition for their operational business needs, an information system is required as a reference. BI approach can be used as an alternative solution to meet these needs. The urgency of BI for SMEs can be seen from BI's function as a decision support tool. More specifically, the BI application in an SME is very helpful in managing SME business management through the fulfillment of access to information.

Simplicity is the key success factor of BI model [3]. It enables the provision of more flexible solutions that aligns with the client's business objectives [4]. Regarding [5] BI as a software platform can deliver 13 critical capabilities across three categories: enabling, producing, and consuming, as well as supporting four use cases. There are several empirical research pieces of evidence [5–7] shown that customer loyalty is increased by BI model implementation and able to elevate relationships to a new level. Customers are educated and expect higher performance and quality from this software suite as stated by [2, 8], hence BI is the answer to managing today's data overload. The segmentation of BI market according to [9] traditional, mobile, cloud, and social business intelligence, depending on the product architecture and user interface. However, the software industry is having fierce competition. It needs a more customer-centered [10] and vendor [11] approach. This statement is also supported by [12] which correctly assesses this perception that it is rigorous for companies in the high-tech and software business. From the point of view of using data to gain business advantage, BI tools can help in information management, helping executives to make more informed decisions [13].

The implementation of BI provides several advantages for SMEs. First, information and data are the basic things that support arguments in making decisions and convince several interested parties. Second, easy access to information by users impacts increasing the value of SME data and information. Third, increasing the value of organizational data and information makes it easier for an organization to monitor its performance. BI can show an organization's Key Performance Indicators (KPIs). Fourth, the application of

BI can become an investment in information technology that has existed before because BI does not replace technology but as a function of scale-up services on the system so that the information is more comprehensive. Overall, BI can make companies work more efficiently to save time because access to find information is easy to understand to minimize costs for employee training [1].

With the benefits obtained from BI, SMEs can determine the steps for implementing BI using a method that suits the company's needs. BI implementation begins with analyzing the problem you want to simplify in the company by evaluating the existing business cases, then planning a solution model. Next, planning results need to be tested for accuracy with in-depth analysis. Then if the analysis phase meets the terms and conditions, the BI system can enter the design phase divided into the design phase (information design) and the construction phase (prototyping). With the complexity of the stages and the benefits of BI implementation, it is hoped that the company can coherently understand the above steps so that BI can become a provider of information that facilitates the company's organizational operations.

The contribution of this research for SMEs are encouraging SMEs to implement BI system by providing model implementation of BI for SMEs. This also explores explicit knowledge about the factors that affect SMEs business performance. BI model implementation assists SMEs in decision-making. In the long term, this will enable

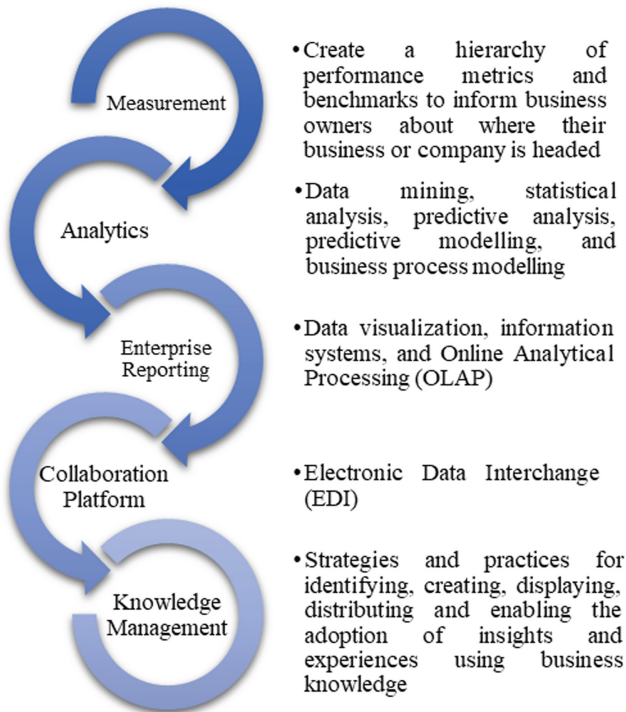


Fig. 1. Business intelligence implementation in Indonesia SMEs

SMEs to build its competitive advantage by having the ability to analyze market trends. Understanding the trends will help SMEs to determine strategies required to anticipate changes (Fig. 1).

2 Paper Preparation

For 65% of SMEs in Indonesia, technology is an essential investment priority. It is because investment in technology can be used to build digital capabilities in terms of sales and services (85%), digital marketing and social media (76%), and network and technology management (64%). Furthermore, 88% of SMEs in Indonesia believe that this technology will guarantee a more sustainable business model in the long term. Technology can help them manage cash flow better and reduce pressure on cash flow by reducing costs related to marketing and delaying the replacement of equipment such as laptops, desktops, and machines [14].

SMEs shall apply 5 (five) stages in implementing BI system. The first stage is measurement application. It creates a hierarchy of performance metrics and benchmarking processes. The result of this stage is to inform business owners about the direction of the business or company goals which is essential for the business. It makes it easier for management to understand market needs and take the necessary steps from a business outlook. By doing the first step, business owners or management boards can choose a method that suits the company's business in its application.

The second is Analytics, an application that builds quantitative processes: data mining, statistical analysis, predictive analysis, predictive modeling, and business process modeling. The result of analytics optimizes the decision in making business knowledge discovery. Analytics helps analyze obstacles, advantages, and solutions and assists companies in determining cost planning.

The Third stage is enterprise reporting for building a strategic infrastructure for business reporting. It is to fulfill strategic business management and not operational reporting. This report produces data visualization, information systems, and Online Analytical Processing (OLAP). Furthermore, enterprise reporting is helpful for the company to determine business decisions because it helps read and interpret data. For example, the BI application collects information on market conditions and processes it into a valuable report.

The fourth stage is the collaboration platform, which enables an organization to create distinct scopes inside and outside the business using Electronic Data Interchange (EDI). Collaboration platforms have a reasonable budget because they are easier to use. It also accelerates business stakeholders' work. The time to acquire data from inside and outside the company is faster. Special knowledge is not required.

Fifth, knowledge management enables the adoption of business knowledge insights and experiences by identifying, creating, displaying, and disseminating business knowledge insights and experiences. Businesses will receive more prepared data forecasts for long-term decision-making with this business intelligence tool. Business intelligence is essential for any organization. Planning, data management, and giving final results in the form of information for all parties involved in a business or business are the responsibilities of business intelligence [15] (Fig. 2).

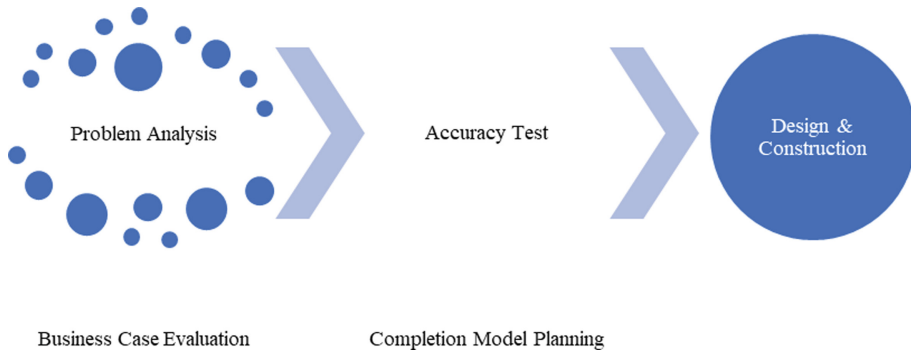


Fig. 2. Stages of the business intelligence implementation process in Indonesia SMEs

3 Literature Review

3.1 Business Intelligence

Business intelligence (BI) is a system and application that converts data (operational data, transactional data, or other data) within a business or organization into knowledge. This program examines historical data, analyzes it, and then employs that understanding to enhance organizational planning and decision-making so that it can be used in crucial corporate decision-making processes or decisions to achieve business goals [1].

In order to aid an organization in decision-making and, at the same time, boost its competitive advantage, business intelligence can also help a firm or organization get specific understanding of the elements that influence organizational performance. An organization can use BI to examine changing trends and identify the tactics required to foresee changing trends. BI can be defined as knowledge derived from the outcomes of data analysis derived from an organization's operations [4].

3.2 Microsoft Processing Tools

3.2.1 SQL Server Integration Services (SSIS)

A Microsoft SQL Server database software component called SQL Server Integration Services (SSIS) is capable of carrying out a variety of data migration activities. SSIS is a platform for workflow applications and data integration. Data warehousing tools with this capability are used for data extraction, transformation, and loading (ETL). This program can also update data in multidimensional cubes and automate SQL Server database maintenance [15].

3.2.2 SQL Server Reporting Service (SSRS)

Microsoft's SQL Server Reporting Services (SSRS) is a server-based reporting tool. It is a component of the Microsoft SQL Server suite of services, which is handled using a Web interface and includes SSAS (SQL Server Analysis Services) and SSIS (SQL Server Integration Services). It can be used to create and deliver a variety of interactive reports that are printable. SQL administrators and developers can connect to SQL databases using the SSRS service's interface for Microsoft Visual Studio and utilize the SSRS tools to format SQL reports in intricate ways. Additionally, a "Report Generator" tool is available for less sophisticated users to produce simpler SQL reports [15].

3.2.3 Decision-Making

Decision-making is universally defined as the choice among various alternatives. This understanding includes both choice-making and problem-solving. Rational decision-making is needed for every organization where managers must take more rational action in dealing with every situation. Managers define issues, weigh potential solutions, and select the best ones for the organization through the systematic process of rational decision-making [1] and [8] (Figs. 3, 4 and 5).

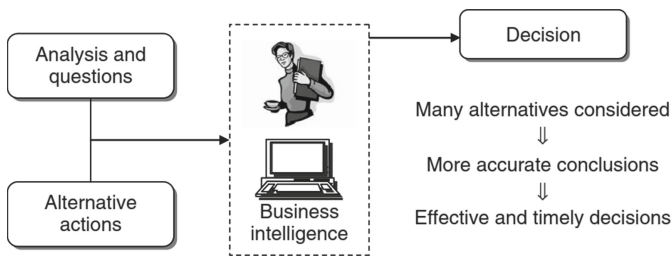


Fig. 3. Benefits of a business intelligence system Source: [1]

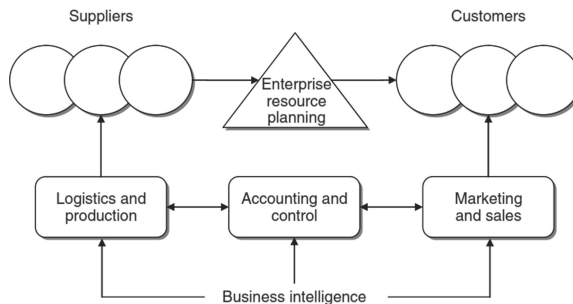


Fig. 4. Departments of an enterprise concerned with business intelligence systems Source: [1]

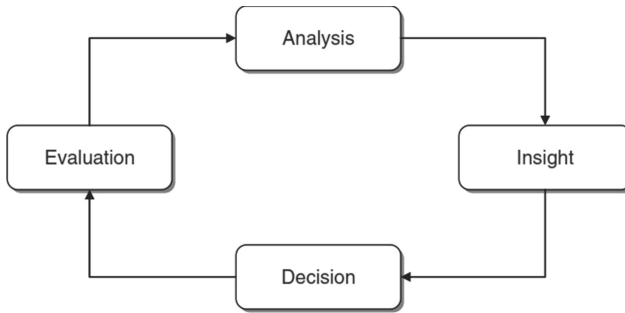


Fig. 5. Cycle of a business intelligence analysis Source: [1]

4 Research Method

4.1 Population and Sample

The population in this study is all SMEs in Indonesia that still exists today with the sampling technique using the purposive sampling. Only SMEs who have used a business intelligent system are eligible to participate in this study as respondents. The rules of thumb are referenced to [16] because the population's size is unknown. For the majority of studies, sample sizes more than 30 and lower than 500 are suitable. Additionally, the sample size in multivariate research (including multiple regression analyses) should be at least 10 times (ideally 100 times) as large as the total number of variables being examined.

4.2 Stages of Business Intelligence Activities for SMEs in Indonesia

- a. Observation Stage: The first stage is planning, which will start by preparing any tools/software needed in making this application and conducting research using interview methods to find out the needs of application users.
- b. Literature Study: Discussing the problems in developing this application service, books and articles from the internet are needed relating to business intelligence.
- c. Data Processing Stage: The data obtained from observations will then measure the perspective errors that generate questions and will be analyzed.
- d. Testing and Implementation: After the business intelligence discussion is complete, then carry out testing or test cases on the system later and apply them to the system.

5 Conclusion

Business intelligence (BI) is a technology that aids in the analysis and visualization of business data by businesses, particularly SMEs. A characteristic of BI allows for the conversion of raw data into valuable information that can aid in decision-making and give the business a competitive edge. Businesses can better serve their customers by evaluating the data they own. High levels of client loyalty and retention must come after rising sales.

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