The role of information systems on boosting business intelligence in modern economic institutions

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Abstract---This study aims to clarify the role of information systems as a vital component in supporting business intelligence within modern economic institutions. In light of accelerating digital transformations, economic institutions have become in dire need of advanced technological tools that enable them to analyze data and make accurate strategic decisions. The integration of information systems and business intelligence also enables Institutions to predict market trends, analyze customer behavior, and enhance operational efficiency, giving them a competitive advantage in a dynamic business environment. The development of technologies such as artificial intelligence and big data analytics has made information systems an indispensable tool for fostering innovation and achieving sustainable growth for modern economic institutions, thus enhancing their competitiveness.

Keywords---Information systems, business intelligence, economic institutions.

1. Introduction

In our current era, the importance of an organization's awareness of the changing environment surrounding it has grown. Survival belongs to the organization that possesses the fastest, most accurate, and most appropriate information at the right time. Continuity belongs to the organization that can efficiently exploit this information, thus maintaining its competitive position in light of these transformations. This relies primarily on information systems, which in turn contribute to enhancing business intelligence. Business intelligence systems are capable of achieving efficiency and effectiveness in a rapidly changing environment. In light of this change, economic Institutions must do their utmost to exploit potential growth opportunities.

From the above, the following main problem can be raised:

How do information systems contribute to enhancing business intelligence in modern economic institutions?

To achieve the goal of clarifying the role of information systems and business intelligence in enhancing the position of modern economic institutions, we will pose some questions as follows:

- ▪ What do we mean by information systems?
- ▪ What is the relationship between information systems and business intelligence?
- • How do information systems and business intelligence work within modern economic institutions?

Study Objectives:
This study aims to understand the concepts of information systems and business intelligence, and how reliance on information systems can impact business intelligence in modern economic Institutions.

2. Basic concepts about information systems:(Definitions and Components)

In the age of digital technology, information systems have become an essential component of the success of modern Institutions, helping organize and analyze data to support decision-making. Individuals and businesses rely on these systems to provide accurate, timely information, enhancing operational efficiency and improving overall performance. The role of information systems is no longer limited to businesses and Institutions, but has expanded to encompass various sectors such as health, education, government, and even the daily lives of individuals.

2.1. Definition of information systems:

There are many definitions, including:
- « An information system is a system consisting of a group of people who specialize in the preventive measures of collecting, analyzing, processing, and explaining the results obtained through some administrative units within the organization ».
- « It is a set of interconnected or interacting components that collect, process, and store data and information, then transmit and distribute it to users. An information system may be traditionally manual, which takes a long time ». (Robertson)
- « An information system is an organized set of resources—hardware, software, people, data, and procedures—that allows information in the form of text, images, sound, or coded data to be captured, collected, organized, processed, and distributed in Institutions ». (Zemmouchi-Ghomari, 2021)

   Therefore, an information system can be defined as: those systems that collect, organize, process, communicate, and display data for use by individuals within the scope of the activities carried out by an economic institution.

2.2. Functions of an information system :

Information systems functions include several key tasks aimed at supporting administrative processes and decision-making in Institutions. The most important of these functions are: (Laudon, 2020)

- Data Collection: Data is collected from various sources, such as manual input, sensors, the internet, and external databases.

- Data Storage: Data is stored in an organized manner within databases to ensure easy access and management.

- Data Processing : Converting raw data into meaningful information using analysis, classification, and filtering processes.

- Information Retrieval: Enabling users to quickly find the required information through search and indexing systems.

- Data Analysis: Using artificial intelligence, machine learning, and statistical tools to extract valuable insights to support decision-making.

- Decision Support: Providing managers and users with the necessary information to support strategic and tactical decision-making.

- System Integration: Linking information systems with other systems, such as enterprise resource planning (ERP) and customer relationship management (CRM) systems, to ensure a seamless flow of information.

- Reporting: Create periodic or ad hoc reports containing data and analysis to help management track performance.

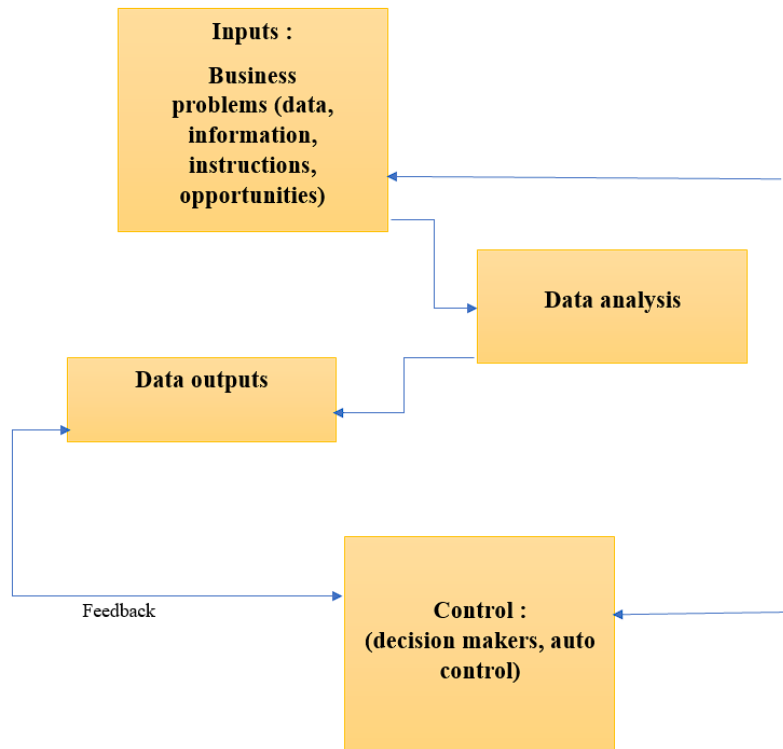We can also explain these functions through the following figure:

Figure 01: Functions of an information system
Source: prepared by the researcher

2.3. Elements of information systems :

It includes the following elements: (Reynolds, 2019)

a. Hardware: Includes computers, servers, storage devices, and input/output devices.

b. Software: Includes operating systems, applications, and database management software.

c. Data: Raw information that is processed and analyzed to extract useful information.

d. Networks: Enable the exchange of information between different devices and systems.

e. Human Resources: The individuals responsible for operating and maintaining the system and analyzing its data.

2.4. Future Trends in Information Systems : (Ausi, 2024)

- **Advanced Artificial Intelligence:** Such as chatbots that support customer service and predictive analytics for better decision-making.
- **Cybersecurity:** Due to the rise of cyber threats, more sophisticated security systems are being developed to protect data.
- **Big Data Analytics:** Companies rely on big data to analyze customer behavior and improve performance.
- **Virtual and Augmented Reality (VR/AR):** Used in training, engineering design, and e-commerce.
- **Blockchain Technology:** Contributes to securing digital transactions and reducing financial fraud.

The basic roles that push the economic institution to obtain an information system are:

- Business and operations support.
- Supporting decision-making by employees and managers.
- Support strategies to enhance competitiveness.
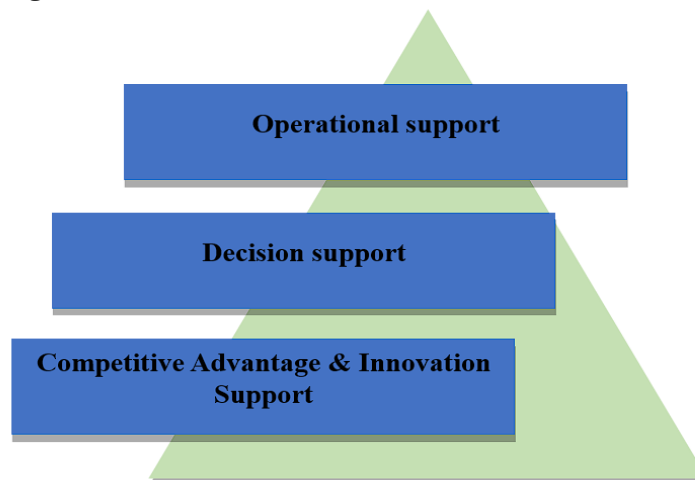
As shown in Figure 2:

Operational support

Decision support

Competitive Advantage & Innovation Support

Figure 2: The three basic roles of information systems applications in the economic institution

Source : (James A. O'Brienm, 2011, p. 9)

Therefore, the roles of information systems applications in an economic organization can be classified into three basic roles:

1. Operational Support: This role facilitates day-to-day operations within the organization by automating repetitive tasks and improving productivity. Its applications include:

- Transaction Processing Systems (TPS): such as inventory management systems, accounting systems, and payroll systems.

- Supply Chain Management (SCM): improving the flow of materials and services across the supply chain.

- Enterprise Resource Planning (ERP) Systems: unifying data across different departments to improve coordination and efficiency.

2. Decision Support : Information systems help analyze data and provide accurate reports to support management in making informed strategic decisions. Its applications include:

- Decision Support Systems (DSS): providing data analysis and modeling tools for more accurate decision-making.

- Management Information Systems (MIS): providing reports on the organization's financial and operational performance.

- Business Intelligence (BI): Analyzing big data and extracting insights that aid strategic planning.

3. Competitive Advantage & Innovation Support : Institutions use information systems to achieve a competitive advantage and innovate in products and services. Applications include:

- E-Commerce Systems: Facilitating online buying and selling.

- Customer Relationship Management (CRM): Understanding customer needs and tailoring services to them.

- Using artificial intelligence and machine learning: Developing new marketing strategies and analyzing markets with greater accuracy.

3. Business Intelligence (BI):

Institutions can use the knowledge gained from business intelligence and data analytics to improve business decisions, identify problems or challenges, monitor market trends, and identify new revenue opportunities or business growth. Business intelligence also provides high-quality, timely information, which can be provided from a variety of information systems.

3.1. Definition of business intelligence:

The term "business intelligence" is composed of two parts: "intelligence" and "business." Intelligence refers to the ability to apply knowledge to the surrounding environment intelligently through rationality, i.e., the ability to acquire knowledge. The "business" component represents the activity that seeks to generate profit by providing goods and services to others. Business intelligence is the process of gathering and processing business information to extract insights and make profitable business decisions. Business intelligence is used in conjunction with other tools, applications, and best practices to gather intelligent business insights and analyze information to improve overall business performance. Business intelligence systems include tools and techniques such as report generation, performance management, data inference, data forecasting,

data exploration, data analysis, and more. Business intelligence relies on extracting data from various sources such as databases, social media, text, company documents, websites, and more.

Thus, Business Intelligence (BI) is a set of technological processes to collect, manage, and analyze organizational data to provide knowledge that informs business strategies and operations.

3.2. Business Intelligence Architecture:
Any information system has an architecture consisting of stages that represent the structure of the system's operations. These must be established according to well-thought-out rules, as the system's operation is based on them. Therefore, all relevant factors must be considered to ensure proper operation. Many researchers and major software companies have proposed a business intelligence architecture that varies in terms of composition, interaction, and the types of components used. The architecture consists of physical foundations, transaction processing applications, extraction, transfer, and loading tools, data warehouse management tools, and analytical applications. A business intelligence architecture is based on three main components: data sources, warehouses, and business intelligence applications.

The business intelligence architecture represents the framework through which data is collected, analyzed, and transformed into valuable information that aids strategic decision-making. This architecture consists of several interconnected layers that work together to ensure the efficient operation of business intelligence systems.
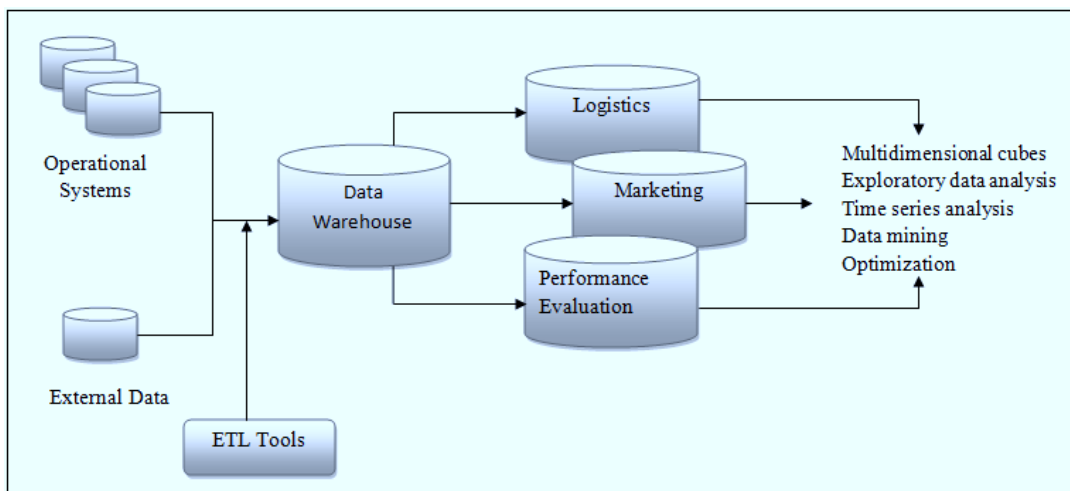As shown in Figure 3:

Figure 3 : Business Intelligence Architecture.
Source : (Yasar, 2024)

From the previous figure, we can see that the business intelligence structure consists of:

3.2.1. Data sources: All information systems within the organization that store data generated from daily transactions and subsequently use it for business analysis. This data is often routine and standard, and in today's Institutions, this data is integrated with external data.

3.2.2. Data organization area: This area consists of ETL processes, which stands for Extract-Transform-Load. In this area, data coming from various areas, whether operational systems or external sources, is purified and organized to be stored uniformly in the data warehouse. During this phase, all data coming from operational systems and external system sources is transformed into a form that is useful for preparing reports and queries requested by the user, through the following steps:
  - Extraction: This involves reading and understanding the data, then transferring the data through the transfer process.
  - Transformation: In this phase, data is cleaned, such as correcting spelling errors and identifying missing elements, so that the data can be converted into standard formats.
  - Loading: This is the final step, where the data organized into three-dimensional tables is copied into the data warehouse, and specific keys are assigned to each quality table.

3.2.3. Data Visualization Area: The data visualization area consists of the data warehouse and a number of data marts. The data warehouse contains a number of databases that contain historical data obtained from operational systems and external data sources. Creating and using a data warehouse is a critical and essential part of an organization's operations. Its primary advantage is reducing the number of queries that require shared computing resources. The second advantage is query analysis, as this process is impossible to perform through database structures. This process is performed within the data warehouse through the ETL process. Data marts contain specialized information for a specific domain, function, application, or organizational division. Data in data marts is stored in tables and three-dimensional models, rather than in a relational model as in databases for operational systems. This results in better performance and a clearer overview. This is achieved through the use of two types of tables:
  - Fact table: This table contains broad headings and comprehensive topics.
  - Dimension table: This table displays descriptive characteristics related to the analysis topic.
Data marts also contain specialized data specific to users.

3.3. The Importance of Business Intelligence:
Business intelligence helps Institutions:
- Improve decision-making by providing accurate and up-to-date information.
- Analyze customer behavior, enabling companies to customize services and improve customer experience.
- Increase operational efficiency by reducing costs and optimizing processes.
- Predict future trends using predictive analytics to anticipate opportunities and challenges.
- Gain a competitive advantage by enabling companies to make faster and more accurate decisions.

3.4. Challenges in Implementing Business Intelligence in Economic Institutions:

Economic Institutions face several challenges when implementing Business Intelligence (BI) systems. Understanding these challenges is vital to ensuring successful implementation and maximizing the benefits of these systems. The most prominent of these challenges are: (Mehrdad Maghsoudi, 2023) (Evans, 2023)

- Data Quality and Integration : The effectiveness of BI systems depends on the quality of data collected from multiple sources. Institutions may face difficulty ensuring the accuracy and consistency of data, especially when dealing with diverse data sources. This process requires data cleansing and standardization to ensure the reliability of the extracted analyses.

- Resistance to Change and User Acceptance: Employees may be resistant to adopting new systems, especially if they are accustomed to previous tools and technologies. Gaining user acceptance and training them to use BI systems is critical to ensuring a successful implementation.

- Complexity of Data Integration : Institutions face challenges in integrating data from multiple systems and applications, whether on-premises or in the cloud. This integration requires careful planning to ensure a seamless flow of data between different systems.

- Security and Privacy Challenges : As the volume of data grows, so do the risks associated with protecting this data from unauthorized access or breaches. Institutions must implement strong security protocols to ensure data confidentiality and integrity.

- Lack of clarity on objectives and requirements : Failure to define clear and specific objectives for business intelligence projects can lead to unsatisfactory results. Institutions must clearly define requirements and objectives to ensure the system aligns with business needs.

- Lack of management support : Getting senior management support is essential for the successful implementation of business intelligence systems. Without this support, projects may face a lack of necessary resources and funding.

- Scalability challenges : As an organization grows, business intelligence systems may need to be expanded to keep pace with increasing data volume and users. Systems must be designed to be scalable without compromising performance.

When you decide to introduce a Business Intelligence system into your company, you must develop a precise strategy to ensure a smooth transition to the new operating system. This strategy will ensure the integrity of your company's data and maximize the benefits of the new system.

4. Increase business intelligence using information systems :

Information systems play a critical role in business intelligence by collecting, analyzing, and presenting data in a way that supports strategic decision-making. These systems can be classified into several types based on their function and role in supporting business intelligence:

4.1. Transaction Processing Systems (TPS) : Used to manage day-to-day operational data in organizations, such as sales records, inventory, and payroll. They provide raw data that is later used in analysis and decision-making. Examples: Point-of-Sale (POS) systems, accounting systems.

4.2. Management Information Systems (MIS) : Used to provide periodic reports summarizing an organization's operational performance.

They rely on data collected from transaction processing systems to create analytical reports. They provide information to assist middle management in making tactical decisions. Examples: Financial reporting systems, operational management systems.

4.3. Decision Support Systems (DSS) : Aid in data analysis and making non-routine and complex decisions.

They use statistical models, simulation tools, and scenario analysis.

Useful for senior management in making data-driven strategic decisions.

Examples: Financial planning systems, risk analysis systems.

4.4. Executive Information Systems (EIS) : Designed for executives to provide a comprehensive overview of an organization's performance.

Provides summarized information from various systems, helping them make strategic decisions. Displays data through easy-to-interpret visual dashboards. Examples: Enterprise performance monitoring systems, financial performance analysis systems.

4.5. Data Warehousing Systems : Store massive amounts of data collected from multiple sources to enable long-term analysis. Used as the foundation for business intelligence systems by providing unified and integrated data. Helps create historical reports and in-depth analyses. Examples: Amazon Redshift, Google BigQuery, Microsoft SQL Server Data Warehouse.

4.6. Data Mining Systems : Use artificial intelligence and machine learning techniques to discover patterns and trends in data.

Used in customer behavior analysis, sales forecasting, and risk analysis.

Examples: RapidMiner, IBM SPSS Modeler, SAS Enterprise Miner.

4.7. Business Intelligence & Dashboards : Provide data analysis tools and visualizations such as charts and interactive reports.

Enable managers to analyze performance and interact with data dynamically. Examples: Microsoft Power BI, Tableau, QlikView.

4.8. Predictive Analytics Systems : Use artificial intelligence and statistical techniques to predict future trends.

Used in areas such as risk analysis, sales forecasting, and improving customer experience. Examples: IBM Watson Analytics, Google AI Predictions, SAS Predictive Analytics.

4.9. Big Data Analytics Systems : Designed to process and analyze massive amounts of unstructured data.

Used to identify trends and make decisions based on big data from multiple sources. Examples: Apache Hadoop, Spark, Google BigQuery.
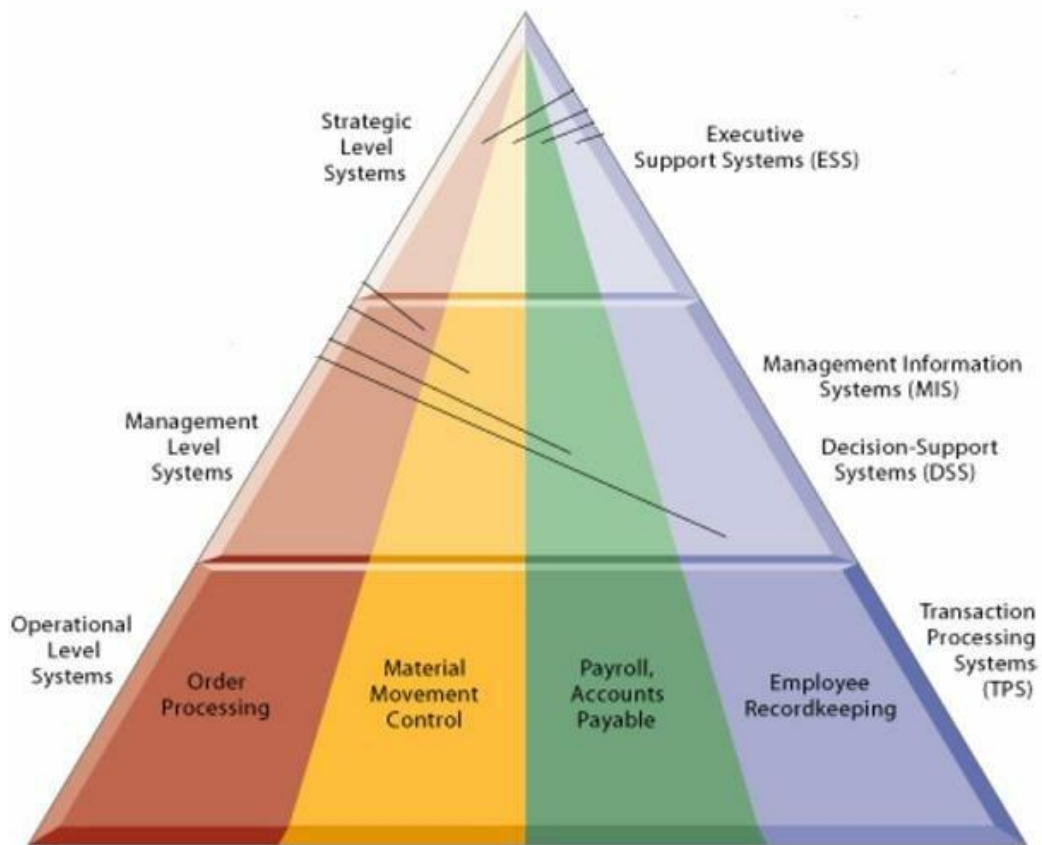
As shown in Figure 4:

Figure 4: The four major types of information systems.
Source : (Mihane Berisha-Namani, 2012)

And Table 1 provides summaries of some of the models used to support decision-making in modern economic institutions.

Table 01 : DSS models in some enterprise functions

functions	DSS models
Enterprise level	Corporate planning, investment analysis, and mergers and acquisitions
Accounting	Cost analysis, break-even analysis and auditing, tax calculation and analysis, depreciation methods and budgeting.
Finance	Discounted cash flow analysis, return on investment, budget capital, bond and securities refinancing, investment portfolio management, and foreign exchange values.
Marketing	Product demand forecasts, advertising strategy analysis and pricing strategies, market share analysis, sales growth and sales performance evaluation.

functions	DSS models
Human resources	Labor negotiations, labor market analysis, employee skill assessment, salaries and deductions.
Production	Product design, production scheduling, transportation analysis, product mix, inventory levels, quality control, machine replacement.

Source : (Stephen Haag, 2009)

5. Conclusion

An organization's success is tied to its ability to make important decisions. However, organizations face real challenges in leveraging the vast amount of data they possess, and linking this data from multiple sources to provide a unified view quickly and effectively is no easy task.

Different information systems also contribute to business intelligence by providing accurate data, analyzing it, and presenting it in ways that facilitate more accurate and efficient decision-making. Choosing the appropriate system depends on the organization's needs and the volume of data it handles.

In light of the rapid changes in the business environment and the massive amount of data flowing daily, the relationship between business intelligence (BI) and information systems has become complementary and essential to the success of modern economic organizations. Business intelligence cannot fulfill its effective role in supporting decision-making, guiding strategies, and achieving competitive advantage without advanced information systems that enable accurate and effective data collection, processing, and analysis.

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