Across Time and Technology: Understanding Trends in Enterprise Information Systems

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***Abstract*—This paper investigates the evolution of Enterprise Information Systems (EIS) over time with new technologies involving. By studying past and current trends, it aims to understand why and how organizations use EIS and predict the future evolution of EIS. In this paper, different papers are studied and compared to understand how EIS has evolved and been used through the years. Opinions on the trends, and challenges related to EIS are also shared. Knowing these trends helps people in business, research, and government understand how EIS has changed and how to use EIS better in today's fast-changing digital world to improve various aspects in their work.**

Keywords— Enterprise information systems, enterprise resource planning, trends, EIS implementation, evolution

I. INTRODUCTION

The key component of an organization is the enterprise information system (EIS), which centralizes an organization's information to boost productivity, reduce costs, and enhance operational effectiveness. Decision-making can be aided by the data provided by integrating multiple systems to enhance an enterprise's operational procedures. According to article, *'Enterprise information systems state of art: Past, present, and future trends*', growing demands for information integration in the manufacturing and service sectors have been met by the development of Information and Communication Technologies (ICT), including Industrial Informatics (e.g., Industry 4.0) and technological advancements in EISs, which support the operations of global supply chains. [3] This remark, in my opinion, appropriately captures the demands and trends of the modern corporate world. Enterprise Information Systems are essential for improving communication, expediting decision-making, and simplifying operations in businesses. ICT integration, including developments in industrial information systems, is becoming essential due to the demands of global supply chains and the demand for real-time information transmission. The use of modern technologies like IoT, big data analytics, and artificial intelligence, which are transforming industrial procedures and supply chain management, is also highlighted by the reference to Industry 4.0. These technologies facilitate smooth data interchange, task automation, preventive maintenance, and increased productivity across a range of corporate operations.

II. COMPARATIVE OF PREVIOUS STUDIES

In this section, multiple studies and papers that focus on the trends in EIS are searched. Studies are conducted on each of these works. Comparison of each study is shown in Table 1 below, which contains the main content and weaknesses identified in each study.

TABLE I. COMPARISON OF PREVIOUS STUDIES

Ref	***Main Content***	***Weaknesses***
[1]	The use of transformative technology for systems and substantial benefits offered to EIS.	- Difficulties on complexity of integration IoT with system - Limitation of cloud computing architecture in handling the explosive growth of IoT data
[6]	The optimization of enterprise HR information using IoT technology.	Inflexibility of the network architecture serving IoT
[7]	The concept of cloud computing, advantages, and challenges from an enterprise perspective.	Security and privacy issues on cloud servers

III. ADVANTAGES OF TREND TECHNOLOGIES IN EIS

A. Internet of Things (IoT)

Organizations need to be agile and flexible to respond to quick change of market environment due to the advent of the information age and the rapid development of economic globalization. To achieve this goal, it is necessary to apply various technologies in organizations which allow their information systems to have integrated data, applications, and resources from across the organizations.

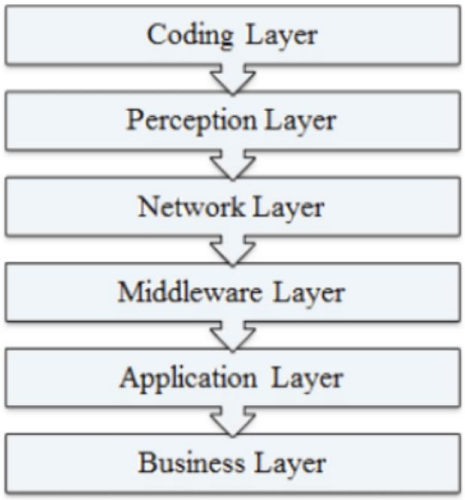


Fig. 1. Six-Layered Architecture of IoT [9]

According to article, '*Optimization of the Enterprise Human Resource Management Information System Based on IoT'*, with the development of computer and network communication technology, numerous devices are connected to the internet, the boundary between the real world and the virtual world tends to be blurred, and the internet is being extended to the physical world, forming the Internet of Things. [6]

While in the article *'The Future of Enterprise Information Systems'*, IoT is a key enabling technology in the Industrial Revolution 4.0 and has been revolutionizing the existing industrial systems. IoT can enable the creation of virtual networks to support the smart factory in Industry 4.0. [1] From both articles which mentioned how Internet of Things can be implemented in organizations where more IoT devices are now being connected to the internet. This indicates that enterprises have access to an increasing amount of data. In other word, both the quantity and quality of data gathered by IoT devices, and the internet are critical. By integrating EIS with IoT data, IoT sensors and devices provide a constant flow of data that enables industries and enterprises to conduct real-time analysis and obtain insights that enhance decision-making. However, it also observes that present single-function IoT search systems are not capable of managing various types of IoT spatial-temporal data simultaneously, highlighting a need for multifunctional IoT systems that can efficiently preprocess and classify data.

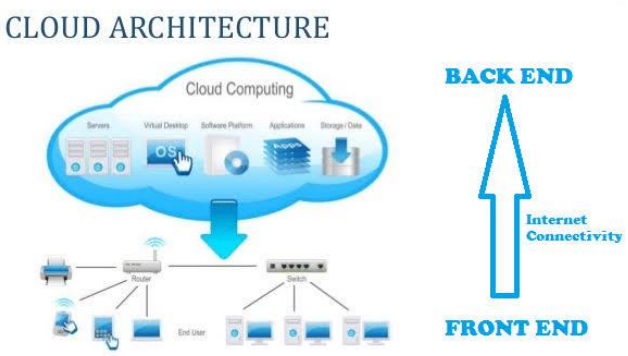
B. Cloud Computing

The provision of scalable, affordable, dependable, secure, and agile infrastructure and services is one of the primary functions of cloud computing in contemporary enterprise information systems. Cloud-based EISs will continue to be essential in fostering creativity, productivity, and competitiveness in today's corporate environment as companies embrace digital transformation.

Cloud computing is the on-demand availability of computer system resources, especially data storage and computation power. Cloud computing relies on sharing resources with high performance and at low cost. A large volume of data can be uploaded to cloud computing center for storage and computation. [1]

From the context, many decisions are made during an enterprise's operations, and these decisions call for a lot of data and significant computation. EIS may alter data sources to meet demand by utilizing cloud computing. This guarantees that businesses can effectively handle a range of workloads without having to make a big upfront investment in their infrastructure.

Referring to article, *'Advantages and Challenges of Adopting Cloud Computing from an Enterprise Perspective'*, cloud computing dramatically lowers the cost of entry for smaller firms trying to benefit from compute-intensive business analytics that were hither to available only to the largest of corporations. These computational exercises typically involve large amounts of computing power for relatively short amounts of time, and cloud



computing makes such dynamic provisioning of resources possible. [7] In this context, by paying for the resources they use, cloud computing allows businesses to save money and increase their financial efficiency by delivering hosted services over the Internet on a pay-as-you-go basis.

Fig. 2. Cloud Computing Architecture [8]

C. Artificial Intelligence

Artificial Intelligence (AI) is widely used in EIS to improve numerous aspects of corporate operations, decision-making processes, and consumer experiences. For instance, manufacturers may want to improve user guidance over system and technology boundaries (e.g., Babaian et al. 2018; Morana et al. 2013), they may explore higher degrees of artificial intelligence (AI)–based automation in process steps and may compare it with traditional execution, they may explore better integration of EIS functionality with quickly evolving workplace technology, etc. [1] By doing so, the productivity and the operational efficiency can be improved. Thus, employees can focus on higher-value activities while AI technologies automate repetitive and other routine tasks within EISs.

Besides, EISs can apply NLP (Natural Language Processing) to comprehend, interpret, and produce human language. By interacting with customers, responding to questions, carrying out tasks, and offering support, chatbots and virtual assistants. For example, virtual assistant implemented in mobile application like Bo Chat in Air Asia application, helping customers to handle several flight ticket issues like refunds or cancel flights through instruction provided in chat. This enables customers can manage their flights in anytime and anywhere. By natural language processing (NLP) algorithms implementation especially in CRM, it can enhance customer service and communication effectiveness in businesses.

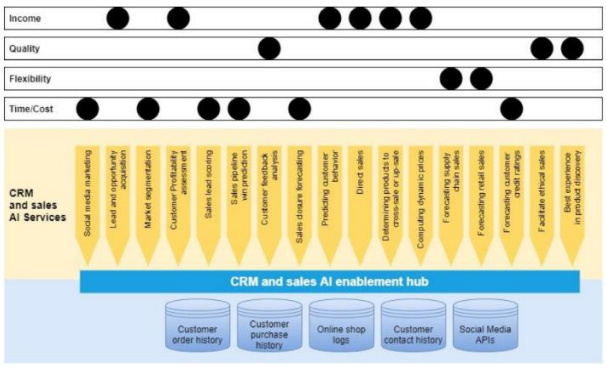


Fig. 3. Customer Relatinship Management (CRM) and AI services [10]

IV. CHALLENGES FACED IN EIS IMPLEMENTATION

To make better decisions and work more efficiently, many organizations decide to implement EIS in their work. However, there are many challenges that need to be overcome. It is important to understand these challenges and find solutions to implement EIS successfully. These are some of the challenges that will be faced:

A. User resistance due to privacy and data security

Having secure systems to share data with various stakeholders while still ensuring privacy and security of the data is thus a major challenge. [5] Many users refuse to share their data through the EIS due to concerns about privacy or distrust in the system's security measures. They may worry about who will have access to their data, how it will be used, and will their data be hacked if the security measures are down. Other than that, users may be tired and afraid of changing to something new that do not have any clear benefits or rewards for them.

B. Ensuring Useful Information

As data nowadays keep increasing, information overload may happen when there is too much information for user to handle. Users may be confused which information is important or useful for them among all the noises. Even though there are a lot of data available, reliability and usefulness of information provided by business systems can be affected by poor data quality such as inaccuracies, incompleteness, or inconsistencies. [5] Besides, users could not be able to understand the context of the information provided, which may cause incorrect decision-making. Therefore, ensuring useful information is a challenge that needed to be overcome while implementing EIS.

C. Inappropriate Learning Method

Keeping up with evolution of technology is a must in this modern society, as well as in the field of EIS. However, using old learning methods do not help people learn the skills they need to adapt with these changes. It is essential that the learning method should upgraded, emphasizing data-driven, social, and experiential learning strategies. [5] Traditional learning methods may fail to explain the dynamic nature of EIS as traditional training programs usually follow a fixed syllabus and do not update regularly with the newest technologies. Other than that, most training programs emphasis more on theoretical concepts and seldom provide practical experience or exposure to real-world applications of EIS technology. Having theoretical concepts is important, however without any hands-on experience can be outdated quickly in this rapidly evolving world.

D. Organizational heterogeneity

Diverse groups within an organization may have different needs depending on factors like local markets, supported products, and functional specificities. [5] For example, each organization may have different marketing strategies and products designed to satisfy the demands of customers in different regions. Heterogeneity within organizations affect the design of EIS at both technical and conceptual level [1]:

- Technical level: Can be seen in hardware, software, and infrastructure used in the design and implementation of EIS which include hardware platforms, operating systems, programming languages and many more. [1] For example, in terms of programming languages, web applications interface may use HTML or CSS for user interface while admin side management may use PHP or Java.
- Refers to data models tailored to different departments' requirements
- Conceptual level: Refers to models of data and the same real-world concepts for products, processes, and data that manage organizational data and workflow. [1] For instance, the sales department may have its own data model for checking customer order details and sales transactions while the accounting department may use a different model for financial reporting and budgeting.

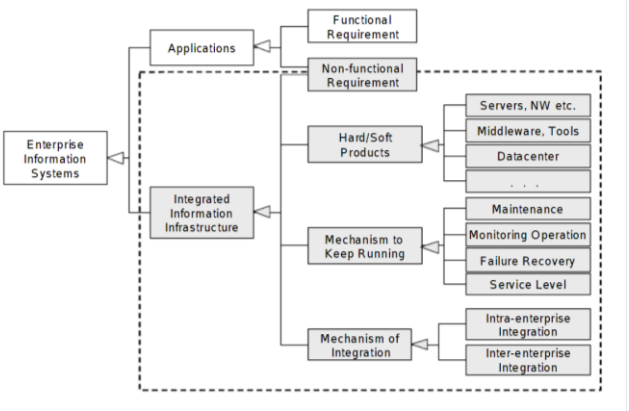


Fig. 3. Class Diagram of Enterprise Information System [4]

V. OPINIONS

The application of technology trends in Enterprise Information Systems (EISs) represent an important change in how business function, make decisions, and engage their customers with the implementation of current developments in enterprise information systems, or EISs. As a result of technological advancements, integration and interoperability within EISs are made easier and more flexible, allowing for efficient data interchange and communication between various applications and systems.

Continuous adaptation in EIS helps in evolving business environments. However, it is never easy and poses many challenges to implement EIS. Challenges faced in EIS implementation should be overcome so that EIS can be implemented more smoothly in organizations.

In the perspective of security and compliance, ensuring strong security and compliance measures is crucial as EISs grow more networked and data driven. Emerging technological advancements provide creative ways to protect confidential data, identify and eliminate potential risks on the Internet, and keep businesses compliant with guidelines and regulations. To overcome information overload, organizations should prioritise relevant or important data so that users can receive the information. This can be done by identifying key priorities and focus areas. Other than that, having a simple data presentation interface can have better understanding and make it easier to find relevant information.

VI. CONCLUSION

In conclusion, technological advancements have enormous potential to improve EIS, but in order to fully reap the rewards, organizations must successfully manage a number of hurdles. All in all, enterprises should approach adopting technology with rational mindset. One organization should evaluate any EIS technology that contributed to revenue growth and cost reduction before implementing it. Clear policies and governance to data should be established by defining roles and responsibilities. A balanced perspective, considering strategic fit, costs and long-term sustainability should be implied in while approaching technology adoption in EIS to ensure that technology enhances business outcomes effectively.

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