Parallels in Evolution: From Siloed ISs to Integrated AI

Ioannis Patias[0000-0003-1355-7433]

Faculty of Mathematics and Informatics, University of Sofia St.Kliment Ohridski“,
5 James Bourchier blvd., 1164, Sofia, Bulgaria
patias@fmi.uni-sofia.bg

Abstract. The evolution of information systems (ISs) has mirrored a trajectory from siloed, task-oriented systems to integrated, process-oriented enterprise resource planning (ERP) systems. This transformation has been driven by the increasing complexity of business operations and the need for efficient, data-driven decision-making. As organizations sought to streamline processes and improve overall performance, the integration of disparate systems became a crucial priority. Concurrently, artificial intelligence (AI) has experienced a similar evolution. Early AI applications were often limited to specific tasks, such as image recognition or natural language processing. However, recent advancements have enabled the development of more sophisticated AI systems capable of understanding complex contexts and making autonomous decisions. This paper explores the parallels between the evolution of IS and AI, arguing that the future of AI lies in greater integration and process orientation. By examining historical trends and current developments, we identify key factors driving this convergence. These include the increasing availability of data, advances in machine learning algorithms, and the growing demand for automation and efficiency. We propose that the next generation of AI will be characterized by its ability to seamlessly integrate with existing systems, understand and respond to organizational needs, and optimize processes across the entire enterprise. By leveraging AI's potential to automate routine tasks, enhance decision-making, and uncover valuable insights, organizations can achieve significant competitive advantages.

Keywords: Information System (IS), Enterprise Recourse Planning (ERP), Artificial Intelligence (AI), AI Integration, Process Orientation.

1 Introduction

1.1 A Subsection Sample

The rapid evolution of technology has profoundly impacted the way organizations operate. Information systems (ISs) have emerged as critical tools for managing and analyzing data, enabling businesses to make informed decisions and improve efficiency. In recent decades, we have witnessed a significant shift in the nature of IS, from standalone, task-oriented systems to integrated, process-oriented solutions

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(Laudon, K. C., & Laudon, J. P., 2020) [1]. This evolution parallels the trajectory of artificial intelligence (AI), which is moving from isolated, specialized tools to more comprehensive and integrated applications.

This paper explores the convergence of IS and AI, arguing that the future of AI will be characterized by greater integration and process orientation. By examining the historical development of IS and the current state of AI, we aim to identify key trends and implications for organizations. The paper is structured as follows: Section 2 delves into the evolution of information systems, from early, siloed systems to integrated ERP solutions. Section 3 discusses the current state of AI, focusing on both standalone and integrated applications. Section 4 draws parallels between the evolution of IS and AI, highlighting the common themes of integration and process orientation. Finally, Section 5 explores future trends in AI, including the potential for more integrated and process-oriented systems.

In conclusion, the evolution of information systems and artificial intelligence has followed a similar trajectory, moving from siloed, task-oriented solutions to integrated, process-oriented systems. As AI continues to advance, we can expect to see even more sophisticated and integrated AI solutions emerge. By understanding the historical context and current trends, organizations can leverage the power of AI to drive innovation, improve efficiency, and gain a competitive advantage.

2 Evolution of Information Systems

The journey of ISs from standalone tools to integrated solutions mirrors the technological advancements of the past few decades. Early ISs were often designed to address specific, isolated tasks within an organization. These siloed systems, while functional, hindered efficient operations and limited data sharing. However, the emergence of integrated solutions like enterprise resource planning (ERP) systems revolutionized the way organizations managed their operations (Rosenkranz, S. et al., (2024) [2].

2.1 Early Information Systems: Siloed and Task-Oriented

In the early days of computing, ISs were often designed to address specific, isolated tasks. These systems, such as accounting software or inventory management systems, operated independently and lacked the ability to communicate and share data with other systems. This siloed approach led to a number of problems, including data redundancy, inconsistencies, and inefficiencies. For example, data might be entered multiple times into different systems, increasing the risk of errors and hindering decision-making.

In this early era of computing, ISs were primarily designed to address specific, isolated tasks within an organization. These systems, often developed independently, operated in silos, lacking the ability to communicate and share data with other systems. This siloed approach resulted in a number of challenges:

Data Redundancy and Inconsistency

- Multiple Data Entry Points: Data was frequently entered into multiple systems, leading to redundancy and increasing the risk of errors.

- Data Discrepancies: Inconsistent data across different systems hindered accurate reporting and analysis.

Lack of Integration

- Limited Data Sharing: Siloed systems prevented the seamless flow of information between departments.
- Inefficient Workflows: Manual processes were often required to transfer data between systems, leading to delays and errors.

Inefficiencies and Poor Decision-Making

- Delayed Insights: Siloed systems hindered the timely access to information, impacting decision-making.
- Suboptimal Resource Allocation: Inefficient resource allocation due to lack of real-time data.

Examples of Early Siloed Systems:

- Standalone Accounting Systems: These systems were used for tasks such as general ledger, accounts receivable, and accounts payable.
- Inventory Management Systems: These systems tracked inventory levels, placed orders, and managed stock.
- Customer Relationship Management (CRM) Systems: These systems were used to manage customer interactions and sales.

These systems, while functional, were limited in their scope and often lacked the ability to integrate with other systems. As a result, organizations struggled to gain a comprehensive view of their operations and make informed decisions.

2.2 Emergence of Enterprise Resource Planning Systems

To overcome the limitations of siloed systems, organizations began to adopt enterprise resource planning (ERP) systems. ERP systems integrate various business processes, such as finance, human resources, and supply chain management, into a single, unified platform. By consolidating data and streamlining workflows, ERP systems can significantly improve efficiency, reduce costs, and enhance decision-making.

To address the limitations of siloed systems and improve overall organizational efficiency, organizations turned to ERP systems. These integrated software solutions aim to unify various business functions, such as finance, human resources, supply chain management, and customer relationship management, onto a single platform.

Key Benefits of ERP Systems:

- Data Integration: ERP systems consolidate data from disparate sources into a central repository, eliminating data redundancy and inconsistencies.
- Process Standardization: They enforce standardized business processes across the organization, ensuring consistency and efficiency.
- Improved Decision-Making: By providing real-time, accurate data, ERP systems enable informed decision-making at all levels of the organization.
- Enhanced Collaboration: ERP systems facilitate collaboration among different departments by providing a shared platform for communication and information sharing.
- Increased Efficiency: Automation of routine tasks and streamlined workflows reduce operational costs and improve productivity.

Core Modules of ERP Systems:

- Financial Management: Handles accounting, budgeting, and financial reporting.
- Human Capital Management (HCM): Manages employee information, payroll, and benefits.
- Supply Chain Management (SCM): Oversees procurement, inventory, and logistics.
- Customer Relationship Management (CRM): Manages customer interactions, sales, and marketing.

By implementing ERP systems, organizations can gain a holistic view of their operations, identify areas for improvement, and make data-driven decisions. However, the successful implementation of an ERP system requires careful planning, execution, and ongoing maintenance.

In conclusion, the evolution of information systems, from siloed, task-oriented systems to integrated ERP solutions, has significantly impacted the way organizations operate. By breaking down silos and streamlining processes, ERP systems have enabled organizations to improve efficiency, reduce costs, and make more informed decisions. As technology continues to advance, we can expect to see even more sophisticated and integrated information systems emerge.

3 Current State of AI

AI has witnessed remarkable progress in recent years, transitioning from standalone, task-specific tools to integrated solutions capable of addressing complex problems. Early AI systems were designed to excel at specific tasks, such as image recognition or natural language processing. These tools, while impressive, lacked the ability to understand the broader context and collaborate with other systems. However, recent advancements, particularly in the areas of machine learning and deep learning, have enabled the development of more sophisticated AI systems capable of integrated and process-oriented applications (Marrone, R., et al., 2024) [3].

3.1 Stand-Alone, Task-Oriented AI Tools

In the early days of AI, researchers focused on developing tools to solve specific tasks, such as image recognition, natural language processing, and game playing. These standalone tools, while impressive in their own right, often lacked the ability to understand the broader context of a problem or to collaborate with other systems (Bory, P., Natale, S. & Katzenbach, C., 2024) [4].

In the early stages of AI research, the primary focus was on developing systems capable of performing specific, well-defined tasks. These early AI systems were designed to excel at narrow, specialized domains, often referred to as "narrow AI" (Banafa, A., 2024) [5].

Key Characteristics of Early AI Tools:

- Task-Specific: Designed to solve a single, well-defined problem.
- Data-Hungry: Relied on large amounts of data to learn patterns and make predictions.

- Limited Generalization: Struggled to apply knowledge gained from one task to another.

Examples of Early AI Tools:

- Expert Systems: These systems were designed to emulate the decision-making abilities of human experts in specific domains, such as medical diagnosis or financial analysis.
- Machine Learning Algorithms: Early machine learning algorithms, such as decision trees and neural networks, were used to classify data and make predictions.
- Natural Language Processing (NLP) Systems: These systems were designed to understand and process human language, enabling tasks like machine translation and text summarization.

While these early AI tools demonstrated impressive capabilities, they were limited in their scope and flexibility. They often required significant amounts of human intervention and were not able to adapt to changing circumstances.

3.2 The Rise of Large Language Models (LLMs)

A significant development in recent years has been the emergence of Large Language Models (LLMs). These models are trained on massive amounts of text data, allowing them to generate human-quality text, translate languages, write different kinds of creative content, and answer your questions in an informative way (Gillings, M., Kohn, T., & Mautner, G., 2024) [6].

Key Characteristics of LLMs:

- Massive Scale: LLMs are trained on enormous datasets, enabling them to learn complex patterns and relationships.
- Generative Capabilities: They can generate text, code, scripts, musical pieces, email, letters, etc.
- Versatility: LLMs can be adapted to a wide range of tasks, from text summarization to creative writing.

While LLMs have demonstrated remarkable capabilities, they are still primarily task-oriented and may struggle with understanding the broader context of a problem or reasoning about the world. However, as research continues to advance, we can expect to see LLMs become increasingly sophisticated and versatile.

3.3 The Rise of Integrated AI Solutions

More recently, there has been a growing interest in developing integrated AI solutions that can address complex problems and automate complex processes. These solutions often involve the integration of multiple AI techniques, such as machine learning, natural language processing, and computer vision. For example, AI-powered chatbots can now understand and respond to complex queries, while AI-driven automation tools can streamline workflows and reduce human error (Raiaan, M. A. K. et al., 2024) [7].

In recent, there has been a significant shift towards developing integrated AI solutions that can address complex problems and automate complex processes (Bousquette, I., 2024) [8]. These solutions often involve the integration of multiple AI techniques, such as machine learning, natural language processing, and computer vision.

Key Characteristics of Integrated AI Solutions:

- Multidisciplinary Approach: Combines techniques from various AI fields to address complex problems.
- Contextual Understanding: Leverages knowledge from multiple sources to understand the broader context.
- Adaptive Learning: Continuously learns and improves over time.
- Human-Machine Collaboration: Enables seamless collaboration between humans and AI systems.

Table 1: Parallel Development of ISs and AI.

Section	Information Systems (ISs)	Artificial Intelligence (AI)
2. Evolution of ISs **2.1 Early ISs: Siloed and Task-Oriented**	-Early ISs were department-specific (finance, HR, inventory) -Focused on automating repetitive tasks. -Limited data sharing across units.	-Early AI tools were narrow (expert systems, rule-based programs). -Designed for single tasks like chess-playing or medical diagnosis. -No interop/lity between tools.
2. Evolution of ISs **2.2 Emergence of ERP Systems**	-ERP unified core business functions (finance, supply chain, HR). -Enabled cross-departmental data integration. -Shift from task automation to holistic process management.	-AI began integrating multiple capabilities (NLP, vision, speech). -Platforms emerged that combine tools into ecosystems (e.g., cloud AI suites). -Move toward end-to-end workflows supported by AI.
3. Current State of AI **3.1 Stand-Alone, Task-Oriented AI Tools**	-Comparable to early IS silos. -Tools like chatbots, recommendation engines, or OCR operate independently. -Useful but fragmented.	-Current AI apps often focus on single tasks (image recogn., translation, summarization). -Lack seamless integration with broader processes.
3. Current State of AI **3.3 The Rise of Integrated AI Solutions**	-Mirrors ERP evolution in ISs. -AI now embedded across enterprise platforms (CRM, ERP, productivity suites). -Supports cross-functional decision-making.	-Gen AI and multimodal systems integrate text, image, and voice. -AI unified workflows across domains. -Trend toward AI as a strategic, process-oriented backbone.

Examples of Integrated AI Solutions:

- Intelligent Virtual Assistants: These AI-powered assistants can understand and respond to complex queries, automate tasks, and provide personalized recommendations.
- Autonomous Vehicles: Self-driving cars rely on a combination of AI techniques, including computer vision, machine learning, and sensor fusion, to navigate roads and avoid accidents.
- AI-Driven Automation: Robotic process automation (RPA) and intelligent automation (IA) tools can automate repetitive tasks and improve operational efficiency.
- AI-Powered Predictive Analytics: These tools can analyze large datasets to identify trends, patterns, and potential future outcomes.

By integrating multiple AI techniques, organizations can develop more powerful and versatile solutions that can address a wide range of challenges. As AI continues to evolve, we can expect to see even more sophisticated and integrated AI systems emerge.

In conclusion, the field of artificial intelligence has made significant strides in recent years. From standalone, task-specific tools to integrated, process-oriented solutions, AI is transforming industries and reshaping the future of work. As AI continues to evolve, it is essential to address the ethical implications of its use and to develop robust governance frameworks to ensure that AI is used responsibly (see Table 1).

4 Parallels Between ISs and AI Evolution

The evolution of information systems and artificial intelligence shares striking similarities. Both domains have moved from a focus on standalone, task-oriented solutions to more integrated, process-oriented approaches. This convergence has been driven by the need for improved efficiency, increased productivity, and enhanced decision-making capabilities. By integrating disparate systems and automating routine tasks, organizations can gain a competitive edge in today's rapidly changing business landscape (Badr, Y., 2024) [9].

4.1 From Siloed to Integrated Systems

The evolution of both IS and AI has followed a similar trajectory, moving from siloed, task-oriented systems to integrated, process-oriented solutions. In both cases, the goal is to improve efficiency, reduce costs, and enhance decision-making. By integrating disparate systems and automating routine tasks, organizations can achieve significant operational benefits.

Both ISs and AI have undergone a significant evolution, moving from siloed, task-oriented systems to integrated, process-oriented solutions. This convergence has been driven by a number of factors, including:

- The Rise of Digital Transformation

The increasing digitization of businesses has led to a proliferation of data and the need to manage it effectively. Siloed systems struggle to handle the volume and complexity of modern data, making integration a necessity.

- The Need for Improved Efficiency and Productivity

Integrated systems can streamline workflows, reduce errors, and improve overall efficiency. By eliminating redundant tasks and automating routine processes, organizations can save time and resources.

- The Demand for Data-Driven Decision Making

Integrated systems provide a unified view of organizational data, enabling data-driven decision-making. By analyzing data from various sources, businesses can gain valuable insights and identify opportunities for improvement.

- The Advent of AI and Automation

AI technologies, such as machine learning and automation, have accelerated the trend towards integration. AI-powered systems can automate tasks, analyze data, and make intelligent decisions, further enhancing the capabilities of integrated systems.

Key Benefits of Integrated Systems:

- Enhanced Collaboration: Improved communication and information sharing between different departments.
- Improved Decision Making: Access to a unified view of organizational data.
- Increased Efficiency: Automation of routine tasks and streamlined workflows.
- Reduced Costs: Lower operational costs through increased efficiency and reduced errors.
- Increased Agility: Faster response to changing business conditions.

By embracing integration, organizations can unlock the full potential of their information systems and AI technologies, driving innovation and growth.

4.2 The Role of Process Orientation

Process orientation is a key factor in both ISs and AI. By understanding and optimizing business processes, organizations can identify opportunities for improvement and automation. AI can play a crucial role in this process by analyzing large amounts of data to identify patterns and trends (Kulkov, I., et al. (2024) [10].

Process orientation is a fundamental principle in ISs and AI. By focusing on the flow of information and tasks within an organization, businesses can identify inefficiencies, bottlenecks, and opportunities for improvement (Prasad Agrawal, K., 2023) [11].

The Importance of Process Orientation:

- Improved Efficiency: By understanding and optimizing business processes, organizations can eliminate redundant steps, reduce cycle times, and improve overall productivity.
- Enhanced Decision-Making: Process orientation provides a clear view of how decisions are made and how they impact the organization.
- Increased Flexibility: By breaking down complex processes into smaller, more manageable steps, organizations can adapt more quickly to changing business conditions.

The Role of AI in Process Orientation:

AI can significantly enhance process orientation by:

- Process Mining: AI-powered process mining tools can analyze event logs to identify bottlenecks, inefficiencies, and opportunities for automation.
- Predictive Analytics: AI can predict future trends and patterns, enabling organizations to proactively address potential issues.

- Robotic Process Automation (RPA): AI-powered RPA tools can automate repetitive, rule-based tasks, freeing up human workers to focus on more strategic activities.
- Intelligent Automation: A combination of AI and RPA, intelligent automation can handle more complex tasks, such as decision-making and problem-solving.

By leveraging AI technologies, organizations can achieve a higher level of process automation and optimization. This can lead to significant cost savings, improved customer satisfaction, and increased competitive advantage.

In conclusion, the evolution of information systems and artificial intelligence shares striking similarities. Both domains have moved from a focus on standalone, task-oriented solutions to more integrated, process-oriented approaches. By leveraging the power of AI, organizations can optimize their business processes, improve decision-making, and drive innovation.

5 Future Trends in AI

The future of AI holds immense potential for transforming industries and societies. As AI continues to advance, we can expect to see a shift towards more integrated and process-oriented solutions. AI-powered systems will become increasingly embedded in business processes, automating tasks and making intelligent decisions. However, the development and deployment of AI raise significant ethical considerations, including bias, privacy, and job displacement. To harness the full potential of AI while mitigating its risks, it is essential to develop robust ethical guidelines and regulations (Akhtar, M. S. et al., 2024) [12].

5.1 More Integrated and Process-Oriented AI

The future of AI is likely to be characterized by greater integration and process orientation. AI-powered systems will become increasingly embedded in business processes, automating tasks and making intelligent decisions. This will lead to significant improvements in efficiency, productivity, and innovation.

The future of AI is poised to be characterized by increased integration and process orientation. AI-powered systems are increasingly being embedded within business processes, automating tasks, making intelligent decisions, and enhancing overall operational efficiency.

Key Trends in Integrated and Process-Oriented AI:

- AI-Driven Automation: AI-powered automation tools, such as robotic process automation (RPA) and intelligent automation (IA), can automate repetitive tasks, reducing human error and increasing productivity.
- AI-Powered Decision Making: AI algorithms can analyze vast amounts of data to identify patterns and trends, enabling data-driven decision-making.
- AI-Enabled Process Optimization: AI can help identify bottlenecks, inefficiencies, and opportunities for improvement in business processes.
- AI-Driven Innovation: By automating routine tasks, AI frees up human workers to focus on creative and strategic activities, fostering innovation.

As AI continues to evolve, we can expect to see even more sophisticated and integrated AI solutions emerge. These solutions will have a profound impact on various industries, transforming the way we work and live.

5.2 Ethical Considerations and Challenges

As AI becomes more sophisticated, it is essential to consider the ethical implications of its use. Issues such as bias, privacy, and job displacement must be carefully addressed. Additionally, organizations will need to develop robust governance frameworks to ensure that AI is used responsibly and ethically (Masciari, E. et al., 2024) [13].

While AI offers tremendous potential, it is essential to address the ethical implications of its use (Vodenitcharova, A., et al.2022) [14]. Some of the key ethical challenges associated with AI include:

- Bias and Fairness: AI algorithms can perpetuate biases present in the data they are trained on, leading to discriminatory outcomes.
- Privacy Concerns: AI systems often collect and process large amounts of personal data, raising concerns about privacy and security.
- Job Displacement: As AI becomes more advanced, there is a risk of job displacement, particularly for routine and repetitive tasks.
- Autonomous Weapons: The development of autonomous weapons systems raises serious ethical questions about the use of lethal force by machines.

To mitigate these risks, it is essential to develop robust ethical guidelines and regulations for AI development and deployment (Leventi, N., et al. 2020) [15]. Organizations should also invest in AI ethics education and training to ensure that their AI systems are developed and used responsibly. By addressing these challenges proactively, we can harness the power of AI to create a better future for all.

In conclusion, the future of AI holds immense potential for transforming industries and societies. However, it is essential to address the ethical implications of its use and to develop robust governance frameworks. By striking a balance between innovation and ethics, we can harness the power of AI to create a better future for all.

6 Conclusion

The evolution of information systems from siloed, task-oriented systems to integrated, process-oriented ERP systems has significantly impacted the way organizations operate. This historical trajectory offers valuable insights into the future of AI.

As AI continues to advance, we can expect a similar shift from standalone, task-specific tools to more integrated, process-oriented solutions. This trend is driven by several factors, including the increasing availability of data, advancements in machine learning algorithms, and the growing demand for automation and efficiency.

The integration of AI into business processes has the potential to revolutionize the way organizations operate. By automating routine tasks, enhancing decision-making, and uncovering valuable insights, AI can significantly improve efficiency, productivity, and innovation. However, it is crucial to address the ethical implications of AI, such as bias, privacy, and job displacement.

The future of AI is bright, but it is essential to adopt a responsible and human-centered approach to its development and deployment. By carefully considering the potential benefits and risks, organizations can harness the power of AI to create a more sustainable, equitable, and prosperous future.

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