Artificial Intelligence-Powered Business Transformation

Artificial Intelligence-Powered Business Transformation:

Strategies, Tools, and Applications

By

Hasan Amca

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To my daughter Asu Lara, son Yılmaz, and wife Senal

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PREFACE

The business world has undergone unprecedented changes due to rapid advancements in digital technologies, Machine Learning (ML), and Artificial Intelligence (AI) since the early 2000s. As organisations navigate the evolving digital landscape and redefine the rules of competition for discovering growth opportunities, integrating the power of Artificial Intelligence (AI) into business processes becomes vital. This book investigates how AI enhances decision-making, automates operations, fosters innovation, and revolutionises businesses through transformation by employing AI-powered procedures, tools, and applications.

Why This Book is Important

Rather than focusing on ML algorithms and programming concepts, as in technical AI books, this book offers a business-centred approach, emphasising the operational, strategic, and ethical concerns of AI integration, to be helpful to professionals with diverse backgrounds. Hence, the book can effectively assist and guide professionals who will either manage the AI-powered business transformation process themselves or facilitate the transformation process as a consultant. The book also includes sections that can help with the use of well-known CRM and ERP packages that use AI for decision-making, customer behaviour prediction and analysis, supply chain management, and stock control. The Data Analytics section provides a detailed explanation of the collection, organisation, and processing of the data required for decision-making processes.

The book also offers expert insights, real-world examples, and case studies to illustrate the transformative power of AI. Readers will gain actionable insights that apply to business organisations and ensure that AI-based solutions are effectively employed for process automation, innovation, and efficiency enhancement, ultimately creating business value. The case study, provided in Chapter 7, describes the details of an AI application in the hospital Emergency Service Admission (ESA) as part of a larger-scale Hospital Management System. Pilot-project test run results, using a relevant dataset to check whether the Random Forest Algorithm is capable of managing ESA based on the Triage Classification of the patients, are also

provided. Similarly, Chapter 8 describes the steps involved in creating a practical AI transformation framework tailored for an island-based international wholesale food and beverage business enterprise, aiming to enhance efficiency, improve resilience, and competitiveness through data-driven strategies and AI integration.

What is the book about?

The book, titled "Artificial Intelligence Powered Business Transformation: Strategies, Tools, and Applications," investigates how Artificial Intelligence (AI) reshapes modern businesses by automating and streamlining business processes, enhancing decision-making, and driving innovation. The book targets business leaders, policymakers, entrepreneurs, academics, and students by providing a comprehensive roadmap for incorporating AI into business strategies. It goes beyond technical coding and emphasises practical implementation aspects, governance, data readiness, AI tools, and ethical concerns. As it is intended for both technical and non-technical readers, the book equips technical and academic professionals with strategies and insights needed to assist and lead AI transformation, supported by real-life examples and educational resources.

Over the eight chapters, the book covers basic AI knowledge, readiness assessments, business process optimisation, data analytics, and real-world AI-powered application examples across various sectors, including finance, healthcare, logistics, and marketing. It concludes with a comprehensive example of business transformation from an international wholesale food and beverage business to an AI-driven business model.

The Problem this Book Solves or the Gap it Fills

The book aims to bridge the gap between business practice and AI theory by providing a practical guide for non-technical professionals to implement AI in real-life business contexts. It also addresses the readiness of business organisations, strategic integration, and sector-specific applications to help leaders traverse AI transformation with tools, case-driven frameworks, and actionable insights.

Motivation for Writing this Book

This book is the culmination of an extensive literature survey on the work of AI pioneers and business leaders, as well as an in-depth investigation and

research on the subject, and a comprehensive analysis of real-world problems related to the impact of AI on business. The experience I gained during the digital transformation process of the Electricity Authority in North Cyprus in the early 2000s also encouraged me to engage in the subject comprehensively. In 2019, we, as a team of experts, compiled the Northern Cyprus Economy Competitiveness Report and a roadmap to guide digital transformation processes for businesses, preparing them for Industry 4.0. Teaching the Artificial Neural Networks course to graduate students at Eastern Mediterranean University also inspired me to conduct an in-depth exploration of the subject and focus intensely on ML and AI applications.

Target Audience of the Book

The book is primarily intended as a textbook for undergraduate and graduate students in academic units such as business and economics, information technology, computer science, software engineering, electrical engineering, communication and media studies, and MIS. The book also addresses business leaders, entrepreneurs, policymakers, and managers who need to understand the power of AI in improving business processes and decision-making mechanisms. The book also serves as a roadmap for executives seeking opportunities to integrate AI into their business strategies, as well as startups looking for innovative solutions to their business problems through the power of AI. AI enthusiasts, academics, students specialising in technology, business, and management subjects, and professionals with non-technical roles can also benefit from the book due to its capacity to provide a practical perspective on the role of AI in modern business organisations.

The Organisation of the Book

The book, which is organised in seven dedicated chapters, covers the key aspects of the AI-powered business transformation process. Each chapter addresses a crucial aspect of the AI transformation in businesses, providing relevant definitions and descriptive examples. The following sections provide a brief description of the book chapters.

Chapter 1 provides a brief introduction to the subjects of human intelligence and artificial intelligence, including their definitions, capabilities, and limitations; AI categories, domains, platforms, and applications; AI readiness assessment for businesses and the market; and finally, the business transformation process.

Chapter 2 covers the AI domains, platforms, and applications with particular attention to definitions and categorisation of the domains, platforms, and applications.

Chapter 3 addresses the AI readiness of businesses, focusing on the market's readiness for the entry of new players, data readiness, governance and ethics readiness, business value readiness, infrastructure readiness, and organisational readiness for AI transformation. The chapter also addresses AI Readiness Index (AIRI) assessment parameters and methodologies.

Chapter 4 focuses on data analytics (gathering, organising, and operating on data), the importance of data analytics for intelligent applications, upgrading the website to improve data generation and acquisition for AI applications, and finally, common tasks and roles in data analytics.

Chapter 5 forms the backbone of the book, which involves business process improvement using AI, identifying business processes with potential for improvement by AI, the impact of AI-based process improvement on business performance, and identifying which business processes need to be improved using AI.

Chapter 6 explores popular AI-powered applications for enhancing business efficiency and driving growth. It includes AI-powered platforms for streamlining content creation, business functionality, productivity, and efficiency improvement, workflow and process automation, data analytics, and performance tracking, product design and prototyping, healthcare applications and personalised treatment, customer behaviour analysis and customer experience management, demand forecasting, supply chain and inventory management, financial services and market analysis, and stock and investment analytics. The chapter also includes a prediction section on future trends in AI-powered applications and the job market.

This chapter also provides an all-inclusive review of popular AI applications for professionals in IT departments of the following sectors:

- Healthcare and Biotechnology
- Marketing and Customer Experience
- Finance and Investment
- Fashion, Design and Creative Industries
- Logistics and Supply Chain Management
- Financial and Business Intelligence

Chapter 7 presents a case study on an AI-powered healthcare management system, focusing on the problem statement, an overview of generic AI-powered hospital management systems (AI-HMS), AI model building and training, ethical considerations, compliance, challenges, and the development of a pilot project for implementing and testing the built AI model. Results of a test run are also provided for clarity.

Finally, Chapter 8 provides a comprehensive framework for an AI transformation strategy tailored for an international wholesale food and beverage business from an island environment perspective. The chapter also addresses AI-driven transformation issues, as well as the unique operational, logistical, and regulatory challenges inherent to wholesale businesses, including geographical constraints, demand variability, and overseas import-export dependencies, in a comprehensive manner.

The book is supported by well-prepared presentation slides and supporting materials for the lecturers and students.

Author Background

I, Prof. Dr. Hasan AMCA, received my B.Sc. degree in Electrical and Electronics Engineering from Eastern Mediterranean University (EMU) in 1984, M.Sc. (telecommunications) degree from the University of Essex in 1985, and Ph.D. (mobile communications) degree from the University of Bradford in 1993. I worked as a faculty member in the Department of Electrical and Electronics Engineering at EMU from 1985 to 2023. As part of a broader portfolio of courses, I taught Artificial Neural Networks to graduate students. I have been serving as the Vice President of the Higher Education Council since April 2023.

I served as the Director of the School of Computing and Technology, Dean of Engineering Faculty, and Vice Rector Responsible for International Relations and Student Recruitment at EMU. I served as a member of the board of directors of the EMU Distance Education Institute, the EMU Technology Development Centre, and the Information Technologies and Communication Authority (BTHK) in Northern Cyprus. I also took on various duties, including serving as president of the EMU Continuing Education Centre, president of the board of directors of Atatürk Teachers Academy, and president of the board of directors of the electricity authority in Northern Cyprus. From time to time, I also provide consultancy on ICT issues.

I am a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE). My current research interests are Machine Learning and Artificial Intelligence applications in Business Transformation.

Acknowledgments

I am grateful to my daughter, Asu Lara, who guided me in designing the book's cover page and prepared some drawings; my son, Yilmaz, with whom I had very informative discussions on the subject; and my wife, Senal, for the moral support she provided throughout the preparation of this book.

A special thank you to the readers, who are eager to harness AI's power and drive meaningful change in their businesses, and whose curiosity and commitment to innovation inspire the writing of this book. Authoring this book has been an especially enlightening experience for me, and I hope it serves as a valuable resource for individuals seeking to integrate AI into their businesses.

Prof. Dr. Hasan AMCA.

1

INTRODUCTION

As Artificial Intelligence (AI)-powered technologies, shaped by businesses across various industries, continue to permeate every aspect of our lives, the benefits and challenges create profound consequences, leaving a lasting impact on social, economic, legal, ethical, and psychological aspects. AI-powered technologies can have a profound impact on businesses, enhancing efficiency, driving innovation, and improving the customer experience. These technologies can also pose challenges, including job losses, privacy concerns, and ethical compromises.

To understand the impact of AI application tools and techniques on businesses and business transformation processes, it is essential to have a detailed understanding of AI, its definition, capabilities, and limitations, AI solutions, platforms, and applications space, and the Business Transformation Process (BTP). The following sections will summarise these concepts with reference to the impact of AI on business processes and performance improvement.

1.1 Human versus Artificial Intelligence, Definitions, Capabilities and Limitations

Before looking at the benefits of AI for different businesses, it is important to know what intelligence and, hence, AI are, what its capabilities and limitations are, what AI solutions, platforms, and application areas cover, and finally, how specific businesses can benefit from practical AI applications to improve their performance. In addition, selected AI applications in various business processes and their impact on business performance are discussed in detail.

1.2 Categories of AI

We can divide AI into four broad categories: Reactive Machine, Limited Memory, Theory of Mind, and Self-Aware AI (Alagar, 2023; IBM, 2023).

Reactive Machines are a type of AI that cannot form memories or use past experiences to form current decisions. A notable example of this type of AI is the IBM Deep Blue chess-playing supercomputer, which defeated the grandmaster Garry Kasparov in the late 1990s (Sirsat & Rajesh, 2022).

Contrary to Reactive Machines, Limited-Memory types of AI have a significant advancement, especially in applications that require adaptation to changing environmental conditions. These machines can look into the past to form current decisions. The Limited Memory type machines, such as self-driving cars, can look into the past to inform current decisions and observe other cars' speeds, directions, and diverse road situations, which requires identifying specific objects in the environment and monitoring them in real-time (Alagar, 2023; IBM, 2023). Continuous improvement in algorithms and data processing capabilities over time will enhance the performance of Limited Memory AI, making it more flexible, reliable, and adaptable. This could enable their further integration into everyday life.

The Theory of Mind type AI machines can form representations of the world and other entities in their environment and use these representations in decision-making. In psychology, understanding the people and creatures in the world who can have thoughts and emotions that affect their behaviour falls in this category of AI.

Finally, the Self-Aware AI belongs to the most advanced category of AI that can not only represent the environment but also represent itself and then establish thoughts relating itself to its environment. This concept ultimately leads to an understanding of consciousness and the development of self-aware machines (Wang, 2023).

1.3 AI Platforms, Models, Tools, Applications and Domains

The integration of AI into business processes can be carried out through constituents of the AI space, including AI platforms, models, tools, applications and domains. A detailed process mapping, efficiency analysis, and Business Transformation Plan (BTP) need to be prepared following the selection of business processes that require change or upgrade through the implementation of AI solutions in related domains, tools, and procedures. The next stage involves choosing a suitable AI platform that best supports the transformation process. Following the selection of solutions and platforms, the necessary applications and tools that best fit the chosen platform must be identified.

1.4 Business and Market AI Readiness Assessment

Integrating AI into business plans means identifying the opportunities for which AI can be used to enhance and optimise the specific roles and functions in the business environment. Using AI to improve business processes requires training staff to work effectively with AI tools and continuously evaluating their impact on business processes to create a strategic vision and increase the chances of success. For this purpose, the need to obtain reliable and sufficient data is evident. To integrate AI into business plans, we can employ a procedure such as the following:

- Map the processes and identify inefficient processes and flaws,
- Determine the right problems to be solved with AI,
- Restructure the problems and derive solutions based on AI,
- Determine which AI tools will be used to implement the solutions,
- Make necessary upgrades to obtain reliable and sufficient data,
- Create a new team, mostly by training the current team members, to adapt and integrate all AI solutions into business plans.

1.5 The Business Transformation Process

The Business Transformation Process (BTP) should be accompanied by a Strategic Positioning Plan (SPP), which will clearly indicate the company's current standing in relation to its nearest rivals and its projected position after completing the BTP. The SPP should also address the business's growth capacity and new position in the local and global context, which will then necessitate the analysis of the global impact of AI integration into business plans. At this stage following the surveys and analysis carried out by the globally accepted companies, it will be necessary to know the global players' standing in the AI-powered BTP, what proportion of companies in different parts of the world are integrating AI into their business plans, and their projected growth in capacity in the short, medium and long terms. We then need to investigate both vertical and horizontal industries to develop a comprehensive business plan.

To enhance the clarity of the business plan and growth projections, it is crucial to support the analysis with sound examples from companies that have already undergone such transformation processes. To clarify the pathway, the business should traverse related industries such as healthcare, clothing, entertainment, food and beverage should be analysed and brought to the attention of the business patrons. The accuracy of various AI

algorithms' effectiveness in personalised styling and recommendations for clients must also be used at the convincing stage for the business patrons.

1.6 Organisation of the Book

The book mainly addresses the procedures, tools, and applications employed in the AI-powered transformation of Small and medium-sized enterprises (SMEs). AI is also extensively employed in government institutions in various ways, including healthcare applications, population growth estimates, inflation rate assessments, and balancing income and expenditure.

Chapter 1 provides a summary of the book's coverage, including definitions, capabilities, and limitations of AI technologies. The space of AI solutions, platforms, and applications is also summarised before a short description of the Business Transformation Process. Chapter 2 details the AI solutions, platforms, and applications space, while Chapter 3 details data, infrastructure, organisation, business value readiness, and AIRI calculation parameters and methodologies. Chapter 4 explores the common tasks and roles covered by data analytics, with a focus on gathering, organising, and operating on data, as well as the web redesign process to improve data acquisition capacity for AI applications. Chapter 5 addresses AI applications in businesses, focusing on the impact of integrating AI into business plans, the economic growth resulting from AI adoption across various industries, and examples of AI applications that enhance business efficiency. Chapter 6 investigates the popular AI application platforms for business efficiency and growth. Chapter 7 exploits an emergency service admission system based on Triage Classification as part of a broader AI-powered healthcare management system. Finally, Chapter 8 presents a case study regarding the AI transformation of a wholesale business.

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2

AI PLATFORMS, MODELS, TOOLS, APPLICATIONS AND DOMAINS

Though they can complement each other, Human Intelligence (HI) and Artificial Intelligence (AI) have completely different natures. AI can successfully handle large volumes of data, perform sophisticated calculations, identify complex patterns, and perform repetitive tasks with very high levels of accuracy. On the other hand, humans can engage in critical thinking and meaningful reasoning, exhibit empathy, creativity, and an understanding of diverse contexts, and make informed ethical decisions (Balamurugan et al., 2022). Merging a great deal of human experience with analytical, pattern recognition, sophisticated calculation, and other intelligent applications strength of AI offers businesses a powerful means to boost the capacity of their production, marketing, and sales processes (Edwards, 2024). The context of Artificial Intelligence (AI), which will be discussed in detail in the next section, can be described in terms of platforms, models, tools, applications, and domain space, as shown in Figure 2.1 (Haseeb, 2019).

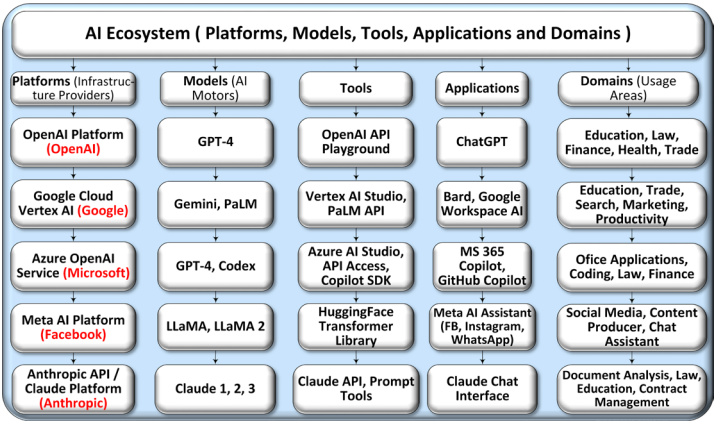

Figure 2.1. AI domains, platforms, and applications space (Haseeb, 2019).

The first deployment times, the developers, deployments histories and distinguishing features of the some of the most popular AI models are summarised in Table 2.1 (OpenAI, 2022).

2.1 Definitions of AI

In the context of the book, thinking is defined as the mental process of generating, analysing, and evaluating ideas, making decisions, solving problems, and reflecting on experiences. On the other hand, intelligence is defined as the ability to think, perceive objective facts, comprehend, think abstractly, judge, and use these mental functions harmoniously for a purpose.

Human intelligence, as a comprehensive and complex concept, encompasses various cognitive abilities that enable us to perceive reason, learn, and adapt to our surroundings (Sternberg, 2012; Gignac & Szodorai, 2024). Figure 2.2 shows the types of human intelligence (OrangeMantra, 2023). Artificial Intelligence (AI), when compared to human intelligence, can be defined as the simulation of human intelligence processes by computing machines to perform tasks that typically require human intervention (Shubhendu & Vijay, 2013).

Table 2.1. First deployment times, developers, deployments histories and distinguishing features of some of some of the most popular AI models (OpenAI, 2022).

Model	Developer	1st Deployment	Notes
GPT-1	OpenAI	June 2018	First “Generative Pre-trained Transformer,” 117 Million parameters
GPT-2	Feb. 2019 (res. paper) Nov. 2019 (full model)		Initially suspended due to "abuse concerns" was later released completely
GPT-3	Jun. 2020	175 Billion parameters; The basis for early private AI applications	
ChatGPT	OpenAI	Nov. 2022	It was initially based on GPT-3.5 Later upgraded to GPT-4.
Gemini 1 (Bard)	Google DeepMind	6 Dec. 2023	Bard was rebranded as Gemini.
Claude 1	Anthropic	Mar. 2023	Constitutional AI-based chatbot.
Phoenix	Huawei	Mid 2023	Mid 2023 (China)

DeepSeek	DeepSeek	Dec. 2023	Open-weight models are available
Mistral	Mistral AI	27 Sep. 2023	High-performance small model (open weights).
LLaMA 1	Meta	24 Feb. 2023	For research purposes
Grok (xAI)	xAI	Nov. 2023	Tied to the X (Twitter) platform.

Intelligence can enhance our problem-solving capability, learning, adaptation, and understanding capacity, generating new ideas, concepts, and artistic expressions. In addition, human intelligence could ease interacting with others, forming complex social relationships, understanding and managing our own emotions and those of others, being aware of ourselves and our surroundings, and enabling self-analysis and self-reflection. However, since our thinking can be influenced by bias, intelligence can lead us to errors in judgment and decision-making. Furthermore, due to its limited processing power, our brains have a finite capacity, limiting their ability to handle complex tasks simultaneously. Due to our brain's vulnerability to emotions, our rational thinking could be impaired. Hence, our perceptions and interpretations of the world can vary from person to person, and lead us to subjectivity (Colom et al., 2010; Gignac & Szodorai, 2024).

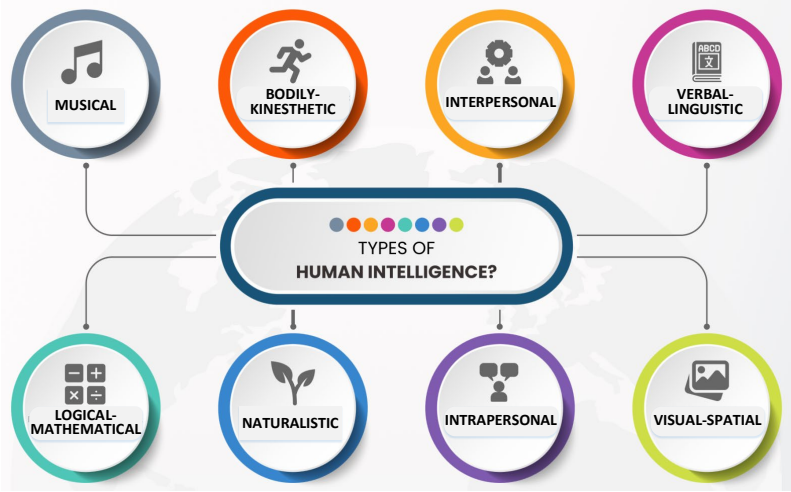

Figure 2.2. Types of human intelligence (OrangeMantra, 2023).

AI is an excellent tool for automating repetitive tasks, analysing large volumes of data, and identifying complex patterns. Additionally, AI can utilise Natural Language Processing (NLP) in applications such as chatbots and text and voice translation. Through predictive analytics, AI can perform decision-making tasks across different applications in various industries.

The adaptive learning feature enables AI to improve continuously its capabilities over time, powering technologies such as recommendation systems and autonomous vehicles (Russell & Norvig, 2020). On the other hand, AI has limitations in generalising across different application domains, where its performance depends heavily on large volumes of domain-specific, high-quality data. Additionally, ethical issues such as privacy and bias pose significant challenges. The high computational costs, which increase with the size of the training dataset and the complexity of the algorithms used, make it a resource-intensive and power-hungry process.

The "black box" nature of AI models makes interpretability and accountability highly complicated, reducing trust and implementation capacity in critical decision-making applications (Binns, 2018). One of the most comprehensive definitions of AI is derived by the European Commission Joint Research Centre (JRC, 2020) as follows.

> "AI systems are software (and hardware) solutions designed by humans that, when given a complex goal, operate in the physical or digital domain by perceiving their environment through data acquisition, interpreting structured or unstructured data, reasoning over the knowledge derived from this data, and deciding on the best actions to achieve the specified goal."

A picture reflecting this definition is shown in Figure 2.3. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions." (JRC, 2020). A more compact definition of AI has been published earlier (ISO, 1995) as, "an interdisciplinary field, usually regarded as a branch of computer science, dealing with models and systems for the performance of functions generally associated with human intelligence, such as reasoning and learning."

An AI system is illustrated in Figure 2.4, where sensors serve as input devices to collect data, processors perform representation and reasoning on the perceived information, decide on the best action to take, and then act accordingly through actuators, possibly by modifying the environment (EC-HLEG, 2018).

Figure 2.3. A picture representing the European Community Joint Research Centre defining AI terms (JRC, 2020).

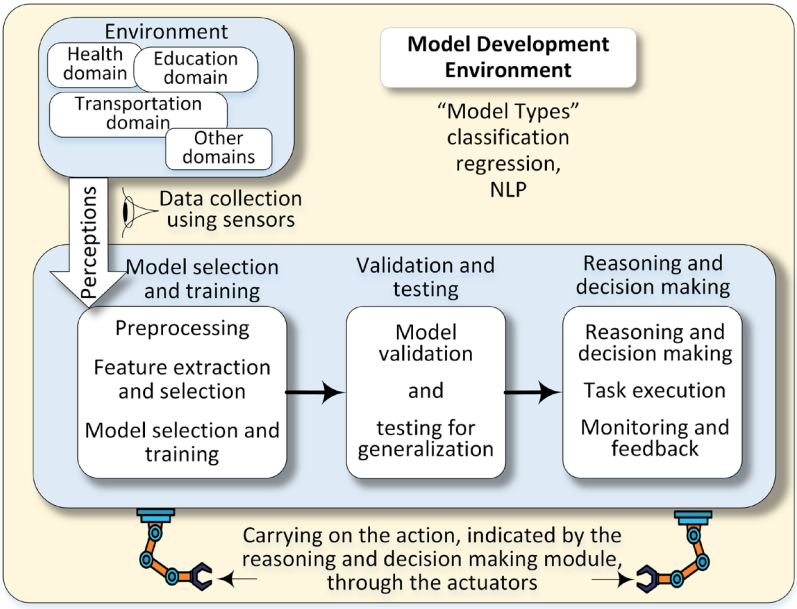

Figure 2.4. Schematic depiction of an AI system (EC-HLEG, 2018).