Cofece
Comisión Federal de Competencia Económica

ARTIFICIAL INTELLIGENCE AND COMPETITION IN THE DIGITAL ENVIRONMENT

Artificial Intelligence and Competition in the Digital Environment

General Directorate of Digital Markets

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Comisión Federal de Competencia Económica

Artificial Intelligence and Competition in the Digital Environment

Original title: Inteligencia Artificial y Competencia Económica en el Entorno Digital

First edition in spanish: november 2024.
First edition in english: february 2025.

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Federal Economic Competition Commission
Av. Revolución N°725, Col. Santa María Nonoalco,
Alcadía Benito Juárez, C.P. 03700,
Mexico City, Mexico.
www.cofece.mx

Content

Glossary

Absolute Monopolistic Practices

Contracts, agreements, arrangements or combinations among competing economic agents aimed at or resulting in price manipulation, market segmentation, manipulation of supply or demand, public bid rigging or the exchange of information for any of these purposes.

Sources:
Cofece (2016), *¿Qué es una práctica monopólica absoluta?* Available here.
Cofece (2020), *Guía para Tramitar el Procedimiento de Investigación por Prácticas Monopólicas Absolutas*. Available here.
Cofece (2020), *Acuerdo mediante el cual el Pleno emite la Guía para el Inicio de Investigaciones por Prácticas Monopólicas y Concentraciones Ilícitas*. Available here.
Cofece (2024), *Algorithms and Competition in the Digital Economy*, p. 32. Available here.

AI Actor

Those who play an active role in the AI lifecycle, including organizations and individuals who use or operate AI.

Source: OECD (2019), *Artificial Intelligence & responsible business conduct*, p. 4. Available here.

AI models

Programs trained with data to perform specific tasks autonomously using algorithms. Neural networks are a prime example, employed for tasks such as computer vision and pattern recognition.

Sources:
The Data Schools (2023), *¿Qué es la Inteligencia artificial (IA)?* Available here
Walther (2023), *¿Qué son los modelos de inteligencia artificial y cuáles son los más usados?* Available here
IBM (2023), *What is an AI model?* Available here.
HPE (n.d.), *AI Models*. Available here.

AI systems

Machine-based systems that can, for a given set of human-defined objectives, make predictions, provide recommendations or make decisions that influence real or virtual environments.

Sources:
OECD (2019), *Artificial Intelligence & Responsible business conduct*, p. 1. Available here.
OECD (2019), *Recommendation of the Council on Artificial Intelligence*. Available here.

Algorithm

Sequence of clear and precise instructions that must be followed in a specific order, mechanically and systematically, to complete a task or activity. Instruction manuals for assembling objects (such as furniture, toys, and others) and cooking recipes are examples of algorithms.

In the digital environment, algorithms are fed with data and transform it into a response or output of information through a sequence of computational steps. For example, Google uses algorithms to display information as the result of a user's search or query.

Source: OECD (2017), *Algorithms and Collusion: Competition Policy in the Digital Age*, p. 8. Available here.
OECD (2023), *Algorithmic Competition, OECD Competition Policy Roundtable Background Note*, p. 8. Available here.

Applications (apps)

Computer programs or software designed for a particular purpose and that can be downloaded to a phone or any other device.

Source: Cambridge Dictionary, *App*. Disponible here.

Barriers to entry

Any obstacle that hinders a company's entry into a market. There are several types of barriers: some are regulatory, such as permits, concessions, or government policies; others are structural, stemming from the inherent conditions of the industry, such as sunk costs required to start operations; and others are strategic, implemented by established companies in the market, aimed at complicating the entry of new competitors through specific business practices or tactics.

Sources: OECD (2006), *Barriers to Entry*, p. 17. Available here.
Cofece (2016) *Herramientas de Competencia Económica*, p. 21. Available here.

Chatbot

Computer program that simulates and processes human conversations (either written or spoken), enabling humans to interact with digital services as if communicating with a real person.

Source: Oracle (n.d.), *What is a chatbot?* Available here.

Cloud computing

Digital service that comprises the provision of remote access to computing resources (*e.g.*, networks, servers, storage, applications, and services) on demand and over a network, rather than through a personal computer or a local server that are not part of the cloud.

Sources: Ofcom (2023), *Cloud services market study. Final report*, p. 20. Available here.
NIST (2011), *The NIST Definition of Cloud Computing*, p. 2. Available here.
DCMS (2022), *Data storage and processing infrastructure security and resilience – call for views*. Available here.

Competition policy

Set of laws, economic principles, rules, regulations, institutions and other tools that the Mexican State has at its disposal to ensure that companies compete, which benefits consumers.

Through its enforcement, authorities prevent, deter, correct, regulate and/or sanction behaviors by economic agents that reduce or eliminate competition, such as collusion or abuse of dominance.

Source: Cofece (2020) *¿Qué es la política de competencia?* Available here.

Data centers

Facilities designed to efficiently host large-scale computing hardware.

Source: Competition Bureau of Canada (2024), *Artificial intelligence and competition*, p. 10. Available here.

Digital economy

All economic activities that depend on digital resources or significantly benefit from them. These resources include technologies, infrastructure, digital services and data. The digital economy encompasses both traditional markets that have adopted digital technologies and markets that operate entirely in a digital environment.

Sources:
OECD (2020) *A roadmap toward a common framework for measuring the Digital Economy*, p. 35. Available here.
OECD (2022), *OECD Handbook on Competition Policy in the Digital Age*, p. 8. Available here.
Cofece (2024), *Basic Concepts of Competition in the Digital Economy*, p. 7. Available here.

Digital markets

The environment in which producers and consumers interact to exchange goods and services within the digital economy, accessible via websites or applications.

Sources:
Cofece (2024), *Basic Concepts of Competition in the Digital Economy*, p. 8. Available here.
OECD (2022). *Handbook on Competition Policy in the Digital Age*, p. 8. Available here.

Digital platforms

Services or infrastructures that facilitates interactions between two or more interdependent user groups through services or applications, adding economic and social value. The user groups connected by the platform are often known as the platform's "sides".

Sources:
OECD (2019), *An Introduction to Online platforms and their role in the Digital Transformation*, p. 21. Available here.
Cofece (2024), *Basic Concepts of Competition in the Digital Economy*, p. 9. Available here.

Economic competition

The effort made by two or more individuals, businesses or companies to increase their market share by offering a greater variety of higher-quality products and services at better prices. Competition enhances purchasing power and consumer welfare, while also allowing companies to access inputs under competitive conditions, encouraging innovation and boosting productivity.

Source: Cofece (2016) *Herramientas de Competencia Económica*, p. 5. Available here.

Foundation models

Type of technology trained on vast amounts of labeled or unlabeled data that can adapt to a wide range of tasks and operations. Foundation models provide the general capabilities that enable generative AI to function, as they make it possible to process inputs in natural language and generate outputs in various forms.

Sources:
CMA (2023), *AI Foundation Models: Initial Report*, p. 8. Available here.
OECD (2024), *Artificial Intelligence, Data and Competition*, p. 18. Available here.

Input

The information that feeds algorithms.

Source: Cofece (2024), *Algorithms and Competition in the Digital Environment*, p. 14. Available here.

Interoperability

The ability of different digital services to work together, enabling communication and data exchange between them, and allowing users to combine multiple services with substitute or complementary functions.

Sources:
OECD (2021), *Data Portability, Interoperability and Digital Platform Competition*, p. 12. Available here.
Cofece (2024), *Algorithms and Competition in the Digital Economy*, p. 7. Available here.

Large Language Models (LLM)

Type of generative AI model that is typically trained on text (although images or sound can also be used as input) using deep learning techniques to make predictions and produce an output.

Sources:
OECD (2024), *Artificial Intelligence, Data and Competition*, p. 13. Available here.
OECD (2023), *Algorithmic competition, OECD Competition Policy Roundtable Background Note*, p. 10. Available here.

Neural networks (in AI context)

Type of machine learning model inspired by the human brain. It refers to a structure that organizes learning from data into nodes or layers, where connections are established between them to facilitate the processing and analysis of information.

Source: OECD (2024), *Artificial Intelligence, Data and Competition*, p. 13. Available here.

Output

Response or information that results from transforming an input through a sequence of computational steps using algorithms.

Source: Cofece (2024), *Algorithms and Competition in the Digital Environment*, p. 14. Available here.

Self-preferencing

Type of discrimination in which companies give undue advantage or preferential treatment to their own products. This can be harmful to competition when exercised by firms with market power.

Sources:
OECD (2020), *Abuse of dominance in digital markets*, p. 54. Available here.
Cofece (2024), *Basic Concepts of Competition in the Digital Economy*, p. 51. Available here.
Cofece (2024), *Algorithms and Competition in the Digital Economy*, p. 26. Available here.

Supercomputers

Networks of connected AI chips, designed to store and process vast amounts of data and perform complex AI tasks.

Source: Competition Bureau of Canada (2024), *Artificial intelligence and competition*, p. 10. Available here.

Tying and bundling

Business strategy in which a company sells a certain product only on the condition that a different or "tied" product is also purchased (selling A only if B is also bought), thereby forcing the purchase of both. Alternatively, the company could sell products A and B together, which can be done in two ways: either by selling them exclusively as a bundle (AB), known as pure bundling, or by selling A and B separately, but offering the bundle at a lower price, known as mixed bundling.

Sources:
OECD (2023), *Algorithmic Competition, OECD Competition Policy Roundtable Background Note*, p. 22. Available here.
Cofece (2024), *Basic Concepts of Competition in the Digital Economy*, pp. 48-49. Available here.
Cofece (2024), *Algorithms and Competition in the Digital Economy*, p. 27. Available here.
Abbott, A, (s.f), *Bundling*. Available here.

Vertical integration

Situation in which a company simultaneously participates in multiple stages of the production chain of a good or service.

Sources:
Cofece (2018), *Cofece emite recomendaciones para generar mayor competencia en el mercado de Gas LP*. Available here.
OECD (2009), *Are Horizontal Mergers and Vertical Integration a Problem,* p. 6. Available here.
OECD (2019), *Vertical Mergers in the Technology, Media and Telecom Sector Background Note by the Secretariat*, p. 5. Available here.

Web crawling

The use of automated bots to crawl the web for new or updated webpages which are then scraped for training data.

Source: CMA (2023), *AI Foundation Models: Initial Report*, p. 11. Available here.

Introduction

Although you might think that Artificial Intelligence (AI) is a recent phenomenon, its roots go back several decades. In 1950, Alan Turing already considered the possibility of building intelligent machines and proposed methods to assess their reasoning ability, what we now call the "Turing Test".[1] Turing believed that, just like humans, machines could use available information and apply logic to solve problems and make decisions autonomously.[2]

The term "Artificial Intelligence" was coined by John McCarthy in 1956 during a conference that revolve around whether a machine could be intelligent.[3] This event became the catalyst of what would be a long track of AI research.[4] From 1957 onward, AI progressed slowly, inhibited by both computer storage and processing capabilities and the development of algorithms. However, the interest around AI was enough to attract government funding and, by the 1980s, new techniques such as expert systems[5] and the first applications of neural networks emerged.

By the early 1990s, neural networks were already being used for specific tasks, such as mail classification through handwritten text recognition. During that decade and into the 2000s, remarkable milestones were achieved in AI development, including the defeat of chess champion Garry Kasparov by Deep Blue (a supercomputer developed by IBM)

1. In his text *"Computing Machinery and Intelligence"*.
2. Rockwell, A. (2017), *The History of Artificial Intelligence*. Available here.
3. Rossi, F. (2016), *Artificial Intelligence: Potential Benefits and Ethical Considerations*, p. 1. Available here.
4. Rockwell, A. (2017), *The History of Artificial Intelligence*. Available here.
5. Expert systems mimic the decision-making process of a human expert in a specific field of knowledge to subsequently replicate the learned information as advice for non-experts. Rockwell, A. (2017), *The History of Artificial Intelligence*. Available here.

and advancements in speech recognition.[6] A pivotal moment occurred in 2009 when researchers at Stanford University managed to increase the operating speed of a neural network by 70 times, using a gaming PC equipped with a graphics processing unit (GPU), which significantly accelerated the training of deep neural networks.[7] The combination of both faster hardware and more efficient training algorithms made it possible to train neural networks with millions of connections in a reasonable amount of time, allowing these increasingly deeper networks to handle large volumes of data and perform more complex tasks with greater accuracy. This breakthrough fueled the rise of what we now call "deep learning".

Today, AI has exponentially expanded its field of application, driving many companies to invest in this technology. Google, for instance, has ventured into the creation of autonomous vehicles and has acquired over ten robotics companies in addition to DeepMind, whose purpose is to develop an artificial general intelligence.[8] Meta (formerly Facebook) opened its AI-focused research center, while IBM has bet on its Watson system (an AI-based system) applied in areas such as medicine, finance and education.[9]

¿Did you know that 27 years ago was the first time a computer defeated a world chess champion? In 1997, IBM's supercomputer Deep Blue defeated Garry Kasparov in one of the greatest AI achievements in decades.[10]

AI can be a great ally for businesses and for you, as it has the potential to make your life better and easier. At the Federal Economic Competition Commission (Cofece), we're convinced that competition policy is a backbone in the development, use, regulation and governance of AI. There-

6. Rockwell, A. (2017), *The History of Artificial Intelligence*. Available here.
7. *A short history of AI*, Schools Brief, Artificial Intelligence. The Economist, 20 de julio de 2024. Available here.
8. System that can perform the full range of human cognitive tasks, including the capacity to understand thoughts, motives, intentions and expectations, and interact socially. Martinho-Truswell, E. et al. (2018). *Towards an AI strategy in Mexico: Harnessing the AI Revolution*, p. 9. Available here.
9. Rossi, F. (2016), *Artificial Intelligence: Potential Benefits and Ethical Considerations*, p. 2. Available here.
10. Yao, D. (2022), *25 Years Ago Today: How Deep Blue vs. Kasparov Changed AI Forever.* Available here.

fore, we work to promote competitive AI markets, ensuring that you have access to AI under the best conditions of price and quality, while also providing you with information to help you become familiar with this and other emerging technologies.

The objective of this notebook is to highlight the most relevant aspects of AI that relate to the digital economy and impact competition conditions. It will allow you to learn what AI is and how it can be applied across various markets for the benefit of both you and businesses, while also addressing potential risks that may arise from its use.[11]

11. In this notebook, we interchangeably refer to AI as both a "tool" and a "technology".

1. AI and its use

Your interaction with chatbots to make a purchase or request customer service are just a few examples of how AI is increasingly present in your daily life. In its early stages, developing AI was a complex task because machines were programmed with algorithms that attempted to replicate human thinking. Over time, this process became more efficient with the development of algorithms that enable machines to learn.[12]

1.1. What is AI?

In a broad sense, AI is the branch of computer science that studies and designs computers capable of performing highly complex tasks in a way that is perceived as "intelligent".[13] In a narrow sense, AI is the discipline of creating algorithms[14] with the ability to perform actions similar to those of humans, such as learning and reasoning.[15] Digital assistants like Siri, Alexa, and Google Assistant are examples of AI.

AI is increasingly being used across various industries and for different purposes, namely e-commerce, smart agriculture and cybersecurity. Moreover, AI takes part in many of our daily activities, going from the automatic caption feature you can activate when watching a YouTube video to the navigation systems we normally use.[16]

12. OECD (2017), *Algorithms and Collusion: Competition Policy in the Digital Age*, p. 9. Available here.
13. OECD (2017), *Algorithms and Collusion: Competition Policy in the Digital Age*, p. 10. Available here.
14. To learn more about algorithms and their relationship with competition, see the notebook "*Algorithms and Competition in the Digital Economy*", available here.
15. OECD (2019), *Hello World: Artificial Intelligence and its use in the public sector*, p. 11. Available here.
16. European Parliament (2021), *What is artificial intelligence and how is it used?* Available here.

During the COVID-19 pandemic, AI played a key role in helping to understand the nature of the virus and speeding up medical research, such as the development of on drugs and vaccines. It was also incredibly useful in calculating infection probabilities and monitoring real-time contagion patterns. In response to the health emergency, semi-autonomous drones and robots were used to deliver supplies and perform high-exposure tasks in hospitals.[17]

1.2. How do machines learn? Automatic learning and deep learning

AI, machine learning and deep learning are all closely related concepts, but they are not the same. Although sometimes used interchangeably, it's important to understand their differences to comprehend how machines can "learn" and make autonomous decisions.

The main goal of AI is to develop algorithms and models capable of performing tasks that would typically require human intervention, such as recognizing patterns, understanding language and making decisions. To achieve this, AI encompasses a variety of techniques and methodologies, including both rules-based systems and machine learning.[18]

Machine learning is a subfield of AI that uses algorithms to enable machines to identify patterns and make data-driven decisions through the repetition of tasks.[19] Although this process doesn't require explicit instructions during its regular operation, initial learning does involve human intervention to set up the algorithms and provide labeled or structured data, especially in supervised learning.

A key aspect of machine learning is its ability to learn in various ways. The main learning methods include:[20]

- **Supervised learning**, whereby machines make predictions based on labeled data. This means they are provided with examples of inputs along with their expected outputs (called labels or annotations), allowing them to adjust their predictions based on these previous examples. The term "supervised" refers to the process of feeding the model with examples of inputs alongside their corresponding

17. OECD (2020), *Using artificial intelligence to help combat COVID-19*. Available here.
18. Hermans, K. (2023), *Becoming an AI expert*, p. 23. Available here.
19. OECD (2017), *Algorithms and Collusion: Competition Policy in the Digital Age*, p. 9. Available here; Hermans, K. (2023), *Becoming an AI expert*, pp. 21, 23. Available here.
20. OECD (2019), *Hello World: Artificial Intelligence and its use in the public sector*, pp. 48-53. Available here.

expected outputs, which are typically known as labels or annotations. An example of supervised learning is classifying emails as "spam" or "not spam".[21]

- **Unsupervised learning**, in which machines are only given inputs without labels or expected outcomes. To learn, machines use advanced mathematical methods to identify patterns, hidden structures, or common features among the different elements within a dataset. This enables them to autonomously group and organize information.[22] For instance, recommendation systems employ unsupervised learning to make relevant suggestions when you are about to make an online purchase. These systems use data from previous purchases to spot hidden patterns and recommend accessories or add-ons that might be useful to you.[23]
- **Reinforcement learning**, which is inspired by human processes, like adjustment based on feedback,[24] but remains a computational model. Under this approach, machines learn through trial-and-error, receiving either rewards or penalties according to their actions. This method is particularly useful in situations of sequential decision-making, such as in robotics or strategy games, where the system improves its performance based on feedback from the environment. For example, a machine playing chess can employ reinforcement learning to find out the best strategies through trial and error and refine its game by playing several times against itself or other opponents.[25]

On the other hand, **deep learning**[26] is an advanced subfield of machine learning that has gained significant relevance in recent years, in which a machine learns directly from large datasets.[27] Unlike traditional machine learning algorithms, deep learning employs artificial neural networks composed of multiple layers (hence the term "deep"), which hierarchically process large amounts of data. These networks are inspired by the

21. Hermans, K. (2023), *Becoming an AI expert*, p. 88. Available here.
22. CMA, (2021), *Algorithms: How they can reduce competition and harm consumers*, p. 4. Available here.
23. OECD (2019), *Hello World: Artificial Intelligence and its use in the public sector*, pp. 48-53. Available here.
24. Joshi, A. (2023), *Machine Learning and Artificial Intelligence*, p. 10. Available here.
25. Aditya (2023), *Reinforcement Learning in Chess*. Available here.
26. OECD (2019), *Hello World: Artificial Intelligence and its use in the public sector*, p. 48. Available here.
27. Goswami, S. (2020), *Deep Learning – A State-of-the-Art Approach to Artificial Intelligence*, p. 8. Available here; Hermans, K. (2023), *Becoming an AI expert*, p. 23. Available here; Nauman, M. (2024), *Artificial Intelligence*, pp. 6-7. Available here.

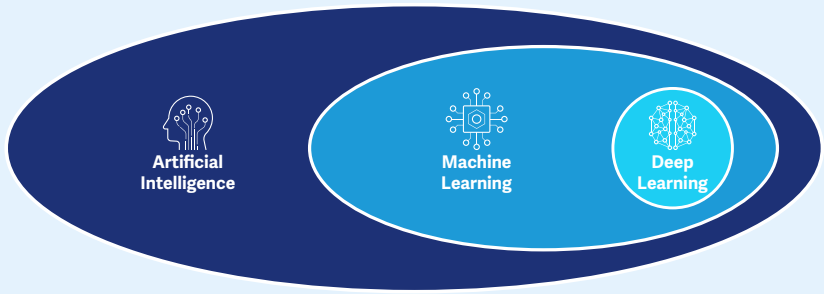
human brain's functioning but operate through mathematical models and interconnected nodes that enable them to learn and recognize complex patterns.[28]

Deep learning neural networks are structured in layers: an "input layer" (where data is received), one or more "hidden layers" (which process the information) and an "output layer" (which provides the results).[29] The nodes (neurons) in each layer use the information from previous layers to reach the outcomes.[30]

Deep learning is particularly useful for solving complex problems involving large datasets or multiple dimensions such as text, voice and images.[31] It has revolutionized fields such as image and video recognition, audio, speech and language processing,[32] and medical data analysis.[33] However, this type of learning also requires substantial computational power and resources, which has been made possible by recent advances in both hardware and the availability of large datasets.

The following diagram better illustrates the relationship between AI, machine learning and deep learning:

Box 1. AI, machine learning and deep learning



28. OECD (2021) *Artificial Intelligence, Machine Learning and Big Data in Finance: Opportunities, Challenges, and Implications for Policy Makers*, p. 17. Available here.
29. The input layer receives the initial data and transforms it into a format that the network can understand. For instance, an image is converted into a matrix of pixels, and text is represented as vectors using techniques like word embeddings, which are methods that convert words into numerical values (vectors) so that machines can recognize their relationships and meanings in specific contexts. Hidden layers process this data by performing mathematical operations, such as dot products (which combine vector values to identify patterns), and applying various activation functions that allow the network to learn complex patterns and features from the data. Finally, the output layer translates all this learning into a comprehensible result, such as classifying an image, predicting a trend, or suggesting a recommendation.
30. OECD (2017) *Algorithms and collusion: Competition Policy in the Digital Age*, p. 11. Available here and Autorité de la Concurrence & Bundeskartellamt. (2019). *Algorithms and competition*, pp. 12 and 13. Available here.
31. OECD (2023), *Algorithmic Competition, OECD Competition Policy Roundtable Background Note*, p. 9. Available here.
32. Craglia, M, *et. al.* (2018), *Artificial Intelligence: A European Perspective*, p. 21. Available here.
33. Lovdahl, L. (2020), *Algorithms and Competition Law. CPI Antitrust Chronicle, July 2020*, p. 22. Available here.

1.3. Generative AI

Deep learning has been pivotal in the development of generative AI,[34] a branch of AI focused on creating content such as audio, text, images and video from existing data. Unlike other AI models aimed at classifying or predicting, generative AI uses the patterns it learns to produce new content that can be difficult to distinguish from human-created content.[35]

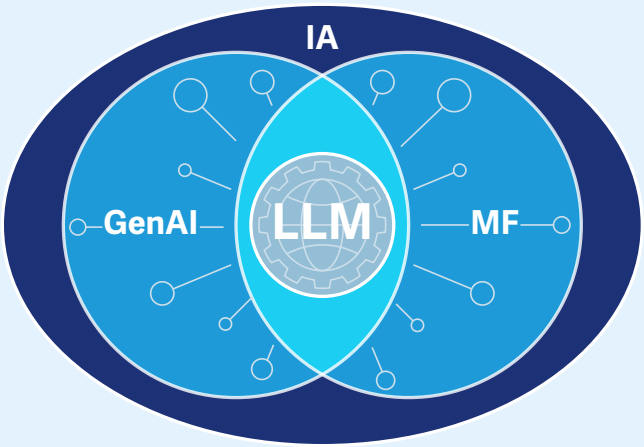
The shift towards generative AI is supported by advanced models that leverage deep learning techniques. Among these, **foundational models**[36] stand out as systems trained on massive datasets and designed to adapt to different tasks and operations.[37] These models are the base that can be fine-tuned and further specialized to perform more specific tasks.[38] For instance, within foundational models, we find large language models (LLMs), which are specifically trained to work with text and perform tasks such as recognizing, summarizing, translating, predicting and generating content.[39]

The term "large" in LLMs refers to the number of parameters with which they are trained. Parameters are the internal variables that models adjust during training to identify patterns in data. By analyzing large volumes of data (in text format), complex patterns and relationships are identified that would otherwise be difficult to detect.[40] The more parameters and data used, the greater the model's ability to generate coherent and relevant responses.

The following diagram shows the relationship between AI, foundational models, LLM and generative AI.

34. OECD (2023), *Algorithmic Competition, OECD Competition Policy Roundtable Background Note*, p. 10. Available here.
35. CAF (2023), *Generative AI: What should governments in Latin America do?* Available here and Granieri Marcelo (2023), *¿Qué es la Inteligencia Artificial Generativa?* Available here.
36. IBM (2023), *What is generative AI, what are foundation models, and why do they matter?* Available here and NVIDIA (n.d.), *What is Generative AI?* Available here.
37. CMA (2023), *AI Foundation Models: Initial Report*, p. 8. Available here.
38. Toner, H. (2023), *What Are Generative AI, Large Language Models, and Foundation Models?* Available here.
39. Angela, R. *et. al.*, (2024), *Foundation Models, Generative AI, and Large Language Models Essentials for Nursing*. Available here and Fleurence, R., *et. al.* (2024), *Generative AI for Health Technology Assessment: Opportunities, Challenges, and Policy Considerations*, p. 5. Available here.
40. CAF (2023), *Generative AI: What should governments in Latin America do?* Available here and Granieri Marcelo (2023), *¿Qué es la Inteligencia Artificial Generativa?* Available here.

Box 2. Relationship among AI, foundational models, generative AI and LLM



Source: Fleurence, R., *et. al.* (2024), *Generative AI for Health Technology Assessment: Opportunities, Challenges, and Policy Considerations*. Available here.

Although LLMs are a prominent example, generative AI capabilities extend beyond text generation. Other relevant formats that are created by generative AI applications include:[41]

- **Images**: tools like DALL-E and Stable Diffusion can generate images from text descriptions, remove objects from your photos, replace people, change the style of an image, etc.
- **Video**: models that can create videos from text prompts, add special effects to existing videos, replace people in particular scenes, etc.
- **Audio**: applications capable of real-time dialogue translation, voice cloning, music generation, etc.

Tools like ChatGPT, Claude and Copilot are examples of generative AI applied to text. Based on deep learning, these tools predict words in a sentence, generating fluent texts in response to user prompts.[42] On the other hand, thanks to their ability to create high-quality visual content,

41. Autoridade da Concorrência (2023). *Competition and Generative Artificial Intelligence, Issues Paper*, p. 8. Available (in Portuguese) here.
42. Ryan-Mosley, T. (2023), *An early guide to policymaking on generative AI*. Available here.

applications like DALL-E and Stable Diffusion have been integrated into art and industries such as animation, gaming, film, architecture and design.[43]

Training and feedback of Generative AI

Training a model like ChatGPT starts with generic data obtained from various sources, such as the internet, books and articles, to identify patterns and relationships in language. The model then undergoes a process called fine-tuning, where it specializes in specific tasks by using additional carefully selected data. This process ensures that the model can adapt to concrete contexts, such as answering technical questions or generating detailed summaries.

Additionally, these models can improve with user feedback. For instance, positive or negative ratings (like thumbs up or down) and users reviews help developers gather data on the AI's performance. While this feedback does not adjust the model in real-time, it is used in future updates to fine-tune the model and improve its accuracy and performance.

Box 3. Instances of generative AI

ChatGPT, Claude and Copilot generate fluent text and respond to both images and text-based prompts. DALL-E and Stable Diffusion can be used to give an about-face to the way art, animation, gaming, film and architecture are represented.

43. Bello, E. (2023), *Inteligencia Artificial Generativa, la nueva era de la IA*. Available here.

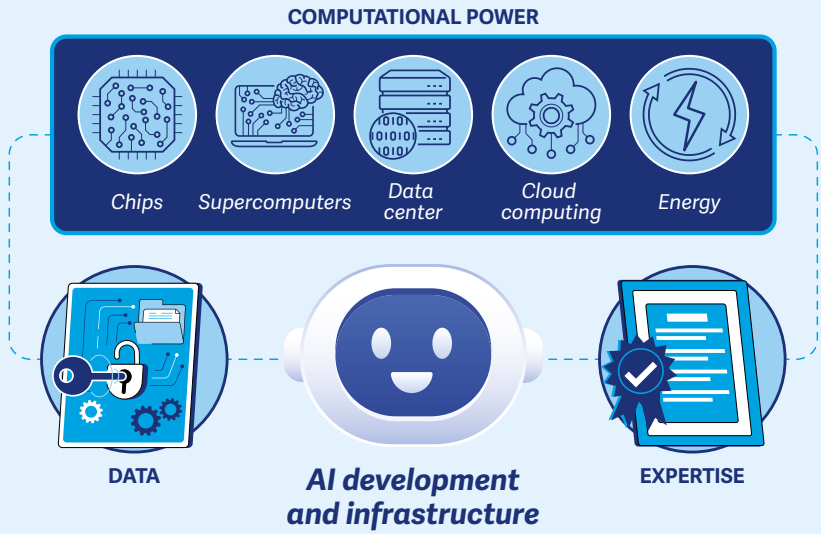
1.4. AI infrastructure and development

The development of generative AI, such as GPT-4, requires a robust technological infrastructure along with a significant investment of money (training GPT-4 cost around 100 million dollars), time and resources. Training these models involves massive datasets, specialized hardware and intensive training processes. This development begins with building **foundational models**, which are initially trained to learn general patterns from large volumes of data and must then be adapted and fine-tuned before they can be used.[44]

1.4.1. AI infrastructure and development

Companies developing AI rely on three key elements: access to data, computational power, and technical expertise to design and train these systems.[45]

Box 4. AI infrastructure and development



The infrastructure required to develop AI includes access to data, computational power (specialized chips, supercomputers, data centers, cloud computing and energy) and a sufficient level of expertise.

44. OECD (2024), *Artificial Intelligence, Data and Competition*, pp. 17-18. Available here.
45. Competition Bureau of Canada (2024), *Artificial intelligence and competition*, p. 9. Available here and CMA (2023), *AI Foundation Models: Initial Report*, p. 10. Available here.

Access to data. Data is essential for foundation models, which are trained applying machine learning techniques on massive amounts of information, often reaching hundreds of thousands of gigabytes. This data typically comes from public sources, such as open databases and web crawling, as well as private data sources.[46] This process creates the knowledge that enables machines to learn and make decisions.

However, volume it's not the only relevant variable in terms of data. The quality of information is equally important to ensure the optimal performance and the accuracy of the models. Hence, data must meet certain standards:

- **Relevance:** data must be aligned with the task at hand. For instance, training a facial recognition model requires images that represent faces and contexts.
- **Diversity:** datasets must cover different cases and conditions to avoid biases that could limit the model's ability to generalize correctly, resulting in inaccuracies known as hallucinations.
- **Cleanliness:** developers must clean and process data to render it compatible with the corresponding model.[47]

Meeting these criteria mitigates issues like bias, incorrect generalizations, or hallucinations, which lead to models generating results that don't match reality. This ensures that AI models are reliable and effective tools in their specific domains.

Computational power. Training foundational models requires substantial advanced computing resources, often referred to as "compute",[48] which include AI chips, supercomputers, data centers, cloud computing and electrical energy.

- **AI chips.** Foundational models are so large, and their training requires such vast data, that conventional computer chips are insufficient. Therefore, accelerator chips are often used to speed up the training process.[49] Accelerator chips, such as Graphics Processing Units

46. To learn more about data, its characteristics, benefits and associated risks, as well as its relationship with competition, see the notebook *Data and Competition in the Digital Environment* by Cofece (2024), available here.
47. OECD (2024), *Artificial Intelligence, Data and Competition* , pp. 18-19. Available here; CMA (2023), *AI Foundation Models: Initial Report*, p. 11. Available here and Competition Bureau of Canada (2024), *Artificial intelligence and competition*, p. 11. Available here.
48. OECD (2024), *Artificial Intelligence, Data and Competition*, p. 20. Available here.
49. CMA (2023), *AI Foundation Models: Initial Report*, p. 12. Available ahere.

(GPUs), allow multiple calculations to be performed simultaneously, making them highly efficient for certain types of AI.[50] Some GPUs are so powerful that they can store an entire AI model on a single chip.[51]

- **Supercomputers, data centers and cloud computing.** AI developers typically access the computational power they need through supercomputers, by building a data center or from a cloud computing service provider.[52] Supercomputers are generally housed in data centers, and can be either used by the center itself or made available to third parties via cloud computing services.[53] Cloud computing is a cornerstone for AI models, as it provides the necessary computational resources and infrastructure to train and deploy them.[54]
- **Electrical energy.** Training and deploying AI models consume significant amounts of electricity, particularly in data centers using GPUs. Energy is a crucial resource for AI development, as significant amounts of electricity are required to efficiently process and analyze data. As AI usage grows, so does the demand for energy in data centers. Training generative AI demands more electricity than traditional data center activities.[55,56]

Technical expertise. AI development requires specialized knowledge and talent, including expertise in AI-based techniques and the skills to employ these techniques to achieve desired outcomes. The rise of generative AI has sparked interest from many companies in hiring specialized workforce for its development.[57] The technical expertise necessary for developing and training AI models encompasses cutting-edge knowledge in machine learning and practical expertise in data engineering and supercomputing. Among the most sought-after profiles by AI developers are data scientists and machine learning engineers.[58]

50. OECD (2023), *A blueprint for building national compute capacity for Artificial Intelligence*, pp. 18, 21. Available here.
51. Vipra, J. & Myers, W. (2023), *Computational Power and AI*. Available here.
52. CMA (2023), *AI Foundation Models: Initial Report*, pp. 13-14. Available here and Competition Bureau of Canada (2024), *Artificial intelligence and competition*, pp. 10-11. Available here.
53. Vipra, J. & Myers, W. (2023), *Computational Power and AI*. Available here and Competition Bureau of Canada (2024), *Artificial intelligence and competition*, p. 10. Available here.
54. Ofcom (2023), *Cloud services market study. Final report*, p. 4. Available here.
55. World Economic Forum (2024), *AI and energy: Will AI help reduce emissions or increase demand? Here's what to know*. Available here; International Energy Agency (2023), *Electricity 2024: Analysis and forecast to 2026*, pp. 31-35. Available here and Harris, D., Lee, B. (2024), *Why AI Consumes So Much Energy and What Might Be Done About It*. Available here.
56. According to The Economist, Nvidia is currently working on solutions to make GPUs more energy-efficient. However, and despite efficiency improvements, this could also lead to increased usage and, as a consequence, to higher demand for electricity. See *Generative AI has a clean-energy problem*. The Economist, 11th April 2024. Available here.
57. OECD (2024), *Artificial Intelligence, Data and Competition*, p. 21. Available here.
58. CMA (2023), *AI Foundation Models: Initial Report*, p. 38. Available here.

1.4.2. Development and release of foundational models: open-source and closed-source

AI models, including foundational models, can be developed and released under two main approaches:

Open-source models are publicly available, meaning you can view, modify, redistribute the code for free, and make adjustments to suit your needs. While they may not always include the original training data, in some cases, the model architecture is accessible, allowing the replication of the training process.

In contrast, **closed-source models** are not publicly available, as their development and distribution are typically controlled by a single company or a group of partners or owners who keep the code and training data confidential.[59]

Both models have advantages and disadvantages. Open-source models favor transparency and accessibility, encourage continuous collaborative innovation and development. However, they may face resource limitations compared to closed-source models funded by private companies.

Closed-source models, on the other hand, allow their owners to maintain control over intellectual property and training data, preventing third parties from using this information to train different models.[60] This can make adapting the model to specific business or third-party needs more challenging.[61]

59. CMA (2023), *AI Foundation Models: Initial Report*, p. 14. Available here; Competition Bureau of Canada (2024), *Artificial intelligence and competition*, p. 12. Available here.
60. CMA (2023), *AI Foundation Models: Initial Report*, p. 14. Available here; Competition Bureau of Canada (2024), *Artificial intelligence and competition*, p. 12. Available here and Lawton, G. (2024), *Attributes of open vs. closed AI explained*. Available here.
61. Kacprzak, K. (2024), *Open Source vs. Closed Source in Language Models: Pros and Cons*. Available here.

Box 5. AI models: open-source vs. closed-source

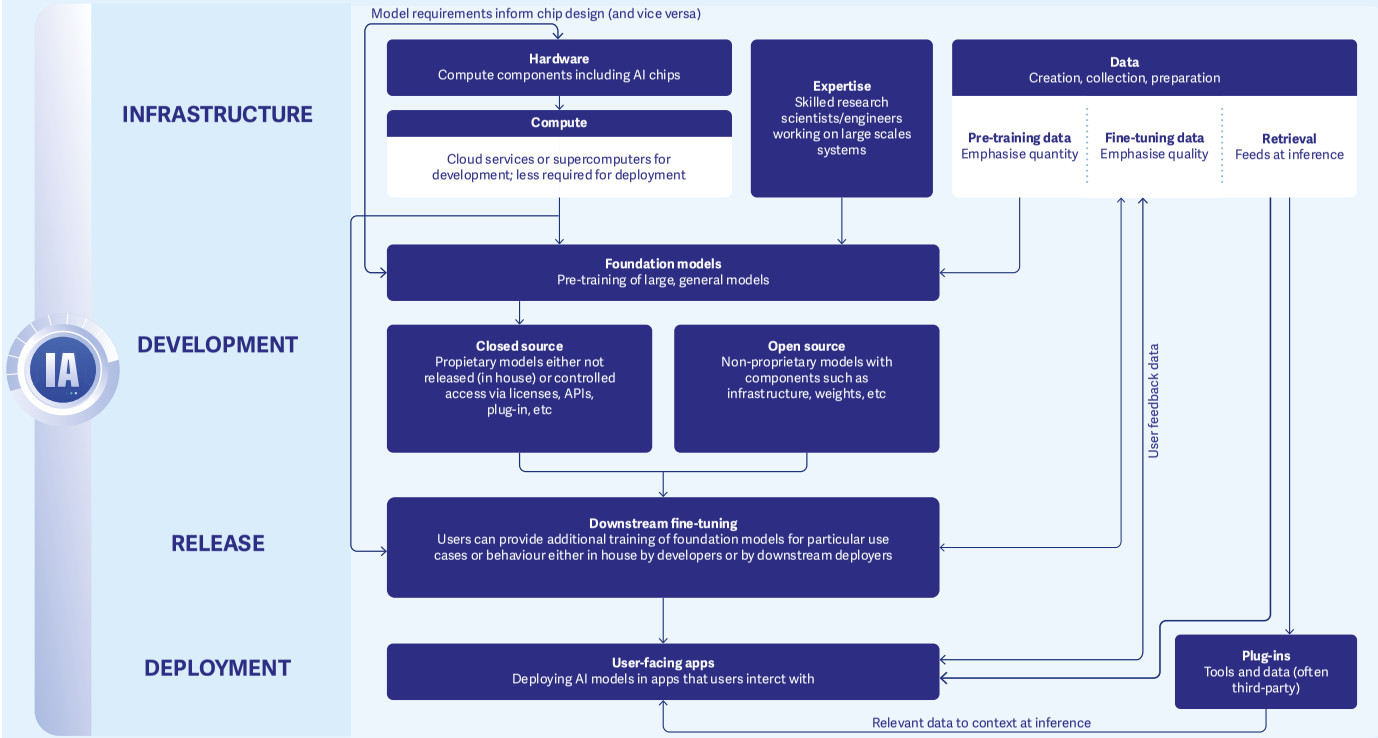
Open-source	Closed-source
Stable Diffusion	ChatGPT
TensorFlow[62]	Claude
Detectron2[63]	Copilot

AI, including foundational models, can be developed and releases as either open-source models (which anyone can access) or closed-source models (which are not publicly available and are only accessible to their owners).

After being developed, a foundational model can be fine-tuned to optimize its performance for specific tasks. This process generally requires resources similar to those used in the initial training, such as access to additional data and computational power, to refine the model and better adapt it for its applications.[64] For instance, a general model like GPT-4 can be fine-tuned to analyze legal texts.

62. Although TensorFlow is an AI library rather than a model itself, it plays a pivotal role in the development and training of deep learning models. Available as an open-source software, it allows developers to customize it for their own research and applications. See official website here.
63. Detectron2 is an advanced object detection and image segmentation system used in computer vision, also available as open-source to facilitate its use in research. See the official website, available here.
64. OECD (2024), *Artificial Intelligence, Data and Competition*, p. 22. Available here.

Box 6. Foundational models value chain



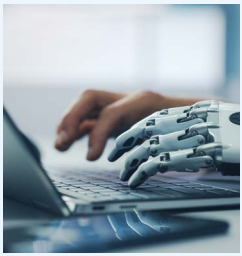
Source: CMA (2024), *CMA AI strategic update*. Available here.

2. AI and economic competition

AI performs versatile and advanced tasks due to its ability to predict, analyze and generate content with remarkable accuracy. These capabilities make AI not just a tool for automation, but also a driver of innovation and creativity.[65] Nonetheless, when businesses misuse this technology, risks to both competition and your well-being as a user may arise.

2.1. Benefits

The use and implementation of AI has the potential to optimize processes within businesses, enhance your experience as a user, and, overall, make your life easier and more convenient.



Did you know that, nearly 35% of companies worldwide report using AI?[66] Additionally, 90% of workers believe AI will help them work faster.[67]

65. OECD (2024), *The impact of Artificial Intelligence on productivity, distribution and growth*, pp. 7, 13. Available here.
66. IBM (2022), Global Data from IBM Shows Steady AI Adoption as Organizations Look to Address Skills Shortages, Automate Processes and Encourage Sustainable Operations. Available here.
67. Swineford, R. (2023), *Generative AI is empowering the digital workforce*. Available here.

Increase in productivity. By implementing AI tools, companies can optimize their processes, thereby boosting their productivity. Employees can work faster and more effectively by quickly integrating information from various sources and spending less time on repetitive or tedious tasks.[68] This streamlines and accelerates the product development process, allowing employees to focus more on higher-value tasks.[69]

As a result, companies not only increase their productivity but also reduce their operational costs.[70] In some companies, automation has helped employees save between 10% and 50% of the time previously spent on manual tasks.[71]

Did you know that access to generative AI assistants has enabled customer service agents to resolve approximately 14% more requests per hour?[72]

Better business decisions. AI can analyze vast amounts of data and generate useful insights, enabling businesses to make swift, informed decisions while reducing both time and the risk of human errors. Predictive analytics allows companies to anticipate trends and optimize their strategies, facilitating proactive decision-making.[73]

In the construction industry, AI enables advanced analytics to identify long-term trends and make quick decisions in specific situations. By creating digital replicas of structures and systems (known as "digital twins")

68. OECD (2024), *Artificial Intelligence, Data and Competition*, p. 14. Available here and Swineford, R. (2023), *Generative AI is empowering the digital workforce*. Available here.
69. McKinsey & Company (2023), *The economic potential of generative AI: The next productivity frontier.* Available here.
70. McKinsey & Company (2017), *Un futuro que funciona: automatización, empleo y productividad*, pp. 10-11. Available here.
71. Kisflow platform (2024), *50+ Crucial Workflow Automation Statistics and Trends for 2024.* Available here.
72. OECD (2024), *Artificial Intelligence, Data and Competition*, p. 15. Available here.
73. Weitzman, T. (2022), *The Top Five Ways AI Is Transforming Business*. Available here.

using AI, it's possible to monitor the performance of devices and systems installed in a real building through a virtual space,[74] simplifying maintenance and optimizing operations.

Furthermore, AI can be used to detect your dissatisfaction, allowing companies to anticipate and take proactive steps to improve your experience.[75] Companies that make better decisions can anticipate challenges, identify new opportunities, assess future actions and plan strategically, positioning themselves as industry leaders and ensuring long-term success.[76]

In the financial sector, the use of AI is increasingly common in activities such as fraud detection and prevention, and customer credit assessment,[77] particularly in fintech and digital banking.[78]

Did you know that machine learning can assess credit risk up to 20% more accurately than traditional methods? This enables better financial decision-making.[79]

Personalized Offers. Some companies use AI tools to collect and analyze vast amounts of data about your past interactions, allowing them to better understand your preferences and behaviors. With this information, they can anticipate your future needs and offer you unique, personalized experiences when you make a purchase.[80]

Many companies use AI to recommend products based on your individual behavior. For instance, Amazon and Netflix use recommendation systems based on your interests and consumption patterns. Social media platforms like Facebook, Instagram, X (formerly Twitter), and TikTok

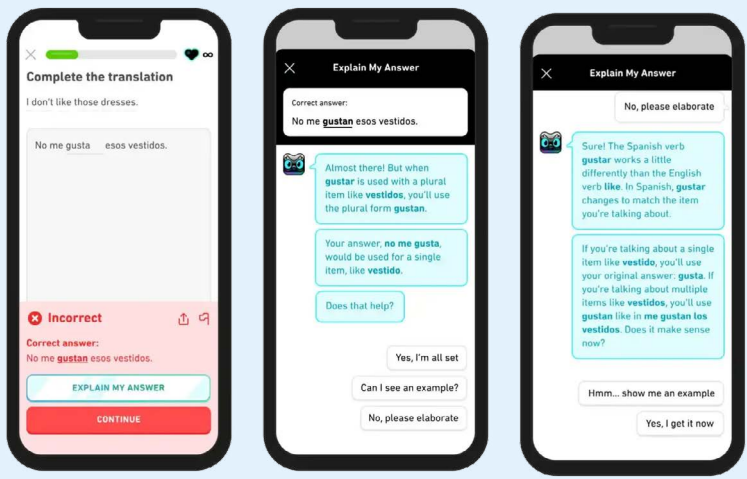
74. Bosch (n.d.), *Artificial Intelligence in Building Management*. Available here.
75. Ifekanandu, C., *et. al.* (2023), *Influence of Artificial Intelligence (AI) on customer experience and loyalty: mediating role of personalization*, p. 1942. Available here.
76. Aldoseri, A. (2024), *AI-Powered Innovation in Digital Transformation: Key Pillars and Industry Impact*, pp. 7-8. Available here.
77. Ilg, B. (2024), *AI in finance*. Available here.
78. Okwechime, J. (n.d.), *How Artificial Intelligence is Transforming the Financial Services Industry*. Available here.
79. McKinsey & Company (2024), *Scaling gen AI in banking: Choosing the best operating model*. Available here.
80. Jenkins, A. (2024), *Marketing Personalization In The Age Of Automation*. Available here.

curate videos and content tailored to your characteristics and browsing history.[81] Through its app, Starbucks collects data on your consumption habits, from your favorite beverages to the times when you typically order them, and suggests drinks you might be interested in.[82]

In addition, companies can incorporate robot assistants into their sales processes, allowing them to access your communication history and personalize their interactions to meet your individual needs.[83]

In the educational sector, AI helps personalize content and teaching methods, adapting to each student's needs by analyzing data about their abilities, preferences, strengths and areas for improvement.[84] For instance, Duolingo's "Explain My Answer" feature, launched in 2023, powered by AI and based on ChatGPT-4, allows you to chat with a virtual assistant that explains why certain answers are correct or incorrect, providing further examples and clarification.[85]

Box 7. Applications of AI in the education industry



Duolingo's "Explain my Answer" feature allows you to receive feedback on your responses directly within the app.

81. Ifekanandu, C., *et. al.* (2023), *Influence of Artificial Intelligence (AI) on customer experience and loyalty: mediating role of personalization*, p. 1942. Available here.
82. Shen, F. (2022), *Starbucks: Leveraging Big Data and Artificial Intelligence to Improve Experience and Performance*. Available here.
83. Ifekanandu, C., *et. al.* (2023), *Influence of Artificial Intelligence (AI) on customer experience and loyalty: mediating role of personalization*, p. 1942. Available here.
84. Unesco (2023), *Education in the age of artificial intelligence*, pp. 5 and 10. Available here.
85. Duolingo Team (2023), *Introducing Duolingo Max, a learning experience powered by GPT-4*. Available here.

Enhanced customer experience. AI enables companies to personalize their interactions with you, automate processes, and gain deeper insights into your preferences, ultimately optimizing your customer experience. For instance, autonomous AI-driven drones for home deliveries streamline the services and improve your shopping experience.[86]

In the financial sector, companies like Bloomberg have developed large language models, namely BloombergGPT, which allow users to access detailed financial information through simple queries.[87]

The application of AI to enhance customer experience goes beyond chatbots and virtual assistants. For instance, the company RISA employs AI to streamline the workflow between patients and healthcare providers by automating processes. This allows providers to focus more on patient care, while automation reduces wait times and makes the process less frustrating for patients.[88]

Better goods and services. AI has the potential to improve the quality of products and services across various sectors of the economy.[89] In healthcare, AI enables early detection and prevention of diseases such as diabetes, edema, cancer and autism.[90] This technology facilitates medical risk assessment and the interpretation of diagnostic imaging results, including X-rays and MRIs, as well as genetic information, to identify anomalies that might go unnoticed by human doctors. This leads to more precise and timely diagnoses, enabling prompt medical interventions.[91]

Did you know that the use of AI in CT scans allows for the identification of specific lung nodules 62% to 97% faster than a team of radiologists could?[92]

86. The use of these kind of drones is subject to local regulations and, in most cases, is still under test.
87. CMA (2023), *AI Foundation Models: Initial Report*, p. 25. Available here.
88. Newsfile Corp. (2024), *Healthtech RISA Launches AI Platform to Optimize Healthcare Prior Authorizations*. Available here.
89. OECD (2024), *Artificial intelligence, data and competition*, p. 52. Available here.
90. Medinaceli, K. & Silva, M. (2021), *Impacto y regulación de la Inteligencia Artificial en el ámbito sanitario*. Available here.
91. Aldoseri, A. (2024), *AI-Powered Innovation in Digital Transformation: Key Pillars and Industry Impact*, p. 14. Available here.
92. Kalis, B., *et. al.* (2018), *10 Promising AI Applications in Health Care*. Available here.

Innovation and technological development. AI's automation and self-learning capabilities accelerate innovation across various industries. Companies investing in AI development tend to be more innovative in terms of brands, patents and new products.[93] By processing large volumes of data, AI enables the reinvention of traditional business models with an innovative twist.[94]

For instance, companies like Microsoft and Google have integrated AI into their search engines;[95] Amazon has enhanced its digital assistant with generative AI to make content discovery easier; Meta has introduced Meta AI into its apps (Facebook, Instagram, WhatsApp, and Messenger) to deliver real-time information within the platform.[96] In the educational sector, AI in Educational Technology (EdTech) is transforming teaching by helping educators save time on grading, providing feedback and planning lessons.[97]

Those who fully harness AI's are equipped with the foundation to grow, compete, unleash their creativity, and succeed, leading to greater innovation. When companies combine human creativity and AI tools, they have the opportunity to create highly advanced products tailored to your needs, resulting in solutions that improve your life and pave the way for further innovation.[98]

AI can predict energy production and help schedule its use when more clean energy is available,[99] contributing to reduced greenhouse gas emissions.

93. OECD (2024), *The impact of Artificial Intelligence on productivity, distribution and growth*, pp. 7, 13. Available here.
94. Aldoseri, A. (2024), *AI-Powered Innovation in Digital Transformation: Key Pillars and Industry Impact*, pp. 1-2. Available here.
95. CMA (2023), *AI Foundation Models: Initial Report*, p. 25. Available here.
96. Hoppner, T. & Uphues, S. (2024), *On the antitrust implications of embedding generative AI in core platform services. CPI Antitrust Chronicle, July 2024*, p. 9. Available here.
97. Unesco (2023), *La escuela en la era de la Inteligencia Artificial*, pp. 5 and 10. Available here and O'Donnell, J. (2024), *Here's how how ed-tech companies are pitching AI to teachers*. Available here.
98. Aldoseri, A. (2024), *AI-Powered Innovation in Digital Transformation: Key Pillars and Industry Impact*, pp. 1-2, 13. Available here.
99. World Economic Forum (2024), *AI and energy: Will AI help reduce emissions or increase demand? Here's what to know*. Available here.

Did you know that AI can help mitigate 5% to 10% of global greenhouse gas emissions?[100] AI contributes to sustainability in different ways:

- Waste management. By optimizing waste treatment and recycling, AI can reduce emissions from waste, which account for 16% of global greenhouse gases.[101]
- Sustainable agriculture. AI enables more efficient food production and reduces the environmental impact of agriculture, which is responsible for 22% of global emissions.[102]
- Clean energy innovations. AI systems facilitate the development of smart grids for renewable energy distribution, the development of new molecules and the introduction of eco-friendly materials.[103]
- Energy control in buildings. AI optimizes energy usage in areas such as electricity, heating and cooling, fostering sustainability.[104]

In a competitive environment, AI plays a crucial role in ensuring that consumers like you and economies at large reap the full benefits of this technology. In this context, competition policy is key to fostering AI-driven innovation.[105] As a competition authority, we must use the tools at our disposal in the best way possible to maximize benefits for both you and the markets.

100. World Economic Forum (2024), *AI and energy: Will AI help reduce emissions or increase demand? Here's what to know*. Available here.
101. World Economic Forum (2024), *9 ways AI is helping tackle climate change*. Available here.
102. United Nations (2023), *Explainer: How AI helps combat climate change. Available* here.
103. FIBK (2022), *¿Cómo puede la inteligencia artificial ayudarnos a luchar contra el cambio climático?* Available here.
104. Ding, C., *et. al.* (2024), *Potential of artificial intelligence in reducing energy and carbon emissions of commercial buildings at scale*. Available here.
105. OECD (2024), *Artificial Intelligence, Data and Competition*, pp. 14-15, 27. Available here.

2.2. Risks

As AI becomes more integrated into the economy, concerns about its impact on competition and market balance are becoming increasingly relevant. The rapid development of generative AI and its application in everyday aspects and professional settings pose significant challenges for competition authorities. Although the concerns discussed in this section are relatively recent and are not necessarily present in all jurisdictions yet, they do represent emerging risks that may dominate future discussions on competition and regulation.

2.2.1. Mergers and strategic partnerships

One of the primary competition risk related to AI arises from acquisitions, collaboration agreements and strategic partnerships among the few companies participating in AI-related markets. To better understand this concern, it is important to address the concept of merger and why competition authorities like Cofece exercise preventive control over these transactions.

Mergers and ex-ante analysis

A merger occurs when two or more companies decide to combine their resources or structures through an acquisition, the purchase of shares or assets, a joint venture or any other operation that unites them.[106] Although mergers can have positive effects, they can also negatively impact competition and reduce consumer welfare. For instance, a company resulting from a merger could grow to such a size that it gains the ability to set higher prices, stifle innovation, or lower the quality of its products or services,[107] leaving you with fewer alternatives.

Merger analysis is essential for preserving competitive markets. Competition in a market depends, in part, on the presence of diverse suppliers offering substitute products or services. Therefore, as a general rule, the presence of multiple competitors drives each one to improve their offerings in terms of quality and price for your benefit.

106. Cofece (n.d.), *Concentraciones*. Available here.
107. CMA (2023), *AI Foundation Models: Initial Report*, p. 104. *Available* here *and Cofece (2018), El Procedimiento de Concentraciones, p. 3.* Available here.

For this reason, in many countries, companies planning a merger are required to notify competition authorities when they meet specific criteria, and they must do so before carrying out the transaction.[108] This makes merger analysis preventive in countries like Mexico, as competition authorities seek to assess these transactions in advance[109] to prevent potential anti-competitive effects that would ultimately affect you and other consumers.[110]

This preventive analysis allows the companies involved to demonstrate how the transaction could generate efficiencies in the market and positively impact market competition. Once the merger assessment is done, Cofece may authorize, object (if it would have an irremediable anti-competitive effect) or condition the transaction on the compliance with specific remedies.[111]

Recently, tech companies have been characterized by actively acquiring startups and small, innovative companies, sometimes to integrate innovations into their business to expand the range of services they offer to you.[112] In other cases, companies that are already well-positioned in a market acquire others that have the potential to challenge their position in the future, with the aim of eliminating future competition.[113] This is what has been called "killer acquisitions".[114]

Bearing this in mind, and in the context of AI development, especially generative AI, some authorities have considered examining all acquisitions made by large tech companies, even if these transactions do not meet the notification thresholds or conditions. Take as an example Brazilian competition authority (CADE), which announced its intention to inquire into whether Amazon, Google and Microsoft should obtain approval to acquire AI startups, to mitigate potential risks to competition.[115]

108. Cofece (2024), *Informe de Concentraciones 2023*, pp. 5 and 6.Available here.
109. It's worth mentioning that, in Mexico, not all mergers need to be notified to Cofece, but only those that overpass the monetary thresholds set forth in article 86 of the Mexican Federal Economic Competition Law, available here. Further information about mergers is available here.
110. Cofece (2018), *El Procedimiento de Concentraciones*, pp. 3-4. Available here.
111. Cofece (2021), *Guía para la notificación de concentraciones*, pp. 51 and 52. Available here.
112. OECD (2023), *Digital Merger Control: Adapting Theories of Harm – Note by Viktoria Robertson*, p. 5. Available here.
113. Pérez de Lamo, D. (2019), *Preserving Innovation Competition in the Digital Era: "Killer Acquisitions*, p. 2. Available here.
114. If you want to learn more about this, check out the section *Fusiones y Adquisiciones: ¿Un medio para eliminar la competencia?*, in Cofece (2018), *Repensar la Competencia en la Economía Digital,* pp. 52 and 53. Available here.
115. CADE (2024), *Superintendência-Geral apura aquisições de startups de inteligência artificial por big techs.* Available here.

Strategic partnerships and collaboration agreements

The development of AI, particularly generative AI, is concentrated in a few companies due to its high costs and infrastructure requirements. In this context, some tech giants have formed collaborations and strategic partnerships that have drawn the attention of antitrust authorities due to their potential impact on competition.

Strategic partnerships are common across all industries, both digital and traditional. Cofece, for instance, analyzed the joint venture between Aeroméxico and Delta, and in 2016 approved the operation subject to accepted remedies that would preserve competition in the passenger flight market between Mexico and the U.S.. Although this case did not involve AI-related issues, it illustrates how some collaboration agreements can be reviewed by competition authorities to prevent a negative impact on markets.

Delta – Aeroméxico

Commercial airlines often form alliances to offer you a wider range of destinations, itineraries and connections, reducing the investments required compared to operating individually. One way this cooperation materializes is through Joint Cooperation Agreements (JCAs), which involve sharing revenues, costs, and benefits, as well as coordinating networks, frequencies, aircraft and prices in a specific market, operating similarly to a merger. However, these alliances must be approved by competition authorities to prevent negative effects on the market.

In 2015, Delta[116] and Aeroméxico[117] notified Cofece of their intention to form a joint venture to jointly operate all their current and future flights between Mexico and the United States. After analyzing the merger, Cofece found that the cooperation would result in:

1. Increased market power: together, Aeroméxico and Delta could attain a dominant position, allowing them to raise prices without facing competitive pressure.
2. Barriers for other competitors: it would become more difficult for other competing airlines (both current and potential) to enter or expand on routes to or from Mexico City.

In light of these findings, Cofece decided not to authorize the operation as originally proposed, but rather conditioned its approval on specific measures to preserve competition in the market and allow other airlines to offer certain cross-border routes.

Ultimately, Delta and Aeroméxico agreed to the conditions set by Cofece, allowing the joint venture to move forward without harming competition. As a result, consumers benefited from more options and competitive prices on flights between Mexico and the United States.

Source: Cofece (2016), *Análisis de Caso. Acuerdo conjunto de cooperación entre Delta y Aeroméxico para sus vuelos entre México y Estados Unidos*. Available here

116. A U.S. company providing air transportation services, primarily for passengers, charter flights, and cargo, both domestically and internationally.
117. A company primarily engaged in the provision of air transportation services for passengers and goods, including regular passenger services, charter flights, and cargo, both within and outside of Mexico, focusing on high-density domestic routes and international markets.

In the case of AI, a notable example is the strategic partnership between Microsoft, a leader in cloud computing services, computer operating systems, and software, and OpenAI, a pioneer in AI development. This collaboration has drawn the attention of competition authorities, as have the investments made by Amazon and Google in Anthropic, the creator of the generative AI model, Claude.[118]

Microsoft – OpenAI

For several years, Microsoft and OpenAI have maintained a relationship based on multi-billion-dollar investments to advance AI development and share its benefits with society. Their latest agreement aims to extend their collaboration into AI supercomputing, enabling developers and organizations from different industries to access infrastructure, models and tools through the Azure platform to build and run their own applications.[119]

On December 8, 2023, the UK's Competition and Markets Authority (CMA) announced the opening of an investigation on the partnership between Microsoft and OpenAI, inviting third parties to share their views on this relationship. The CMA seeks to determine whether this partnership constitutes a merger that should be assessed under the Enterprise Act 2002 and, if so, whether it has the potential to harm competition.

On January 9, 2024, the European Commission (EC) also weighed in, announcing that it would examine the nature of the relationship between Microsoft and OpenAI to determine whether it should be assessed as a merger under European law. After a thorough investigation, the EC concluded that no further action was necessary, although it stated that it would continue to monitor the alliance.

On January 25, 2024, the U.S. Federal Trade Commission (FTC) announced that it had requested information from five companies, including Microsoft and OpenAI, regarding recent investments and partnerships in generative AI, with the aim of assessing their potential impact on competition.[120]

Sources:
Microsoft (2023), *Microsoft and OpenAI extend partnership*. Available here.
CMA (2023), *Microsoft/ OpenAI partnership merger inquiry*. Available here.
CMA (2023), *CMA seeks views on Microsoft's partnership with OpenAI*. Available here.
CE (2024), *Commission launches call for contributions on competition in virtual worlds and generative AI*. Available here.
CE (2024), *Speech by EVP Margrethe Vestager at the European Commission workshop on Competition in Virtual Worlds and Generative AI*. Available here.
FTC (2024), *FTC Launches Inquiry into Generative AI Investments and Partnerships*. Available here.

Competition authorities such as the CMA, EC, and the FTC are alert to the potential adverse effects of collaboration agreements in the AI sector. The main concerns include the possible reduction of players in the generative AI market and the creation of exclusive advantages for large tech companies that forge strategic partnerships with AI developers. To evalu-

118. FTC (2024), *FTC Launches Inquiry into Generative AI Investments and Partnerships*. Available here
119. Microsoft's cloud computing service.
120. The FTC is empowered to conduct studies to deepen its understanding of market trends or business practices, which can serve as a basis for future actions.

ate these issues, factors such as the impact on innovation, the availability of market options, pricing dynamics and access to strategic inputs such as data must be considered.[121]

2.2.2. Barriers to entry, vertical integration and potential anti-competitive practices

As we have seen, the development and operation of AI models involves significant upfront investment, lengthy development times, and access to several resources and specialized talent. These factors can create significant obstacles for new participants to enter and compete in these markets, thereby generating **barriers to entry**.[122]

For AI services, barriers to entry stem from the structural conditions of the industry, such as high upfront costs and the need for key inputs (large databases, advanced processors, computational power, expertise, among others). In the AI value chain, particularly in Generative AI, there are high barriers to entry, and few players control the fundamental inputs for the development and consolidation of this technology. These barriers can also arise from business practices or strategies of established companies.[123]

Control over key inputs by a limited number of companies poses potential risks to competition associated with the use and development of AI.[124] On the one hand, there is a risk that participants controlling key inputs (processors, cloud infrastructure, etc.) might restrict third-party access to these resources or favor their own services or those of their allies, making it difficult for new competitors to enter and reducing growth opportunities for other companies.[125]

On the other hand, some companies participate in different stages of AI development and distribution, and often are **vertically integrated**. That is, they stop depending on external suppliers and handle the necessary processes in-house to offer their products or services.

121. Carugati, C. & Perez, M. (2024), *Antitrust in the age of Artificial Intelligence: lessons from "I, Robot". CPI Antitrust Chronicle, July 2024*, p. 40. Available here.
122. ACCC (2024) *Digital Platform Services Inquiry- Final Report*. pp.14-15. *Available* here.
123. Cofece (2016) *Herramientas de Competencia Económica*, p. 21. Available here.
124. FTC (2024), *Joint Statement on Competition in Generative AI Foundation Models and AI Products*. Available here.
125. CMA (2023), *AI Foundation Models: Initial Report*, pp. 16-18, 66, 69. Disponible aquí.

Notable examples of vertical integration include big techs like Microsoft, Apple, Amazon and Google, which are developing their own chips and processors to avoid relying on companies like Intel and Nvidia.[126] Companies like Google and OpenAI not only develop their own AI services but also offer them directly to consumers and other companies, often as supporting tools such as chatbots.[127]

Box 8. Examples of tech companies which are actively involved in the AI value chain

Cloud computing:	Amazon Microsoft, Google
Large databases:	Google, Meta, Microsoft
AI development:	Amazon, Apple, Google, Meta, Microsoft
AI joint ventures and partnerships:	Amazon, Google, Microsoft, Apple

Source: CMA (2024), *AI Foundation Models, Update paper*, p. 9. Available here.

Moreover, these companies are also active in other markets within the digital economy, where they hold strong positions. This has raised concerns among competition authorities, particularly when considering the high barriers to entry and vertical integration of these companies in the AI supply chain.

Box 9. Presence of technology firms in other digital markets*

Google	Search engines; mobile ecosystems; and productivity suite
Microsoft	Search engines; computer operating systems; and productivity suite
Apple	Mobile ecosystems; computer operating systems; and productivity suite
Meta	Social networks

*These markets are suitable for the implementation of AI services (especially generative AI)
Source: CMA (2024), *AI Foundation Models, Update paper*, p. 9. Available here.

126. Apple is developing chips for data centers, seeking edge in arms race, *The Wall Street Journal*, May 6, 2024. Available here.
127. Google and OpenAI develop their own foundational models and offer them directly to consumers (Gemini, by Google, is available here and ChatGPT is available here) and, simultaneously, to third-parties (PaLM2 is available here and GPT-4 is available here) see CMA (2023), *AI Foundation Models: Initial Report*, p, 66. Available here.

Vertically integrated firms with market power may engage in anti-competitive practices that manifest in various ways, such as bundling or tying, denying or restricting access to services needed to compete in the market, or offering preferential treatment to their own products or those of their business partners, among others.[128]

One example of these risks is the potential for self-preferencing at various stages of the value chain. Companies providing AI services and developing their own AI applications may have an incentive to favor their own products over those of third parties. Likewise, providers of cloud computing services or next-generation chip manufacturers might prioritize their own technologies or those of their allies, negatively impacting other market participants.[129] This could harm competition, reduce the variety and quality of products, and increase prices, ultimately affecting both businesses and consumers.[130]

Finally, there are concerns about the use of algorithms to train AI, which may facilitate collusive behavior (absolute monopolistic practices under Mexican competition law) such as price-fixing, restricting or reducing quantity or quality, market allocation, bid rigging or the exchange of information to engage in such actions.[131]

128. To learn more about self-preference and tying, see the notebook *Basic Concepts of Competition in the Digital Economy*, pp. 48-52. Available here. To learn more about data access restrictions, see the notebook *Data and Competition in the Digital Environment*, pp. 34-37. Available here.

129. Von Thun, Max & Hanley, Daniel. *Stopping Big Tech from becoming Big AI: a roadmap for using Competition Policy to keep Artificial Intelligence Open for all.* Open Markets Institute, pp. 22-25. Avaialble here.

130. CMA (2024) *CMA AI strategic update.* Available here. Von Thun, Max & Hanley, Daniel. *Stopping Big Tech from becoming Big AI: a roadmap for using Competition Policy to keep Artificial Intelligence Open for all.* Open Markets Institute, pp. 22-25. Available here.

131. FTC (2024), *Joint Statement on Competition in Generative AI Foundation Models and AI Products.* Available here. To learn more about algorithmic collusion, see the notebook *Algorithms and Competition in the Digital Environment*, pp. 32-38. Available here.

3. Proposals to address the risks posed by AI

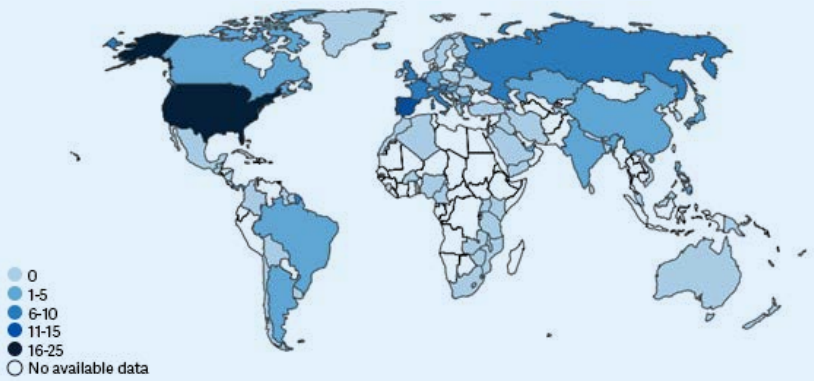
The rise of AI and its increasing use have prompted countries around the world to create laws to regulate it. However, it remains unclear whether it is the right time for regulation or if it's better to allow innovation to progress further.

There is an ongoing debate on whether sectoral regulations for AI should be introduced before issuing specific regulations. Moreover, there is growing consensus on adopting certain principles to guide AI development. Understanding these principles is crucial, especially if beyond being a user, you are interested in developing AI.

As the following map illustrates, between 2016 and 2023, 148 AI-related bills were passed all over the world.[132]

132. AI Index & Stanford University (2024), *Chapter 7: Policy and Governance, Artificial Intelligence Index Report 2024*, p. 376. Available here.

Box 10. Number of AI-related bills passed by country between 2016 and 2023



Source: AI Index & Stanford University (2024), *Chapter 7: Policy and Governance, Artificial Intelligence Index Report 2024*, p. 376. Figure 7.2.1. Available here.

3.1. Regulatory proposals

While over 120 countries have taken regulatory actions regarding AI, the EU's AI Act[133] has emerged as the benchmark for regulatory purposes, which governs AI development and use according to its risk level. This proposal has been the basis for similar initiatives in other countries, such as Brazil, where efforts have been made to establish national standards for the responsible development, implementation and use of AI systems.[134]

Furthermore, the first legally binding international treaty was recently signed to ensure that the use of AI systems is consistent with human rights, democracy and the rule of law.[135]

3.1.1. EU's AI Act (AIA)

In 2018, the EC issued a press release[136] announcing the AI Act initiative. Under this law, AI systems are classified based on their risk level (unacceptable, high, limited and minimal) and, accordingly, obligations are imposed on providers and developers of such systems.

133. *AI Act*. Available here.
134. Senado Federal (2023), *PROJETO DE LEI N° 2338, DE 2023*. Available here.
135. Council of Europe (2024), *Details of Treaty No.225*. Available here.
136. CE (2018), Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social committee and the Committee of the Regions. Available here.

On May 21, 2024, the European Council approved the AIA.[137] The regulation came into force on August 1, 2024,[138] with full application two years later.[139]

Under the AIA, systems are deemed unacceptable if they pose a threat to human safety, livelihood or rights, such as social credit systems and manipulative AI that involves subliminal or deceptive methods that distort behavior and impair decision-making.

High-risk AI use is regulated. This category covers technologies used in: critical infrastructures that could endanger citizen's lives and health; educational or vocational training that could determine someone's access to education and career paths; product safety components; employment, worker management, and access to self-employment; essential utilities and private services; law enforcement that may infringe on fundamental human rights; migration, asylum and border control management; administration of justice and democratic processes; and remote biometric identification systems, banned in public spaces for law enforcement purposes.

Limited-risk AI is associated with a lack of transparency in its use, requiring transparency obligations such as ensuring end-users awareness of their interaction with AI. Finally, the AIA does not regulate minimal-risk applications, which in fact encompasses most AI-powered applications, such as video games or spam filters.[140]

This law aims to foster the development and adoption of safe and reliable AI systems while safeguarding fundamental rights and stimulating investment and innovation in AI. To ensure an effective implementation of the AIA, the law mandates the creation of an AI Office, an independent panel of scientific experts, an AI Council and a consultative forum.[141]

137. Council of the European Union (2024), *Timeline – Artificial intelligence*. Available here.
138. European Commission (2024), *AI Act enters into force*. Available here.
139. Most of the provisions of the AI Act will apply starting August 2, 2026. However, the prohibitions on unacceptable-risk AI systems will take effect six months after the Act's entry into force, while the rules for general-purpose AI models will apply twelve months later. European Commission (2024), *European Artificial Intelligence Act comes into force*. Available here. Council of the European Union (2024), *Artificial intelligence (AI) act: Council gives final green light to the first worldwide rules on AI*. Available here.
140. EU Artificial Intelligence Act (2024), *High-level summary of the AI Act*. Available here.
141. Council of the European Union (2024), *Artificial intelligence (AI) act: Council gives final green light to the first worldwide rules on AI*. Available here.

3.1.2. Council of Europe Framework Convention on AI and Human Rights, Democracy and the Rule of Law

Since 2019, the Council of Europe's Committee on AI began exploring the possibility of drafting a Framework Convention on AI, which was designed and negotiated in 2022. The Framework Convention was drafted by 46 member states of the Council of Europe, with participation from countries such as Mexico, Canada, Japan, the Vatican, the United States, Australia, Argentina, Costa Rica, Israel, Peru and Uruguay.[142]

On September 5, 2024, Andorra, Georgia, Iceland, Norway, the Republic of Moldova, San Marino, the United Kingdom, Israel, the United States and the EU signed the Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law. This treaty provides a comprehensive legal framework covering the entire lifecycle of AI systems; promotes progress and innovation in AI while managing potential risks.[143] It aims to address specific challenges and spread awareness of the risks and impacts related to these technologies in areas such as human health, the environment and employment, among others.[144]

Both the AIA and the Framework Convention share concerns about the use of AI and its impact on human rights, democracy and the rule of law, while seeking ways to avoid stifling technological progress and innovation. The current trend suggests that an increasing number of countries will draft and adopt laws to regulate AI in the coming years.

3.2. Guiding principles for AI development

To address the risks posed by AI and foster competition and innovation, authorities such as the CMA[145] and the FTC,[146] and organizations like the Organization for Economic Co-operation and Development (OECD)[147] and the United Nations Educational, Scientific and Cultural Organization (UNESCO),[148] have issued recommendations and proposed common principles to foster competition and drive innovation. However, AI's competition risks must be assessed on a case-by-case basis.

142. Council of Europe (n.d.), *The Framework Convention on Artificial Intelligence*. Available here.
143. Council of Europe (2024), *Council of Europe opens first ever global treaty on AI for signature.* Available here.
144. Council of Europe (2024), *Details of Treaty No.225*. Available here.
145. CMA (2023), *Proposed principles to guide competitive AI markets and protect consumers*. Available here and CMA (2023), *AI Foundation Models: Initial Report*, pp. 120-121. Available here.
146. FTC (2024), *Joint Statement on Competition in Generative AI Foundation Models and AI Products*. Available here.
147. OECD (2024), *AI Principles*. Available here.
148. UNESCO (2024), *México: evaluacion del estadío de preparación de la inteligencia artificial*. Available here.

For instance, they emphasize the need for a comprehensive policy approach that allows companies of all sizes to develop AI technologies and improve access to financing, possibly via public sources.[149] They also stress the importance of promoting access to training data and systems interoperability by harmonizing international regulations.[150]

Below, we summarize some of the principles proposed by these authorities and organizations:

1. **Fair dealing**: the AI ecosystem will be benefited as long as companies with market power don't engage in anti-competitive practices. When companies with market power use tactics to exclude competitors, they can reinforce their dominant position, discourage third-party investment and innovation, and weaken competition. This principle would allow you to engage in AI development on a level playing field.
2. **Interoperability**: competition and innovation in AI will thrive as AI products, services and their inputs become more interoperable. Likewise, large tech companies with substantial databases could allow third-party access, enabling other companies or developers like yourself to participate and compete.
3. **Choice**: whether you own a startup, a tech company, or you are a developer or a consumer, you will benefit from the wider range of products and business models resulting from a competitive process. This requires a close examination of the tactics that companies might use to limit your ability to choose alternatives.
4. **Transparency**: as a consumer it's important to have access to information about the limitations and potential consequences related to AI-generated content. You should be informed when interacting with AI, so you can understand the underlying system, know where the data that fuels the system comes from and the processes used to obtain results, among others. This will help you to make informed decisions, incentivizing companies to improve and compete for your trust, which in turn will enrich the market and foster innovation. As an AI actor, it is important to ensure you provide relevant, timely information so users know when they are interacting with AI.

149. OECD (2024) *The impact of Artificial Intelligence on productivity, distribution and growth.* Available here.
150. OECD (2024) *The impact of Artificial Intelligence on productivity, distribution and growth.* Available here.

5. **Respect for human rights**: as an AI actor, it's crucial to respect the law and human rights throughout the AI lifecycle, including non-discrimination, equality, dignity, autonomy, privacy and data protection, and social justice, among others. This is another area where you can compete with other AI developers and could be a differentiating factor influencing consumers to choose you over an alternative provider.

These principles outline best practices for the development and use of AI, aimed at protecting your rights, providing guidance for both developers and consumers, and strengthening competition. While not formal regulations, these principles offer concrete actions to address the main concerns around AI governance. They also provide key elements that can guide the development, implementation, and interaction with AI technology.

3.3. Striking a balance between regulation and innovation

Regulatory efforts commonly struggle to keep pace with technological advancement. What is happening with AI is no exception, as it's difficult to create a regulatory framework that can evolve at the same pace. By nature, regulation is a step behind the regulated activity. Therefore, legislators and regulators face the challenge of drafting regulations that are not overly restrictive, as this would stifle innovation.[151]

In Mexico, we are still in the process of identifying specific needs to strike a balance between regulation and innovation. Overregulation could discourage innovation, limiting the potential benefits of new technologies. An excessive regulation could restrict your access to more services, hinder economic growth, and inhibit the emergence of new businesses, thereby limiting your options. It could also reduce competition, making it harder for smaller companies to enter or remain in the market and compete.[152]

Conversely, a flexible regulatory approach could foster business growth and enhance the global digital economy. One way to avoid overregulation is by adopting international AI standards that are flexible enough to adapt to diverse regulatory scenarios while preserving the potential for

151. Australian Law Reform Commission (2023), *The regulatory challenges of evolving technology and financial services law*. Available here.
152. Girón, I. (2024), *¿Es necesario regular la Inteligencia Artificial en México?: Un Enfoque Basado en la Realidad Nacional.* Available here.

innovation. If the regulatory framework is not overly restrictive or rigid, companies may have sufficient incentives to continue operating and adopting new ideas to implement emerging technologies like AI, providing you with a variety of innovative solutions.[153]

AI regulations should aim to protect and safeguard your rights while promoting fair conditions and a level playing field for all AI actors.

153. Panait, C., *et. al.* (2021), *Striking the balance between innovation and regulation in AI – is Europe leading the way or lagging behind?*, pp. 34-35, 40. Available here.

4. Conclusions and recommendations

AI has been a catalyst for transforming the economy, driving innovation and technological advancement, increasing productivity, improving efficiency, and creating new business opportunities. Its applications are widespread, including areas such as construction, education, and healthcare. AI is also present in our daily lives, powering features like automatic captions, navigation systems, text generators, digital assistants, and chatbots.

AI is vast and diverse, reflected in its wide range of applications. Through machine learning, AI uses algorithms to learn from data and the repetition of tasks, such as in search algorithms and facial recognition on your phone. Through deep learning techniques, AI mimics how our brain works by using neural networks formed by layers to learn and recognize patterns, which could be useful for activities like image recognition and audio processing.

Optimal AI development is contingent on a combination of data access, sufficient computational power and specialized personnel. The computational power required includes specialized chips, supercomputers, data centers, cloud computing and lots of energy. Under certain circumstances, this can pose risks within the digital economy. Only a few firms have the capacity to develop AI, making it difficult for new entrants to participate and ultimately hindering competition. This is why our role as competition authorities is of paramount importance, as we're respon-

sible for promoting a level playing field so as everyone can compete on equal terms.

Nowadays, over 120 countries have introduced AI-related legislative initiatives. Notably, the AIA in the EU stands out as a risk-based regulatory proposal. Moreover, the first international treaty on AI was signed in September 2024.

As it's still unclear how AI should be regulated, different authorities and organizations around the world have made recommendations and proposed guiding principles with best practices in its development and deployment. These principles could enhance competitive conditions, fostering innovation and maximizing the benefits AI brings.

As an AI user, you can also take steps to protect your safety while enjoying the benefits of this tool. For that purpose, we recommend that you:

1. Stay informed and updated on AI and its implications, so you can access the technology that best suits your preferences and needs.
2. Simultaneously use different complementary AI tools. This not only maximizes the benefits AI can offer in executing tasks but also encourages healthy competition among providers.
3. If you wish to participate as an AI actor, follow the guiding principles for the development and use of this technology and adopt best practices in the process.

By combining our efforts, we can all contribute to ensuring free competition in markets using AI and those involved in its development and deployment. This will ensure that you have access to the best technology, at the best prices, under better conditions, and from a variety of providers, allowing you to choose what best suits your needs.

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