

ARTIFICIAL INTELLIGENCE *Future Vision* STUDY 2025

Exploring AI trends and applications within the Sebrae ecosystem — highlighting future opportunities and challenges for Micro and Small Enterprises.



*Brazilian Micro and Small
Business Support Service*

SEBRAE · 2025

Credits & Institutional Information

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ABOUT THIS STUDY

Developed jointly with the **Center of Excellence in Artificial Intelligence (CEIA) at UFG**. Aligned with Brazil's PBI-A priority axes, this study equips small businesses and policymakers with the strategic intelligence needed to navigate the AI era.

IN THIS STUDY

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This study traces the historical trajectory of AI, presents key concepts, analyzes global and Brazilian positioning, and describes Sebrae's proposed strategic, tactical, and operational plan for the AI era.

STUDY OVERVIEW

Introduction

This study aims to **explore the trends of Artificial Intelligence and its applications within the Sebrae ecosystem**, highlighting future opportunities and challenges, while considering the fundamental role of MSMEs (Micro and Small Enterprises) in the global economy.

The document traces the historical trajectory of the technology and presents key AI concepts that will help the reader understand the reasoning put forward throughout the text. At the end, the proposal for Sebrae's strategic, tactical, and operational plan is described.

History

From Dartmouth 1956 to
Generative AI 2025

Global

AI in the World, in Brazil, and in
MSMEs

Strategy

Sebrae's 3-layer plan: Strategic ·
Tactical · Operational

WHY THIS STUDY MATTERS

Artificial Intelligence is no longer a future technology — it is reshaping industries, labor markets, and public policy today. For Sebrae, understanding and acting on these trends is **a strategic imperative** for the more than **17 million micro and small businesses** served across Brazil. This study is the foundation of that action.

The growing impact of AI is evident in recent studies such as *"Artificial Intelligence in Small & Medium Business Market – Forecast (2024–2030)"* published by IndustryARC, which demonstrate significant advancement in the use of AI. According to the OECD report *"The Impact of Artificial Intelligence,"* AI holds a prominent position among general-purpose technologies due to its high potential to dominate cognitive tasks.

CHAPTER 01 | HISTORY & CONCEPTUAL REVIEW

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

From Turing *to* Deep Learning

AI has evolved from a theoretical concept first articulated at the **1956 Dartmouth Conference** into the world's most transformative general-purpose technology — one capable of advanced cognitive tasks, self-improvement, and autonomous operation.

Machine Learning

Neural Networks

Deep Learning

NLP

Computer Vision

Robotics

CORE DEFINITION

AI is an interdisciplinary field of computer science that seeks to develop systems capable of **learning patterns from data** and performing repetitive tasks — from large-scale data analysis to simulating human perception and decision-making.

History of Artificial Intelligence

1943	First research on neural networks — McCulloch & Pitts mathematical model
1950	Turing publishes " <i>Computing Machinery and Intelligence</i> " — proposes the Turing Test
1956	Dartmouth Conference — McCarthy, Minsky, Rochester & Shannon coin the term "Artificial Intelligence"
1957	General Problem Solver (GPS) by Newell & Simon — first heuristic search program
1966	ELIZA (MIT, Weizenbaum) — first natural language processing / psychotherapist simulation
1976	MYCIN (Stanford, Shortliffe) — expert system for bacterial infection diagnosis
1980–86	"AI Winter" — reduced funding; backpropagation algorithms (Rumelhart et al., 1986) revive neural networks
1997	IBM Deep Blue defeats world chess champion Garry Kasparov in an official match
2000s	Internet explosion — Google, Amazon, Microsoft integrate AI; cloud computing enables large datasets
2010s	Deep learning dominance — CNNs, RNNs; AlphaGo defeats world Go champion Lee Sedol (2016)
2023–25	Generative AI explosion — GPT-4, LLMs, agent personalization enter mainstream global use

Source: Sebrae AI Future Vision Study 2026 · CEIA–UFG

AI vs. Other General-Purpose Technologies

According to the OECD report *"The Impact of Artificial Intelligence,"* AI can be compared to other general-purpose technologies and holds a prominent position due to its high potential to dominate cognitive tasks:

	STEAM ENGINE & ELECTRICITY	COMPUTERS & INTERNET	ARTIFICIAL INTELLIGENCE
Primary output	Energy	Calculations and information exchange	Advanced analyses, predictions, optimizations, and content generation
Tasks primarily affected	Physical	Cognitive routine and communication	Wide range of cognitive tasks
Autonomy?	No	Limited	Potentially advanced
Self-improvement capability?	No	No	Yes
Method of invention?	No	Yes	Yes

Source: OECD · *The Impact of Artificial Intelligence*

This self-improvement capability increases the complexity of AI models, potentially surpassing human ability to understand how they work — the so-called "black box" behavior — reducing transparency and predictability.

OECD · THE IMPACT OF ARTIFICIAL INTELLIGENCE

IMPORTANT LIMITATION

Despite its high cognitive potential, **AI is not capable of performing basic common-sense or physical-reality reasoning** — for example, understanding how things change over time. It can simulate generative responses based on data, but cannot "perceive" common sense without historical data input.

Key Technology Areas

Machine Learning

Deep learning techniques dominate in 2024, with Transformer architectures at the core of LLMs. **AutoML tools** automate model selection and hyperparameter tuning, democratizing AI for SMEs. **Federated Learning** enables privacy-preserving training on decentralized data.

Computer Vision

Advanced CNNs (EfficientNet, Vision Transformers) redefine image processing. **Medical image analysis** now detects diseases in X-rays and MRI scans with precision comparable to human specialists. 3D perception via LiDAR and stereoscopic cameras enables autonomous vehicles.

Natural Language Processing (NLP)

LLMs like GPT-4 and BERT revolutionize text comprehension, translation, and generation. **Multimodal models** (DALL-E) combine text and image. Voice assistants (Alexa, Google Assistant) provide increasingly natural, contextual interactions.

Robotics

Collaborative robots (cobots) work alongside humans in manufacturing and logistics. Surgical robots perform complex procedures with enhanced precision. Autonomous drones are revolutionizing last-mile logistics.

Studies discuss the collaborative role between humans and machines, emphasizing the importance of AI in enhancing — rather than replacing — human capabilities.

NORMAN (2017) · JOURNAL OF ARTIFICIAL INTELLIGENCE RESEARCH

THE ARCHITECTURE OF INTELLIGENCE

What *makes* a system intelligent?

Generative AI aims to produce **text, images, audio, and video** in a probabilistic manner. Understanding the distinction between an AI system and an AI model — and how they layer across infrastructure, development, and application — is critical for **strategic decision-making**.

Generative AI

LLMs

GANs

VAEs

Transformers

MLOps

Gen.

Text · Images · Audio · Video ·
Code

Non.

Predictive & classificatory
analyses

3_x

Layers in the AI Engineering
Stack

Generative AI Key Characteristics

- **Creation of new content:** Generates text, images, audio, video, code — original and not limited to reinterpreting existing data
- **Learning of complex patterns:** Learns intrinsic rules and relationships of training data, enabling coherent, contextually relevant outputs
- **Variety of applications:** Product design, musical composition, creative writing, translation, speech synthesis, simulations
- **Notable examples:** Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), Transformer Models (GPTs)

AI System vs. AI Model

AI SYSTEM A computer program or AI-based product. Example: ChatGPT — the full interface, APIs, safety layers, and user experience built on top of a model.	AI MODEL A set of parameters whose values are learned during training. Example: GPT-4 — the core trained weights powering the system.
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Source: Stanford AI Index Report 2024

The AI Engineering Stack

LAYER	COMPONENTS
Application Development	AI interface · Prompt engineering · Context construction · Evaluation
Model Development	Inference optimization · Dataset engineering · Modeling & training · Evaluation
Infrastructure	Compute management (CPU/GPU/TPU) · Data management · Serving · Monitoring

Source: AI Engineering, O'Reilly — Chip Huyen, 2025

GLOBAL AI LANDSCAPE · 2023–2025

Brazil *in the* Global AI Arena

The concentration of major AI discoveries remains in the hands of **big tech companies** and developed nations. Lack of government traceability over training methods is a key driver of the EU's AI Regulatory Act. Brazil ranks **34th out of 36** countries in the Stanford AI Vibrancy Index.

#34 / 36 Countries

Stanford AI Index 2025

PBIA 2024

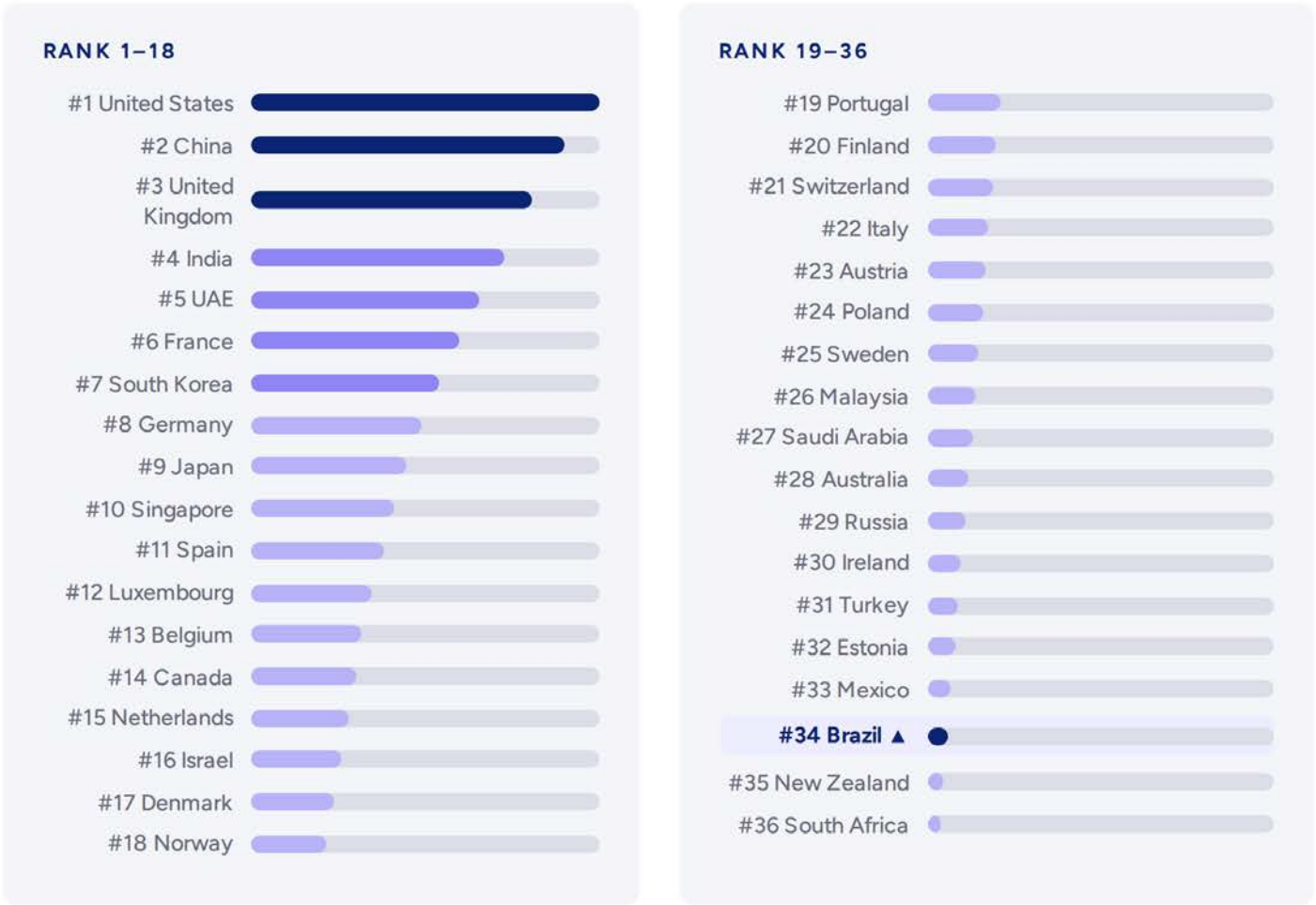
EU AI Act

36Countries in the Stanford AI
Vibrancy Ranking**34^o**Brazil's global AI readiness
position**1st**

United States — global AI leader

2023 Global AI Vibrancy Ranking — All 36 Countries

Weighted Index Score · Source: Stanford AI Index 2025



Regional Analysis

NORTH AMERICA — #1 UNITED STATES

Dominates in R&D, private investment, notable ML models, and GitHub activity. Big tech companies hold disproportionate influence over global AI development and deployment.

EUROPE — INNOVATION BALANCED WITH SAFETY

EU countries unify around the **AI Regulatory Act (2024)**, following the GDPR model. **Germany (#8)** leads in academia-industry collaboration and talent. Europe serves as global benchmark for AI governance.

MIDDLE EAST — AMBITION MEETS PRAGMATISM

UAE (#5) positions itself as a global AI powerhouse with massive public-sector investments in education, transportation, healthcare, and public services.

ASIA — PRAGMATIC APPROACHES AND RAPID ADOPTION

China (#2) leads in AI publications, patents, and private investment. Prior investments in public digital infrastructure drive continuous technological growth across the region.

AFRICA — LEAPFROGGING TRADITIONAL DEVELOPMENT

AI advances in education, fintech, and healthcare diagnostics driven by a younger population. Requires significant public investment in infrastructure and private investment in innovation.

LATIN AMERICA — A MOSAIC OF PROGRESS · BRAZIL #34

Uneven growth due to inequalities and lack of infrastructure. Brazil launched **PBIA in 2024** to protect and stimulate domestic AI development, reducing dependence on international platforms.

Brazil: Stanford AI Index 2025 — Key Indicators

Brazil ranks 34th among 36 countries (Overall ranking: 34 of 36). Key normalized-score indicators measured:

Measured Indicators

- National AI Strategy Presence
- Internet Speed
- AI-Related Social Media Conversations
- Relative AI Skill Penetration
- Net Migration Flow of AI Skills
- AI GitHub Projects & Stars
- Supercomputers
- AI Mentions in Legislative Proceedings
- AI Journal & Conference Publications
- Newly Funded AI Companies
- Compute Capacity (Rmax)
- Total AI Private Investment
- AI Hiring Rate YoY Ratio

Key Challenges

- Digital infrastructure still faces challenges despite improved speeds
- Device computational capacity insufficient for daily AI use
- Public and private R&D investment remains low
- AI production concentrated in large companies
- Mass use of international platforms

Emerging Trends (CEIA–UFG)

- **Simplified, personalized interfaces** — AI-based, anticipating user needs
- **Voice interaction** replacing keyboards on mobile
- **Intelligent agents** for information curation
- **Multi-platform** information access (AR/VR/messaging)

PBIA 2024 — BRAZIL'S RESPONSE

The **Plano Brasileiro de Inteligência Artificial** aims to protect Brazil's leading role in AI development, reduce mass consumption of international technologies, and strengthen R&D, public infrastructure investment, and private investment in startups.

THE BRAZILIAN MSME DIGITAL LANDSCAPE

Small Business, *big* opportunity

Brazilian small businesses have **not yet adopted AI** in their day-to-day operations. Low digital maturity, dependence on basic tools, and limited automation investment create a significant gap — and an unprecedented **strategic opportunity for Sebrae**.

47% ERP

32% CRM

57% WhatsApp

38% Paid Ads

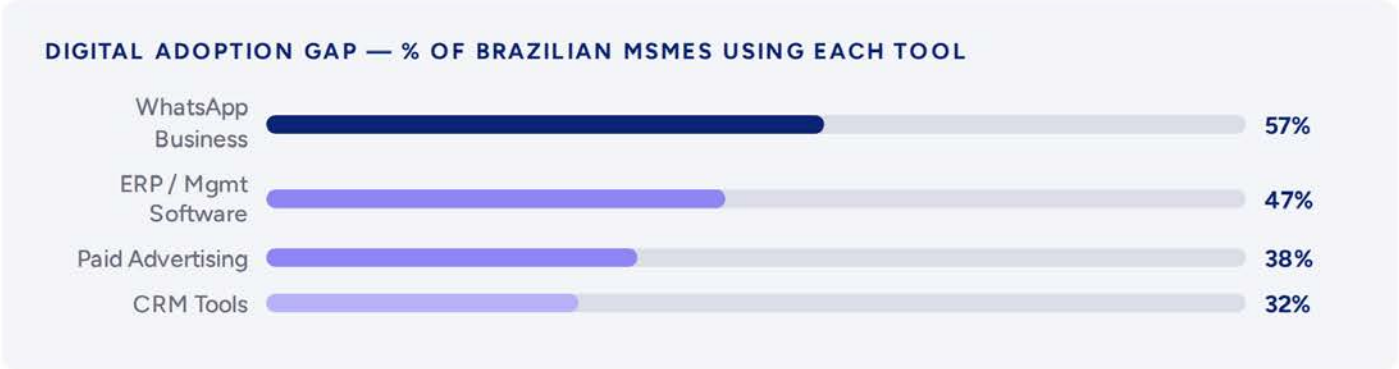
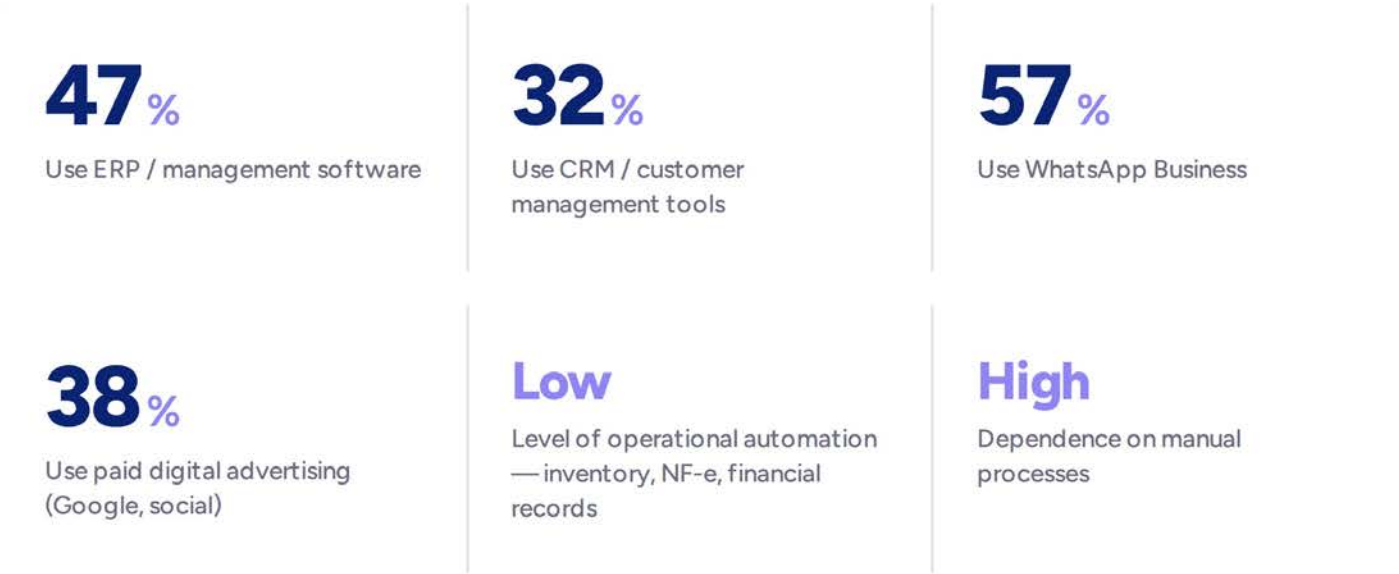
Low Automation

According to the Observatório do Desenvolvimento, Brazilian small businesses have not yet adopted Artificial Intelligence in their day-to-day operations.

OBSERVATÓRIO DO DESENVOLVIMENTO · BRASIL MAIS PRODUTIVO STUDY

Digital Tool Adoption by Brazilian MSMEs

Source: Observatório do Desenvolvimento · Sebrae AI Future Vision Study 2026



Action Opportunities for Sebrae

- Promote accessible **management software** to improve operational and financial control
- Train companies on **CRM systems** to integrate customer data and optimize marketing
- Implement **generative AI** for campaign personalization and social media content
- Introduce **AI-based chatbots** to improve customer service and reduce response time
- Encourage strategic use of **paid digital advertising** to expand customer base

Pain Points Analysis — Brasil Mais Produtivo

Drawing on the reported pain points of MSMEs served by **Brasil Mais Produtivo**, the following analytical process was carried out:

METHODOLOGY

Stopword extraction → Word vectorization → **Machine Learning clustering** (Topic Model) → Pain point labeling via **LLM (Llama model)** → Pareto analysis of recurrence → Frequency and human-intervention classification

Pain points were classified by their potential for AI-driven execution:

DECISION SUPPORT <i>Aid to the consultant / agent</i>	DECISION-SUPPORT SOLUTION <i>Guided by consultant to MSME</i>	AUTOMATION SOLUTION <i>Offered directly to MSME</i>
Production control · Strategic planning · Lack of standardization · Sales process improvements · Low productivity · Adaptation of internal processes · Recording of business activities · Store improvements · Internal communication improvements · Disorganized financial management · Performance indicators · Team overload · Improving confused processes · Lack of financial management · Defined processes · Goals and objectives · Growth management · Entrepreneur overload	Delivery delays · Technical procedure sheets · Business financial control · Reduction of production waste · Service quality · ERP for control and management · Financial monitoring · Improving customer service · Product standardization	WhatsApp service

Source: Brasil Mais Produtivo · ALI Database Analysis · Sebrae AI Future Vision Study 2026

The arrow of increasing automation potential runs from left (human-guided) to right (fully automated), indicating where AI can be directly applied versus where consultant guidance remains essential for MSMEs.

CHAPTER 05

OVERVIEW OF AI USE BY SMALL BUSINESSES WORLDWIDE

THE GLOBAL MSME AI CONTEXT

The engine of *the* economy

MSMEs represent **more than 90% of all companies** in many countries and account for approximately **70% of global GDP**. Yet they face structural barriers — from lack of data infrastructure to limited talent — that prevent full AI adoption.

90%+ of All Companies

~70% Global GDP

McKinsey MGI

Cognitive Economy

90%+

Share of companies that are
MSMEs in many countries

40%

Global workforce employed by
MSMEs

70%

Private sector employment from
MSMEs

Challenges Facing SMEs in the Digital Era

- Adapting to a constantly evolving digital environment — reconciling global expansion with complex data protection regulations
- Mitigating higher risks of **cyberattacks**, as SMEs represent the weakest links in value chains
- Accessing, cleaning, and eliminating biases from data repositories to compete with large multinationals
- Adopting **intelligent supply chain solutions** — investing in rapid response to market changes
- Building qualified teams with professionals in data, security, and AI — high cost, outsourcing risks
- Promoting synergy between human skills and cognitive technologies (generative AI, machine learning)
- Anticipating and responding to market disruptions by reconfiguring business models

The key to overcoming these challenges lies in knowledge: managers and employees need to understand the basic concepts of AI, its benefits, and its risks. MSMEs' agility is one of their greatest assets.

EESC · OVERVIEW OF AI IN MSMEs

The Rise of the Cognitive Economy

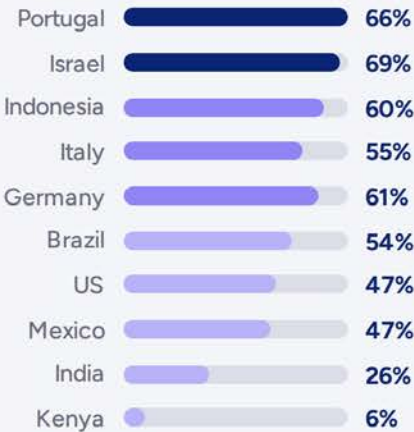
The information era, driven by the abundance of data and the advancement of AI, is giving rise to the **cognitive economy** — characterized by greater efficiency, improved decision-making capacity, personalization of products and services, new business models, and a profound transformation of the labor market.

The transition demands deep technical knowledge beyond IT infrastructure, so companies can **transform their processes, products, services, and customer relationships**. Public policies must invest in training, infrastructure, and a regulatory environment that promotes innovation and digital inclusion.

McKinsey Global Institute: MSME Productivity

Analysis of MSMEs in 16 countries representing more than 50% of global GDP · Source: McKinsey Global Institute

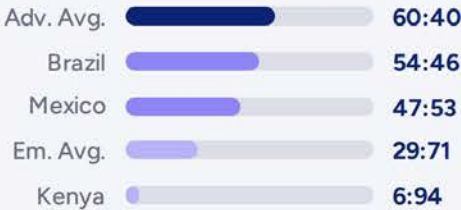
MSME SHARE OF VALUE ADDED, % BY COUNTRY



ABOUT 1 IN 5 LARGE COMPANIES

Were MSMEs at some point since 2000. **Australia (44%)** and **Israel (42%)** show highest scale-up rates. Brazil and Germany: 10–11%.

MSME PRODUCTIVITY GAP VS. LARGE COS.



Productivity ratio : Gap — larger ratio = smaller gap

Reducing the MSME productivity gap could generate significant value. The gap is larger in **emerging economies** than in advanced economies. **Microenterprises** show a particularly lower productivity ratio compared to large companies.

Data as a Competitive Differentiator

Data is the new oil. Like oil, data is valuable, but if not refined, it cannot be efficiently used. Data is the key to gaining important discoveries, staying ahead of trends, and obtaining a competitive advantage in today's uncertain, volatile, and dynamic global business environment.

WORLD ECONOMIC FORUM · CENTER FOR THE FOURTH INDUSTRIAL REVOLUTION (C4IR)

Key Challenges (WEF C4IR Survey — 111 SMEs, 42 countries)

- **64%** struggle to effectively use data from their systems
- **74%** have difficulty maximizing data investment value
- **55%** have difficulty finding data within their systems
- **54%** have difficulty maintaining data integrity
- Only **36%** operate in more than one regulatory jurisdiction
- Only **25%** familiar with sustainability reporting systems

Key Opportunities

- **Innovation intermediaries:** SMEs' agility positions them well in supply chain ecosystems
- **Improve data systems:** Prioritize data availability and aggregate relevant sources
- **Data governance:** Clear policies for security, privacy, and regulatory compliance
- **Data skills & culture:** Cultivate data-driven decision-making across the organization
- **Partnerships:** Collaborate with public/private sector, universities, and NGOs

THE BOTTOM LINE FOR SEBRAE

By embracing data culture and collaborating with key stakeholders, SMEs can **revolutionize their decision-making**, anticipate market trends, optimize operations, explore new growth opportunities — and drive innovation in a digitalized global landscape.

DRIVING GROWTH IN THE NEW DECADE

Digital *gap* or digital divide?

In the last decade, the digital economy accounted for **55.7% of GDP** in developed countries and **29.8%** in developing ones. China's digital economy contribution grew from 21.6% to **41.5% between 2012 and 2022**. SMEs lag — but the opportunity is enormous.

EU Digital Intensity

OECD

Cloud Computing

AI in MSMEs

DII Index

90%

EU 2030 target for SMEs at
basic digital intensity

69%

EU SMEs at basic digital intensity
in 2022

98%

Large enterprises at basic digital
intensity

OECD Digitalization Highlights

- Digitalization has continued at an **accelerated pace** — all sectors equipping employees with computers and internet, though smaller companies do so more slowly
- **Complementarities exist** in digital diffusion: adoption of technology A accompanies adoption of technology B, with greater elasticity as companies grow
- SMEs tend to digitalize **general administration and marketing operations first**; the gap vs. large companies is smaller in e-invoicing, social media, and online sales
- The SME **adoption gap increases** when technologies become more sophisticated
- **Microenterprises go unnoticed** — ~90% of the business population in OECD countries are not covered by international digital adoption statistics

EU Digital Intensity Index (DII) — 2022 Results

The DII measures adoption of 12 digital technologies. Score 0–3 = very low; 4–6 = low (basic threshold); 7–9 = high; 10–12 = very high.

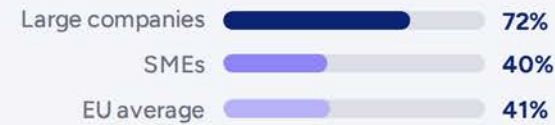
EU DIGITAL INTENSITY LEVEL BY COMPANY SIZE (2022)



Denmark and Finland: 89–90% of SMEs at basic digital intensity · Greece and Bulgaria: 41–47% · Source: OECD

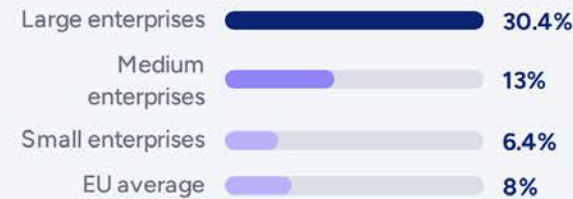
Cloud Computing & AI in EU Enterprises

CLOUD ADOPTION (2021)



Top cloud users: Finland & Sweden (75%), Netherlands & Denmark (65%). Most common use: email hosting (79%), file storage (66%), office software (61%)

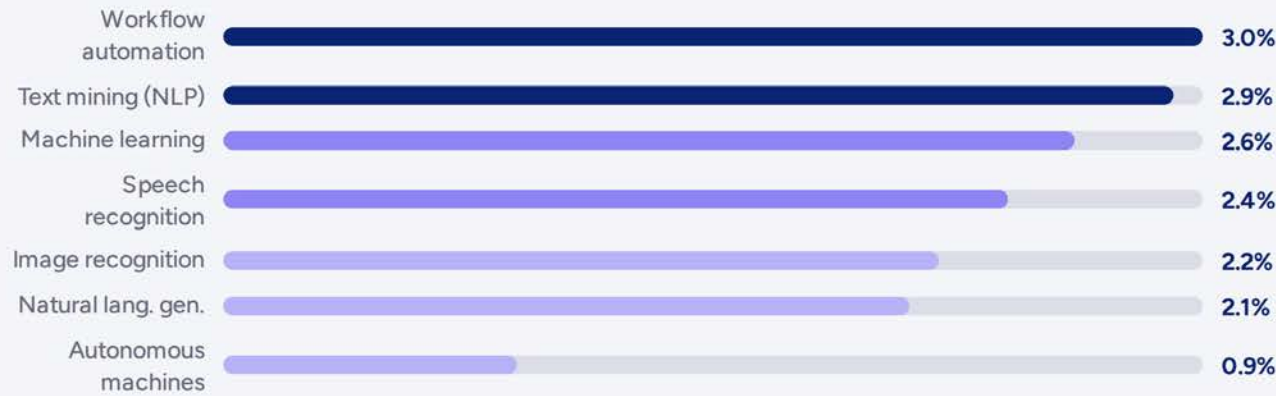
AI TECHNOLOGY USE BY SIZE (EU 2023)



Top countries: Denmark (15.2%), Finland (15.1%), Luxembourg (14.4%). Lowest: Romania (1.5%), Bulgaria (3.6%)

AI Technology Types Used by EU Companies (2023)

% OF ALL EU ENTERPRISES USING EACH AI TECHNOLOGY



Source: Eurostat · Digitalization in Europe 2023 edition

AI Use by Purpose and Company Size (EU 2023)

% of enterprises using at least one AI technology · Source: Eurostat (isoc_eb_ai)

AI PURPOSE	ALL	SMALL	MEDIUM	LARGE
ICT Security	26.2%	20.5%	~28%	47.9%
Accounting / Finance	25.8%	~20%	~26%	~38%
Business Administration / Management	~20%	~16%	~22%	~35%
Marketing or Sales	~16%	~13%	~18%	~28%
R&D or Innovation	~14%	~12%	~16%	~25%
Production Processes	~24%	22.3%	~28%	39.4%
Logistics	9.6%	7.5%	~10%	20.6%

For large companies — most used: Workflow automation (16.4%), ML for data analysis (14.6%). Least used: Autonomous machines (7%).

The EESC warns: growing algorithmic complexity raises serious questions about data quality, protection, and security — as well as ethical concerns such as discrimination and deepening inequalities. MSMEs cannot avoid AI adoption, but must do so responsibly.

EESC OPINION ON ARTIFICIAL INTELLIGENCE IN MSMES · 2021

SECTORAL LEADERS

ICT sector: **29.4%** use AI · Professional, scientific & technical services: **18.5%** · All other economic activities: below **10%** · Source: Digitalization in Europe 2023

EESC CONCLUSIONS & RECOMMENDATIONS

Building AI *trust* for all

The EESC recognizes the **transformative potential of AI** for MSMEs while warning of challenges in reliability, inclusion, and sustainability. MSMEs are the backbone of the European economy — and equitable AI access is the central imperative for their digital future.

EESC

Regulatory Framework

Data Access

Education & Training

Governance

Building a climate of trust is essential to include MSMEs in the strategy of excellence pursued by the EU. Bridging the digital divide and integrating networks to reduce the gap between MSMEs and larger entities in terms of AI are of crucial importance.

EESC · PERCEPTIONS FOR THE GENERATION OF PUBLIC POLICY

MSME Challenges vs. AI Opportunities & Risks

Adapted from EESC Study "Boosting the Use of AI in European MSMEs" — Table 17

CHALLENGES FACED BY MSMEs	OPPORTUNITIES BROUGHT BY AI	CHALLENGES IMPOSED BY AI
Acceleration of innovation and digitalization — new business models	Leveraging AI for market expansion despite limited size	Additional pressure to keep pace with AI innovations
Increased demand for skills	Outsourcing tasks requiring high AI qualifications	Additional AI skills and awareness required
Limited access to financial markets	—	Additional investments required in AI solutions to stay competitive
Administrative burden	Automation of administrative tasks and large-volume information processing	Additional pressure to ensure compliance and deal with legal uncertainty on personal data
Intensification of competition through globalization	Leveraging AI for market expansion	Additional competition from non-traditional third parties
Organizational problems: lack of time, future-oriented management	AI-driven automation to optimize operations and improve time management	Additional management pressure to implement AI-driven processes and training
Lack of skills to anticipate and adapt to changing trends	—	Unfavorable position to adapt; risk of unequal competition with large tech companies
Limited capacity to shape external environment; losing bargaining power	AI-driven insights and forecasts to monitor market and identify opportunities	Unfavorable position to influence AI regulation; risk of one-size-fits-all approach

EESC Guiding Principles for AI in the EU

- Establish a **flexible regulatory framework** with specific measures for SMEs — starting from pilots
- Strengthen the legal framework and promote clarity to stimulate AI adoption and innovation investment
- **Simplify AI understanding** through policy harmonization and a dedicated MSME support platform
- Create **regulatory sandboxes** ("testing sites") — environments for new solution experimentation by SMEs
- Consolidate the digital single market; create flexible AI policies meeting each Member State's needs
- Guarantee access to **open data** respecting privacy and property rights
- Ensure a **transparent and interoperable** single market to reduce risks and facilitate AI adoption

Four Acceleration Actions (EESC Study)

EDUCATION & TRAINING

Specialized AI training programs for the workforce + continuing education across professional fields

FAVORABLE ENVIRONMENT

Innovation hubs, simplified bureaucracy, and AI-specific credit lines for MSMEs

CULTURE OF INNOVATION

Raise MSME awareness of AI benefits and risks — including cybersecurity and algorithmic bias

FOSTER COLLABORATION

Collaborative networks: MSMEs + universities + research centers + large companies

Despite the high costs, the use of AI is fundamental for MSME competitiveness. **Only adequate financing** will compensate for the disadvantage in size and maturity that hinders AI development in MSMEs — through both European and national funding mechanisms.

SEBRAE'S STRATEGIC AI ROLE

Sebrae as *catalyst* for change

Sebrae operates at the center of six strategic nodes — from anticipating technological uncertainties to updating its own internal platforms — positioning the institution as both a **knowledge observatory** and a **technology democratizer** for Brazilian MSMEs.

Anticipate Uncertainties

Public Policies

New Technologies

Free Solutions

Train SMEs

Internal Update

6

Strategic nodes in Sebrae's AI
role framework

9

AI microservices in the LIS
platform (2024)

5

Priority axes of PBIA aligned
with Sebrae

Sebrae's Six Strategic Roles in the AI Era

01 · ANTICIPATE UNCERTAINTIES

Act as a **proactive technology observatory** — identifying economic, social, technological, and regulatory trends that may impact small businesses. Disseminate accessible information and develop solutions to help entrepreneurs prepare for change.

02 · PARTICIPATE AND INFLUENCE PUBLIC POLICIES

Spokesperson for proposing, defending, and influencing the creation of public policies for responsible AI use. **Following and participating in PBIA development** through projects aligned with the Plan's 5 priority axes.

03 · FACILITATE ACCESS TO NEW TECHNOLOGIES

Catalyst for digital transformation — identifying relevant technologies, promoting awareness of benefits, training entrepreneurs, and developing or intermediating access to accessible technological solutions.

04 · DEVELOP NEW FREE OR LOW-COST SOLUTIONS

Create and adapt AI methodologies, tools, and services that are financially accessible — addressing specific challenges of small businesses such as financial management, marketing planning, and process optimization.

05 · TRAIN SMALL BUSINESSES

Identify specific needs and offer **continuous, focused training** to develop the skills of small businesses to navigate the new context of digital transformation and AI.

06 · UPDATE INTERNAL TECHNOLOGIES

Constantly invest in updating Sebrae's own tools and technological platforms — optimize internal processes and train the team for AI use, maintaining institutional relevance in the digital landscape.

PBIA-Aligned Initiatives — Sebrae 2025

Sebrae has been following and participating in the **Brazilian AI Plan (PBIA)** development through projects aligned with the Plan's 5 priority axes:

INITIATIVE	DESCRIPTION & STATUS
AI Course in Practice for Public Managers	Expected launch in July 2025, at the Transformar Juntos event.
Technical Cooperation with Microsoft	Microsoft-specific courses for small businesses and Sebrae employees. Expected launch August 2025.
Course with Google & Alura	Curriculum under development; recordings scheduled for June 2025. Launch date to be defined.
Órbita Digital Event	Training for small businesses (commerce & services). Lectures and workshops on understanding and applying AI.
Adaptive Learning with AI	Pilot of a new chatbot format integrated with WhatsApp for microlearning.
Sebrae AI Strategy	Strategy approved by the Technical Board of Sebrae Nacional in March 2025.
Future Vision Study	Development of this study jointly with the Center of Excellence in AI – CEIA team.
AI R&D Project	Scope under development. Stimulus for AI-focused startups and development of AI solutions for small businesses.

LIS – Learning Intelligence System · 9 AI Microservices

Speech to Text

Facial Recognition

Graphs

Recommendation System

Emotion Analysis

Sentiment Analysis

Smart Chatbot

Personalized Narrative

Content Security

Platform for generating agents launched September 2024. LIS 3D avatar v2 launched August 2024. **Empretec AI Interview System** — generative AI for interviews (H2 2024). **Business Ideas** — content update using generative AI.

FOUR INTERCONNECTED STRATEGIC PILLARS

Strategy for *an* AI era

The Sebrae System's AI strategy is structured around **four main and interconnected pillars** — Uncertainty Mitigation, Digital Inclusion, AI Solutions for Small Businesses, and Internal Solutions — enabling decision-making in a rapidly changing scenario.

Uncertainty Mitigation

Digital Inclusion

AI Solutions

Internal Modernization

4

Strategic pillars structuring the
Sebrae AI plan

3_x

Tactical pillars: Precision ·
Personalization · Prediction

∞

MSME beneficiaries across Brazil

The Four Strategic Pillars

PILLAR 01 · UNCERTAINTY MITIGATION

Sebrae acts as a **proactive technology observatory**. Supports universities for MSME-focused research, participates in PBIA development, and monitors AI trends to anticipate impacts on small businesses.

PILLAR 02 · DIGITAL INCLUSION

Ensuring full and equitable participation in AI. Developing **courses and workshops** (in-person and online), partnerships with universities, and adaptive learning pilots powered by AI via WhatsApp microlearning.

PILLAR 03 · AI SOLUTIONS FOR SMALL BUSINESSES

Developing **ready-to-use, low-cost AI tools** accessible without major investment. Specialized AI consulting and mentoring, plus continuous improvement of the LIS (Learning Intelligence System) platform as a free MSME assistant.

PILLAR 04 · INTERNAL SOLUTIONS

Developing **AI agents** to automate tasks, optimize service delivery, and generate reports. Continuous AI training for consultants, analysts, and managers via UC Sebrae. Improving the Governance Policy developed by the AI Integration Room.

This approach allows Sebrae to operate in the AI era with **well-defined objectives**, supporting small businesses at the dawn of a new technological era — practically, structurally, and with governance-driven accountability.

Guidance Table on Key AI Risks (Part 1)

Adapted from the AI risk mitigation list used by the United States government — aligned with the needs of the Sebrae System. These suggested actions can be transformed into projects and complementary demands to strengthen risk management.

SUGGESTED ACTION	TYPE OF RISK
Align the development and use of generative AI (GAI) with applicable laws and regulations, including data privacy, copyright, and intellectual property laws.	Data privacy; harmful bias; intellectual property
Establish transparency policies to document the origin and history of training data and GAI-generated data.	Data privacy; information integrity; intellectual property
Establish a testing plan and response policy to periodically evaluate whether the model may improperly use information or offensive cyber capabilities.	Information security
Define organizational responsibilities for periodic review of content provenance and monitoring of incidents in Generative and Non-Generative AI systems.	Information integrity
Maintain a document retention policy to preserve the history of tests, evaluations, validations, and verifications (TEVV).	Information integrity; intellectual property
Create protocols to ensure that generative and non-generative AI systems can be deactivated when necessary.	Information security; value chain integration
Define acceptable use policies for human-AI interfaces, modalities, and configurations — including criteria for query types that GAI applications should refuse.	Human-AI configuration
Establish terms of use and terms of service for generative AI (GAI) systems.	Intellectual property; dangerous content; obscene content
Establish and train interdisciplinary teams reflecting diverse demographic groups, specializations, educational backgrounds, and skill sets to inform risk management functions.	Human-AI configuration; harmful bias

Guidance Table on Key AI Risks (Part 2)

SUGGESTED ACTION	TYPE OF RISK
Establish tests and evaluations for data and content flows within the GAI system — including original data sources, data transformations, and decision-making criteria.	Intellectual property; data privacy
Implement and document fact-checking techniques to verify the accuracy and veracity of GAI-generated information, especially from multiple or unknown sources.	Information integrity
Integrate tools to analyze content provenance, detect data anomalies, verify authenticity of digital signatures, and identify disinformation patterns.	Information integrity
Apply and document ML explainability results: embedding analysis, counterfactual prompts, gradient-based attributions, model compression, and term occlusion.	Confabulation
Document GAI model details: intended use, assumptions and limitations, data provenance, quality, model architecture, optimization objectives, training algorithms, RLHF approaches, fine-tuning, ethical considerations, and legal requirements.	Information integrity; harmful bias
Identify the classes of individuals, groups, or ecosystems that may be impacted by GAI systems through direct engagement with potentially affected communities.	Environmental; harmful bias
Measure or estimate environmental impacts (energy and water consumption) for model training, fine-tuning, and deployment — assess trade-offs between inference and training resources.	Environmental
Collaborate with external researchers, industry experts, and community representatives to maintain awareness of emerging best practices for risk management.	Information integrity; harmful bias
Share transparency reports with internal and external stakeholders detailing measures taken to update GAI systems for improved transparency and accountability.	Information integrity; harmful bias

Source: Adapted from the U.S. Government AI Risk Mitigation Framework · Sebrae AI Future Vision Study 2026

PRECISION · PERSONALIZATION · PREDICTION

Three *pillars* of tactical execution

The tactical plan establishes **simplified and practical guidelines** for implementing AI solutions. The three pillars cover the main AI strands — avoiding overemphasis on any single area (such as Generative AI) to the detriment of equally important predictive and precision capabilities.

Data Quality

Recommendation Systems

Predictive Models

MLflow

LGPD

01 · PRECISION

Ensure all data used by AI systems is **reliable, consistent, and up-to-date**

02 · PERSONALIZATION

Deliver **tailored experiences** through recommendation systems and dynamic segmentation

03 · PREDICTION

Anticipate risks and opportunities through **robust predictive models** managed in MLflow with real-time monitoring

Source: JEAN, Aurélie; ESPOSITO, Mark. **Playing to Win at the High-Stakes AI Table**. [2024].

Tactical Framework

Precision — Ensuring Data Reliability

Component	Description & Tactical Action	Key Metric
Quality Framework	Data validation, cleaning, and enrichment for AI projects. Define business rules that invalidate incorrect records.	Inconsistencies/month
Data Catalog	Centralized inventory with standardized metadata, lineage, and business terms. Approval workflows for new datasets.	% documented datasets
LGPD Compliance	Privacy control per Brazil's General Data Protection Law. Data usage protocol for AI system training.	% projects compliant

Personalization — Tailored Experiences

Component	Description & Tactical Action	Key Metric
Recommendation System	Collaborative and content-based filters for offers, articles, and products. Improve the existing LIS architecture system.	CTR (Click-Through Rate)
Dynamic Segmentation	Group users by behavior and adapt journeys. Establish and update segments periodically.	Active segments
Feedback Loop	Collect implicit (clicks, usage time) and explicit (evaluations) feedback to refine models via tag manager.	Model accuracy

Prediction — Anticipating Risks

Component	Description & Tactical Action	Key Metric
Ingestion Protocol	Define how data from the Precision pillar reaches the modeling environment. Agree on data latency SLAs.	Avg. data availability time
Model Lifecycle	Rules for development, testing, deployment, and performance monitoring. Use MLflow for experiment management.	Defined per experiment
Validation & Monitoring	Verify biases, performance, and stability in real time and post-deployment. Alerts for accuracy drops.	Alerts triggered
Model Governance	Version control, access, and documentation in Bitbucket. Maintain hypothesis, metrics, and usage docs per version.	% auditable models

TRACEABLE · STANDARDIZED · ETHICAL

Governing AI at *every* layer

The operational plan structures the deliverables approved by the tactical plan, ensuring that **everything produced for AI at Sebrae** is traceable, standardized, and ethically aligned — from data provenance and algorithm selection to model governance and deployment monitoring.

Generative AI

Non-Generative AI

Data Governance

LGPD

Model Lifecycle

Ethical AI

CORE OPERATIONAL MANDATE

Training and acquisition of third-party models must follow standards of **quality, transparency, security, and ethical alignment** — per the Governance Policy and Sebrae System's data policy. The following must be considered beyond what the Strategic Management Unit already determines.

Algorithm Selection & Model Categories

Data & Infrastructure Requirements

- Implementation of **bias-avoidance techniques** during algorithm training
- **Data auditing** to identify patterns that may bias decisions
- Implementation of **data processing traceability** throughout the pipeline
- **Training data traceability and monitoring** in third-party environments

GENERATIVE AI

Generates text, images, audio, and video probabilistically via **LLM APIs** and NLP packages.

REQUIRED DELIVERABLES

- Data provenance & quality
- Model architecture documentation
- Optimization objectives
- RLHF & fine-tuning approaches
- Training and test data
- Performance report & documentation
- Source code & configuration files
- Trained model file(s)

NON-GENERATIVE AI

Primarily generates **predictive and classificatory analyses** — algorithm selected per training context.

REQUIRED DELIVERABLES

- Interpretability tools
- Configuration files & documentation
- Performance report
- Source code of training scripts
- Training and test data
- ML pipeline (when applicable)
- Trained model file(s)

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*Brazilian Micro and Small
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