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# Unveiling the Generative AI boom: what hype metrics reveal for digital business and E-commerce

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## Abstract

The rapid emergence of Generative AI (GAI) in recent years, coupled with its potential to revolutionize a vast array of industries, functions, and tasks, has led to an increasing number of companies—including digital businesses and e-commerce firms—to evaluate its immediate application at both operational and strategic levels. One of the existing tools to support such business decisions is the Gartner Hype Cycle (GHC), where AI in general, and GAI in particular, have been positioned for years. Notably, in Gartner's latest report, GenAI occupies a concerning position, as it appears to be entering a phase where declining investment and interest are driven by its inability to meet initial expectations. This paper aims to assess whether the scenario outlined in the report can be objectively confirmed through public and replicable indicators that any researcher can utilize to address this question. Additionally, we explore the possibility that certain technologies—such as GAI, that due to its training and improvement requirements have been introduced in the market as a free tool and targeting individual users rather than solely corporate clients —may bypass some phases of the Gartner curve. Our main contribution is the proposal and testing of indicators that can be used for this purpose, yielding key insights from an exploratory rather than confirmatory perspective, with implications for companies' adoption of GAI and particularly for digital and e-commerce businesses. Finally, we highlight the main limitations identified and outline future research avenues to address them.

**Keywords** Generative AI · Large language models (LLMs) · Gartner Hype Cycle · AI adoption · Digital commerce

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## 1 Introduction – Generative AI and the hype cycle model

Artificial intelligence (AI) has emerged as a transformative force across various industries, including retail and e-commerce. AI technologies, such as machine learning (ML), computer vision, speech recognition, recommendation engines, and chatbots, have the potential to significantly enhance the capabilities of Electronic Data Interchange (EDI), a fundamental requirement for the development of e-commerce.

These AI-powered tools enhance customer segmentation, optimize marketing, personalize recommendations, improve customer support, and automate key EDI processes like data entry, order processing, and invoicing. This aligns with the broader strategic shift observed in recent research, where online reputation management (ORM) and customer trust are increasingly embedded in holistic e-commerce strategies [1]. As such, these advancements demonstrate the strong potential of AI to revolutionize EDI and drive significant improvements in business operations and customer experience within the retail and e-commerce sectors [2].

Artificial intelligence (AI) has rapidly evolved from a standalone tool to a versatile component within the broader technological landscape. Its integration with emerging technologies such as virtual and augmented reality, the metaverse, and voice assistants is revolutionizing e-commerce. Song et al. [3] highlight the synergistic effects of combining AI with visual communication design in retail. This integration enhances customer experience, leading to increased website traffic and revenue streams.

Rawool et al. [4] explored the impact of AI-powered voice assistants on the e-commerce landscape. These voice assistants provide personalized shopping experiences by offering tailored product recommendations, answering customer queries, and assisting with purchases. Moreover, they enable retailers to gather valuable data on customer preferences and purchase behavior, facilitating predictive analytics and enabling businesses to anticipate future spending trends.

Generative Artificial intelligence (GAI), as the latest trend of emerging technologies focused on creating unseen content that could be cataloged as human-like material derived from existing data sources such as text, images, or video, and leveraged on highly specialized ML algorithms [5]. GAI models learn the patterns and structure of input training data and generate new information preserving similar characteristics in a rapid manner with low upfront investments.

Promising developments in the field occurred between 1950 and 2009. However, it was between 2010 and 2020 that disruptive software advances, such as deep learning (DL) and specialized hardware like graphic processing units (GPUs) and Google's tensor processing units (TPUs), accelerated the development of efficient GAI systems capable of learning and replicating diverse content.

These advancements stem from widely used systems like ChatGPT, Gemini, BingChat, DALL-E, Stable Diffusion, and Midjourney, which gained popularity due to their accessibility. As a result, expectations for their adoption and application in both individual and organizational settings have risen exponentially [6].

GAI has revolutionized e-commerce, surpassing the capabilities of previous AI developments. Kshetri [7] emphasizes these transformative capacities, highlighting how GAI provides personalized assistance to customers while helping retail-

ers optimize operations and enhance customer engagement with near-human-like capabilities.

For customers, GAI acts as a sophisticated assistant, navigating the complexities of vendor selection, product characteristics, and product fit. By providing concise summaries and personalized recommendations, GAI empowers informed decision-making [8]. For retailers, GAI significantly enhances productivity across various departments. In areas such as coding, customer service, editing, and copywriting, GAI automates tasks, reducing costs and improving efficiency. Moreover, GAI facilitates innovative customer interactions through personalized experiences, significantly influencing purchasing decisions [9].

However, Despite AI and GAI's potential impact on e-commerce, there is a notable scarcity of academic research devoted to studying their dissemination and adoption. Dedehayir & Steinert [10] recognize the significance of new technology diffusion for organizations, acknowledging the challenges of accurately forecasting its trajectory from launch to fully adoption. Factors such as organizational barriers, technical limitations, and economic constraints may act as hindering factors to impede its adoption cycle.

However, due to some limitations, traditional theoretical models have not been able to fully capture the nuances of emerging technological diffusion and adoption. As a result, the Hype Cycle methodology, introduced in 1995 by IT consultancy firm Gartner Inc., has rapidly gained prominence, becoming a widely utilized tool to assist organizations in navigating these complexities.

This framework, defined as a "qualitative analytical tool" [11] has been successfully applied to identify potential emerging technologies based on their features [12], and even as an input for enhancing managerial decision-making on ICT investments. Kaivo-Oja et al. [13] demonstrated how the Hype Cycle can be integrated with customized index measurements, assessing factors such as average ranking, technological power, and comparability to other technologies, to guide investment strategies at an organizational level.

The model depicts a bell-shaped dissemination process combined with an S-shaped maturity curve for emerging technologies, defining an initial phase of excitement and inflated expectations due to limited understanding of its capabilities, followed by disillusionment, as functional limitations become apparent. Eventually, technologies mature, finding their niche and leading to informed adoption. Gartner defines five stages that emerging ICTs experience through its lifecycle (see Fig. 1):

1. **Innovation trigger**: Technologies emerge and create excitement, though practical applications are still rare.
2. **Peak of inflated expectations**: Early successes in development fuels inflated expectations, as few enterprises adopt them, leading to mixed business results.
3. **Trough of disillusionment**: Technologies fail to meet expectations, and investment stagnates as general interest reduces.
4. **Slope of enlightenment**: Technologies mature, as their capabilities are better understood by potential users.
5. **Plateau of productivity**: Technologies are widely adopted, becoming mainstream, as functional applications are available.

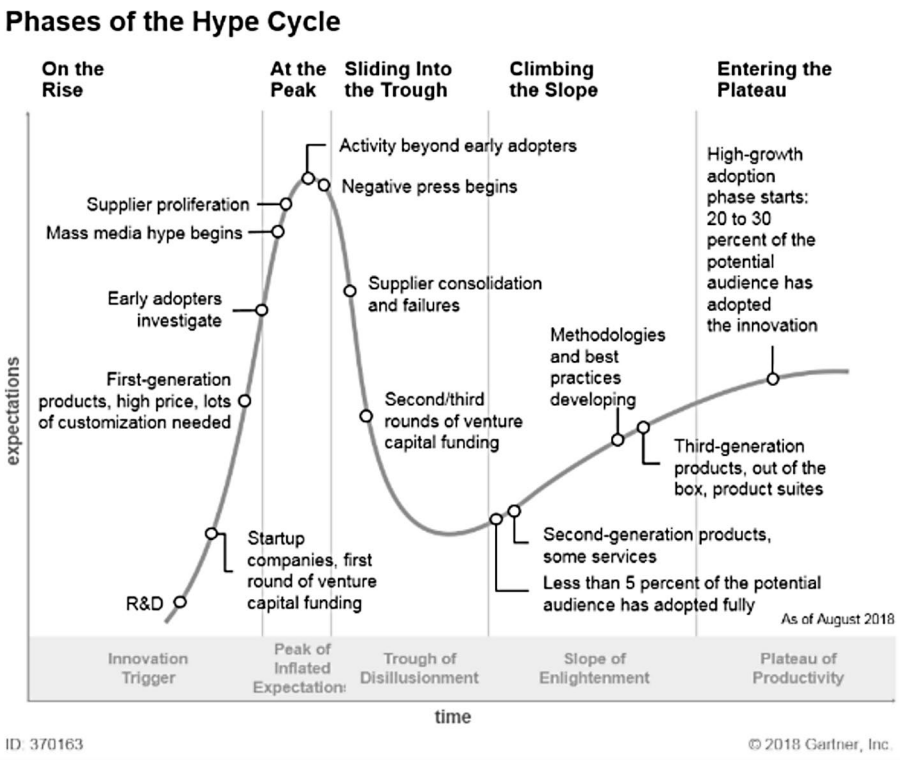


**Fig. 1** Phases of Gartner's Hype Cycle for emerging technology adoption [11]. Source: Gartner Inc

And while the Hype Cycle has become a popular tool for explaining the evolution of investment in various new technologies, facilitating the prioritization of ICT investments, its applicability and validity have been questioned by some researchers. Dedehayir & Steinert [10], Steinert et al. [14] and O'Leary [15] have all raised concerns about empirical inconsistencies and methodological flaws, particularly related to limited quantitative and mathematical formulations. These critiques highlight discrepancies between projected and observed trajectories of various assessed technologies, motivating the development of this article within the context of GAI.

### 1.1 Current assessment of GAI in Gartner's reports

Gartner, along with other major IT firms, has highlighted the significance of recent advancements in GAI, particularly in areas such as text-to-image generation and code completion. Gartner's reports from 2020 to 2023 have positioned GAI as an upcoming trend, entering and advancing through the *Innovation Trigger* phase, initially estimating that it could reach a potential plateau within the next 1 to 3 years. However, their 2024 report shows a shift, with GAI rapidly reaching and exiting the *peak of inflated expectations* into the *trough of disillusionment*. This evolution can be evidenced in Fig. 2.

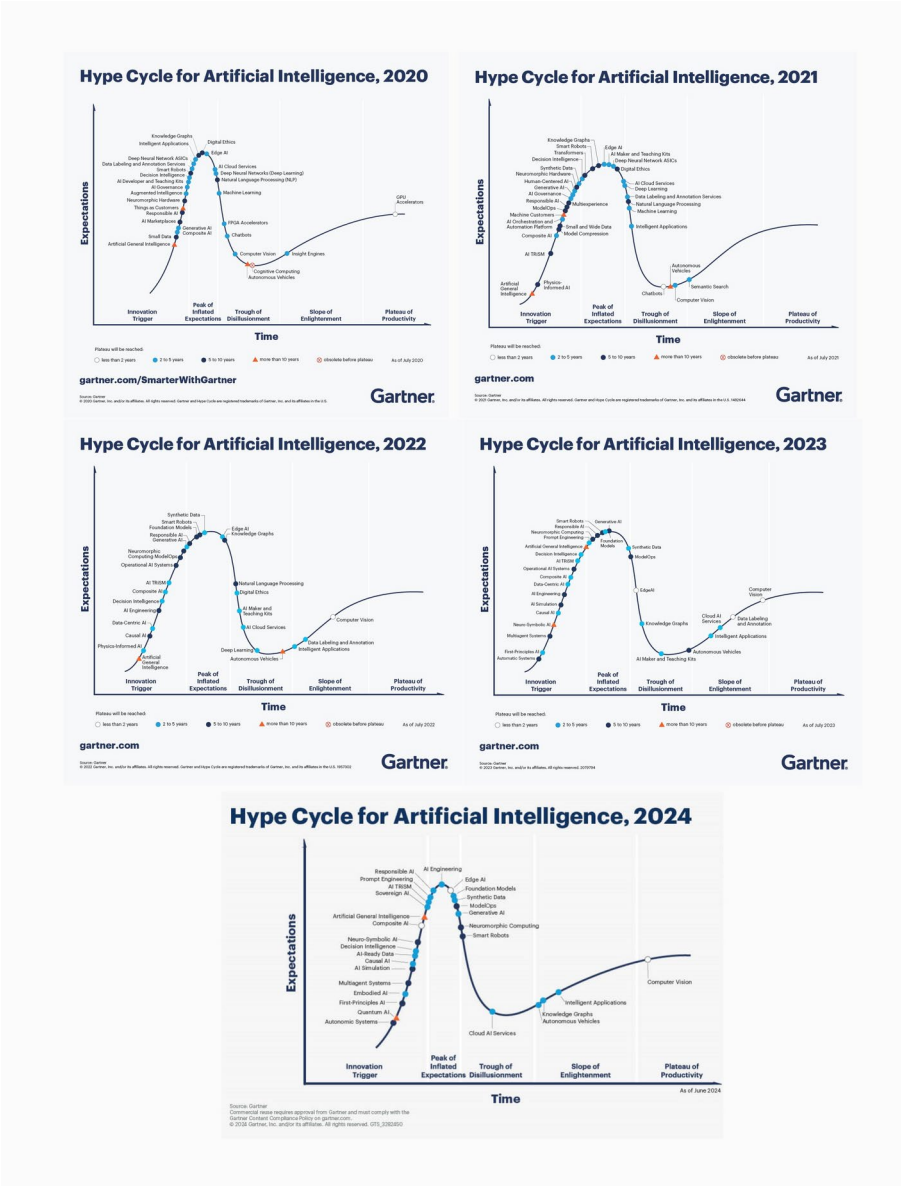


**Fig. 2** Evolution of GAI and Smart Robots positioning in Gartner's Hype Cycle (2020–2024) [17]

Despite significant periodic advancements in the last 2 years by companies such as OpenAI, Google, and Microsoft, its maturity timeline was revised to a 2–5-year period in the last report. This change stems from confusion about GAI's true capabilities and unsupported claims of human-level intelligence made by some IT vendors for marketing purposes [16].

This behavior contrasts with the dynamics observed for other AI technologies depicted by Gartner in this framework over the same period. For example, *Responsible AI* positioned further along the curve in 2020, has yet to reach the *Trough of Disillusionment* phase by 2024. Similarly, *Smart Robots*, initially positioned further along the curve than GAI in 2020, was surpassed by GAI in the 2023 report. However, on the 2024 report, *Smart Robots* has progressed further along the curve, now residing deeper within the *Trough of Disillusionment.*

As a result of this evolution seen on the Hype Cycle methodology for GAI and other AI-adjacent technologies, this article seeks to offer an alternative methodology to contrast if the conclusions presented by Gartner for GAI to be entering a *thorough of disillusionment* after a phase of potential overhype are valid, based on publicly and open data sources. This alternate framework could be used by management roles to prioritize potential investments seeking to maximize returns-on-investment on them, reducing unexpected technical and functional impacts.

## 2 Literature review and emerging research questions

To understand the dynamics of technological adoption, various theoretical frameworks have been developed over the last years, including the Diffusion of Innovations theory [18] which explores how innovations spread through a population, the Product Lifecycle model [19] which examines the stages of a product's development, the Industry Lifecycle framework by [20] which analyzes the evolution of industries in relation to technological advancements, the Technology Acceptance Model (TAM) [21] which analyzes how likely people are to use new technologies, based on the existing perceptions of a technology's usefulness and ease of use, or the Technology, organization and environment framework (TOE) [22] that defines the importance of a firm's context in the process of technological adoption.

While these frameworks offer valuable insights into the potential behaviors that can influence IT adoption decisions, they may not always accurately predict the trajectories of novel and emerging technologies [10], especially given the profound differences between software and hardware-based continuous innovation cycles, as the first characterize for their flexibility, rapid iteration, and broad deployment capabilities, which contrast with the more rigid and slower cycles typical of the second ones [23].

Consequently, the Hype Cycle methodology, developed by Gartner Inc., has gained prominence in the business and management fields as a valuable tool for strategic decision-making. However, a significant research gap exists regarding its application to forecast the expected behavior of disruptive AI technologies.

Despite a surge in AI research, with published articles tripling and pre-prints growing 26 times over the past decade [24], a comprehensive literature review revealed a limited number of academic studies explicitly examining the Hype Cycle methodology in the context of AI technologies.

We choose to perform a series of queries on the Web of Science (WoS) and Scopus repositories, recognizing that the first is known for its selectivity, while the second

one offers broader coverage, with a combination of both offering comprehensive journal coverage and robust citation tracking [25].

Defining the use of the keywords "hype cy*" and "Generative artificial intelligence" for articles published on English language between 2010 and 2024 on the business and management fields, this query yielded only 6 relevant results in both repositories. This finding highlights a notable gap in academic research considering the significant role the Hype Cycle plays in guiding AI-related investment decisions for organizations.

This gap could be explained by the perception of the Gartner Hype Cycle as a *black box* methodology. Scholars have highlighted that it lacks clear definitions for its axes, leading to notable limitations [26]. This can result in exaggerated expectations, as seen with technologies like Deep Learning (DL) that was rapidly placed in the *Peak-of-Inflated-Expectations* stage, indicating a surge in interest that may not always align with actual outcomes [27].

Despite its popularity and explanatory capabilities, the model has apparent constraints; these include inconsistencies in the data used and relevance across different technology domains [28], underscoring the need for further research to critically evaluate its applicability and limitations in the context of rapidly evolving AI technologies.

Steinert et al. [14] empirically demonstrated discrepancies between projected and observed trajectories for technologies such as tidal power, Integrated Gasification Combined Cycle (IGCC), and photovoltaic generation. Mullany [29] found that technologies such as podcasting and desktop search did not complete in fact the full Hype Cycle trajectories, while Woodie [30] identified similar issues for example with Big Data technologies, often due to discontinuation, replacement by other technologies, or significant implementation limitations.

Considering these limitations, we propose a research question to disentangle Gartner's Hype Cycle in relation to its classification on GAI technologies, evaluating its suitability for academic purposes.

- RQ1: Using GAI as a study case, can publicly available indicators such as media coverage, internet search trends, startup creation, and projected number of users can be used as openly alternative hype measurements compared to Gartner's methodology, and if so, does GAI depict signs of potential overhyping as concluded by the Hype Cycle methodology?

An in-depth analysis of the six resulting papers from WoS and Scopus revealed a diverse range of research topics. These included examinations of the potential overhyping of GAI in the mist of non-profit operations for automatization, the observed trajectory and general disillusionment that the metaverse has experienced and that could be extrapolated to GAI technologies, limitation of cognitive computing adoption as a predecessor for GAI technologies, exploration of media operation and AI technologies in the context of advanced GAI capabilities and overhyping, evaluation of overexcitement over developing GAI capabilities in accounting based on the behavior of previous disruptive ICTs, and evaluation of GAI usefulness in the context of entrepreneurial capacities formation.

And while all studies include mentions of growing concerns among practitioners and academics of potential signs of mediatic overhype for GAI technologies based on unsubstantiated claims for various IT vendors, lack of knowledge and skilled labor force to asses these claims, and an explosion of commercial GAI-based offerings, only two out of the six articles found in our review has direct mentions to Gartner's methodology, and none of them offer a critique or alternative methodology to assess its results. Summarization of these results can be seen in Table 1.

**Table 1** Main findings of articles related to GAI and the hype cycle methodology for selected fields (Business, management, economics or Accounting) found at web of science and Scopus repositories between 2010 and 2024.
Source: own elaboration.

| Author | Methodology | Conclusions |
|---|---|---|
| (Goldkking et al., 2024) | Summarization of main GAI (LLMs) features and assessment of these capabilities in the context of social and nonprofits organizations operation. Mapping of know GAI limitations and contrast with the proposed phases of Gartner's Hype cycle methodology. | GAI has the potential to enhance nonprofit operations through LLMs, to assist with communications, development, evaluation, analysis, and human resources. However potential concerns such as data privacy, algorithmic bias, and misinformation, that are usually overlooked by organizations due to *peaks of inflated expectations* according to Gartner's methodology, need to be assessed. |
| (Jacobides et al., 2023) | Analysis of industrial data using mixed methods, including real-time participation in key events, natural language processing, and interviews to gain a detailed understanding of the metaverse ecosystem | The metaverse was overhyped as the next internet revolution, but user excitement didn't match the initial predictions. The technology, particularly AR/VR devices, failed to deliver valuable customer experience. This behavior could be repeated for other disruptive ICTs, such as GAI. |
| (Veres, 2017) | Analysis of the limitations of current AI technologies, such as difficulties in resolving lexical ambiguity, and arguing for a symbiotic approach where humans and machines collaborate | A preconception that machines can perform tasks "just like humans" is counter-productive and lead to potential overhype if not true, setting up industry expectations that cannot be fulfilled and might stifle alternative approaches. |
| (Feher, 2022) | Topic modeling, data scanning, and a four-step research process: creating a trendline, identifying 75 trending topics using statistical programming, identifying collective terminology through text-based search and manual scans, and grouping topics into present and future dimensions. | There is a need for a nuanced understanding of AI's integration into media, suggesting that some expectations might be premature. Fundamental challenges like trust, ethics, and potential human-social consequences, which implies a caution against overly optimistic or simplistic views of AI's capabilities are identified. |
| (Eulerich et al., 2024) | Test of ChatGPT 3.5 and 4 using a random sample of 150 to 300 questions from certifications exam questions, and measurement of performance improvements through few-shot training and enabling reasoning and acting abilities (ReAct) in ChatGPT 4 | There is a nuanced view on the "overhyping" of ChatGPT. Although initial limitations of ChatGPT 3.5 are evident which might have fueled skepticism, the significant performance improvements observed with ChatGPT 4, especially when enhanced with ReAct, indicate that the technology's potential is substantial and not merely hype. |
| (Kostis et al., 2024) | Qualitative research approach, specifically participatory action research, and conducted 16 semi-structured interviews with entrepreneurs and business coaches | Generative AI's (GenAI) value does not appear solely based on its inherent characteristics, suggesting that this view might oversimplify its potential, implying that focusing too much on its theoretical capabilities might lead to overhyping. |

### 2.1 Disentangling the hype cycle: applications for GAI technologies

Given the limitations of Gartner's qualitative definitions, we aim to identify a set of open and replicable quantitative metrics that could be used by scholars and practitioners to assess GAI and other emerging technology potential hype cycle trajectories. These metrics could serve as early warnings for disillusionment in the months or years ahead and support the definition of corporate digital strategies.

Doing so, we follow the lines developed in previous studies by Järvenpää & Mäkinen [31] focused on DVD technology, Özmen [32] or Bosch-Sijtsema et al. [33] that suggested metrics such as expectations, lifecycle indicators, bibliometrics, and software could be used to measure proposed progression trough hype cycle stages. These could also provide valuable insights into technological evolution, dissemination and adoption.

To evaluate these GAI hype indicators, we propose a chronological analysis for each metric, spanning from months or years based on the nature of each data source. Also, to contrast them, we propose similar measures for a second AI adjacent technology (Smart Robots) currently assessed by the Hype Cycle methodology that has experienced a different observed trajectory.

We defined including smart robots as secondary AI technology for contrast as complementarities with GAI have been identified, recognizing that GAI adoption has been generally driven by its compatibility with existing workflows, social influence and support, performance and effort expectancy and organizational and environmental factors [34], while smart robots have faced different adoption challenges such as technological readiness, cost efficiency and organizational support [35].

The following sections delves into each one, explaining our data gathering and analysis methods.

### 2.2 Landscape of GAI and smart robot startup ecosystem

Measuring hype using upcoming ICT suppliers and their funding is challenging due to scarce and fragmented data on the startup ecosystem ecosystems [36]. However, some companies have aggregated data to provide insights on startup trends. Platforms such as Crunchbase.com, Dealroom.co and F-Prime have seen growth since 2017, being used by academics to analyze entrepreneurial ecosystems [37].

Considering this, we propose four potential hype proxies for GAI and Smart Robots derived from these sources, including:

- **US Venture Funding**: Percentage allocated to AI and Robotics startups and total funding in MUSD, from 2020 to 2024.
- **Global VC Investment**: Segmented by region for GAI and Robotics.
- **Median Round Size**: For GAI and rest of tech startups between 2016 and 2024.
- **AI Unicorns**: Number of new and existing unicorns (>$1 billion valuation) developing AI and robotics offerings between 2016 and 2024.

### 2.3 Website traffic (GAI) and market size (robotics)

Website traffic and engagement metrics, while not directly reflect paying users, can offer valuable insights for public interest and engagement on commercially emerging technologies such as GAI [38]. Website traffic is a key performance indicator for individual interest in organizations [39] and has been linked to measures of success for large language models (LLMs).

Among website analytics platforms, Similarweb.com is recognized for its robust data collection methods [40], providing comprehensive traffic estimates, making it a reliable source to gauge public interest for LLMs. Therefore, to proxy public interest and engagement, we employed this source to analyze monthly website traffic (mobile and desktop) for the three leading LLM applications: OpenAI's ChatGPT, Google's Gemini, and Microsoft's BingChat. This analysis covered the period from November 2022 to September 2024.

Given that website traffic measurement is not applicable for the smart robot sector, we propose alternative measurements to proxy for engagement as indicators of emerging technologies based on Jiang et al. [41]. Global figures of market size estimations for service robots between 2019 and 2030 and smart robots between 2023 and 2032 (expected) were both used as metrics to estimate its real-world adoption and deployment, providing a tangible measure of market penetration and technological advancement.

### 2.4 Google trends

Google Trends (GT) is the tool offered by the widely popular search engine Google to analyze search queries [42, 43]. GT provides a "*Search Volume Index"* (SVI) reflecting search frequency relative to other terms, offering insights into public interest without revealing absolute search volumes. Its free access makes it valuable for gauging trending topics.

GT's open-source nature has fostered academic research, particularly in fields like medicine, where *infodemiology* leverages GT data to study human behavior and disease outbreaks [44]. This approach has proven to be an asset in areas with challenges for direct data collection. And while concerns exist regarding data quality and potential biases in GT [45, 46], its ease of use and reach is acknowledged. As such, we emphasize careful analysis when interpreting GT data.

To assess public and media engagement, key indicators for overhyping according to Gartner, we employed GT to analyze:

- **Weekly Global Searches**: Public search volume data for the top three LLMs (ChatGPT, Gemini, BingChat) and for smart robots, comparing these search-volume trends to the observed behavior of their underlying technologies: AI for LLMs and Robotics for Smart Robots. This analysis was performed with the hope of identifying potential hype peaks.
- **News SVI**: Relative news coverage for the same LLMs and for Smart robots using the same methodology as with weekly global searches (comparison with the trends of underlying technologies).

The data gathered from this source, covering a period between January 2020 to November 2024, complements website traffic analysis for a comprehensive understanding of public interest in these technologies and potential signs of overhyping.

### 2.5 Global database of events, languages, and tones (GDELT)

GDELT Project's 2.0 event database is a prominent open-source resource capturing global news data in 100 languages [47]. GDELT 2.0 boasts unmatched comprehensiveness, encompassing both Western and non-Western sources since 2015. Its reliability, data range, and global coverage are appealing features, allowing for its use in timeseries aggregation for event-count analysis based on its near real-time, quarter-billion-event repository, facilitating social science research on a massive scale [48].

We harnessed GDELT 2.0's strengths to analyze media engagement and sentiment surrounding LLMs, based on two key metrics:

- **Volume Intensity**: Percentage of articles mentioning specific terms (ChatGPT, Gemini, BingChat) for GAI and Smart Robots relative to overall global news coverage monitored by GDELT (0-100%), contrasting the results with underlying base technologies (AI and robotics).
- **Tone**: Sentiment analysis of articles based on the same topics, with values above 5 and below −5 indicating positive and negative sentiment, respectively.

We analyzed daily average global search volume intensity and sentiment for the top three LLMs (ChatGPT, Gemini, BingChat) and for smart robots from January 2020 to November 2024. This approach provided valuable insights into media coverage and public perception of these AI technologies.

### 2.6 Data collection procedures

Free tiers of Dealroom.co, Crunchbase.com and F-prime provided historical venture capital (VC) data and reports on selected technologies. Due to download limitations, relevant figures were manually extracted. Additionally, Dealroom's free tier (statistics module) offered data and graphics on emerging unicorns.

Similarweb's free tier provided website traffic estimates (rankings, visits) for the three LLMs. To overcome the 3-month limit, data from Exploding Topics, Reuters, Statista, and Writerbuddy supplemented Similarweb's data for user trends over the entire period. For Smart Robots, publicly available figures from recognized market research firms (market US and Horizon) were used to assess market size data and projections as a proxy for engagement.

Google Trends offered free access to query its database, allowing us to compare LLM's and smart robots' technologies popularity (0-100 index) segmented by web and news searches for the proposed period. Obtained data was saved in comma separated values (CSV) format for analysis and visualization.

GDELT 2.0 data facilitated media analysis. Given its vast size, the "gdelt-doc-API V1.5.0" python library was used to query GDELT 2.0 using API calls for the selected period using query terms for selected LLM applications and smart robots. Obtained

data (CSV) was cleaned and integrated for numerical and graphical analysis. Table 2 summarizes the data sources and methods used:

## 3 Results

Crunchbase data (Fig. 3) reveals a surge in AI startup funding, with AI's share jumping from an 13% average in 2022 to 33% on September 2024, exceeding the 2020–2022 historical average of 14% despite a clear decline in overall US VC funding. This suggests investor prioritization of AI despite broader market contraction. In terms of robotics, Crunchbase shows that global funding for startups in this industry spiked during 2021, dramatically reducing in 2022, but stabilizing during 2023–2024, differing from the view of Gartner's hype cycle.

Dealroom.co data supports this trend. Global GAI VC funding skyrocketed from $495 US million in 2016 to US $40.5 billion on 2024 (projected), quadrupling in just one year (2022–2023). The US leads, attracting most funding (considering OpenAI), with Europe lagging behind. Notably, the median funding for GAI seed rounds almost doubled since 2020, reaching $4.7 million in 2024, compared to $2.5 million for non-AI rounds. This data depicts a growing investor focus and financial commitment to these technologies.

For robotics, a similar dynamic is depicted by data obtained from F-prime. Their analysis shows that VC investments in robotics have in fact rebounded in 2024, including significant growth in areas such as humanoid robots and autonomous vehicles, product lines included in the smart robot segment (Fig. 4).

Dealroom.co data (Fig. 5) also shows growth in actual and potential LLM-related unicorns (startups valued over $1 billion) in the US and Canada. These jumped from just 1 in 2016, to a peak of 90 created on 2021, slowing along declining overall VC funding (29 in 2022, 19 in 2023), with a new surge in 2024. This suggests a strong correlation between funding and unicorn creation and renew interest in the field.

For robotics, that from Dealroom.com aligns with the tendencies observed for AI. The number of robotics-based Unicorns (startups valued over $1 billion) peaked in 2021 (with 11 new Unicorns created). This number dipped in 2022 and 2023 but showed signs of recovery in 2024 (with 7 new Unicorns). Overall, cumulative figures show a positive trend for the number of robotic based Unicorns over the last 8 years, especially those located in the US and Asia (Fig. 6).

Similarweb reveals exponential growth in traffic for ChatGPT, particularly following its May 2024 4o release. However, the free tier limitation restricts access to historical data beyond three months. Therefore, using complementary data from exploidingtopics.com showed an impressive increase in traffic for the first months of 2024, reaching a milestone of more than 3 billion monthly visitors by September 2024, growing almost 15% in just one month.

And while seasonality was suspected as the possible cause for passing interest between May and September 2023 related to summer and winter breaks at universities in the US, China, and Europe [54], the results for 2024 are very different, partially explained by enhanced features and capabilities announced in the first semester of 2024 for all three selected LLMs.

**Table 2** Summary of selected data sets, sources and proxy measurements for Gartner's hype cycle methodology indicators, including data gathering methods used. Source: own elaboration.

| Data sets | Source | Proxy measurement | Data gathering method |
|---|---|---|---|
| Percentage of US venture funding for AI / Robotics startups and funding for AI startups (in MUSD) 2020- 2024<br>Global venture capital investment, segmented by region.<br>Median round size for GAI / Robotics startups 2020-2024<br>New potential and current AI related unicorns (startups valued above 1 billion USD) 2016–2024 | Dealroom.co<br>Crunshbase.com<br>F-prime | Number of potential GAI / Robotics suppliers.<br>Figures for venture capital investment interest and volume for GAI and Robotics companies. | Manual data gathering from free tiers and reports. |
| Monthly visitors (web and desktop) for main GAI (LLM) applications November/22 – September/24.<br>Market Size estimations for Service and Smart Robots 2023–2030 | Similarweb.com (primary)<br>Explodingtopics.com<br>Reuters.com<br>Statista.com<br>Writerbuddy.com (Secondary)<br>Market US & Horizon Research | Number of early adopters | Manual data gathering from free tier (last 3 months) complemented by secondary data sources |
| Weekly global searches and news SVI for main GAI (LLM) applications and Robotics January/20 - November/24. | Trends.google.com | Public interest<br>Media coverage volume | Data query and download (CSV) directly from source. |
| Daily GVI for GAI applications (LLM), January/20 – November/24.<br>Daily global tonality for GAI applications (LLM) applications January/20 – November/24. | Gdelt.org | Media coverage volume<br>Media coverage sentiment and tonality | Data query and download (CSV) with Python library and GDELT API. |

For direct ChatGPT competitors, Google's Gemini (launched on March 2023) and Microsoft's Bing with GAI features (introduced in May 2023), the results from Similarweb.com show rather stable trends, with Bing closing to a 2 billion monthly visitor figure and Gemini lagging. We consider that these behaviors might not strictly follow the boom-and-bust pattern traditionally associated with emerging technologies in Gartner's hype cycle (Fig. 7).

For smart robots, traditional website traffic analysis wasn't suitable for gauging customer engagement. Therefore, we utilized market size estimations as a proxy metric. Data from market.us projects a significant growth trajectory for the smart robot market, with a Compound Annual Growth Rate (CAGR) of close to 26.3% expected between 2023 and 2024, reaching a total market size of 128.1 billion USD by 2032. Furthermore, data from Horizon Grand View reinforces this trend, indicating a projected CAGR of nearly 12.6% for the global service robot market by 2030 (Fig. 8). These growth projections suggest a sustained rise in customer interest and market excitement surrounding robotics technologies.

Google Trends reveals contrasting patterns for news and web searches for AI and LLMs (Fig. 9). Public interest in ChatGPT displayed a peak in the last few months (August-December 2024) even surpassing interest in the general field of AI by the end of 2024, while Gemini had a moderate growth in the same period and Bing displayed a slight descendant trend.

General web searches for ChatGPT closely mirrored its user traffic surge, displaying a notorious surge from April 2024 to September 2024. Similarly, Bing and Gemini witnessed smaller web search increases between February and May 2024, aligning with their respective traffic patterns. Interestingly, all three platforms experienced a simultaneous dip in web search interest in the last months of 2023, followed by a joint peak between March and June of 2024. However, search interest for all platforms plummeted by June, showing a slight recovery by August of 2024.

All LLMs experienced limited mediatic coverage when compared to the general field of AI, reducing expectations of potential mediatic overhype, even displaying significant drops in news search interest (May to mid-august and December 2024) possibly related to the summer and winter periods at the northern hemisphere.

GT news data also shows a moderate growth in news search interest in the last months of 2024 that might be attributed to new feature announcements (multimodal capabilities for ChatGPT and similar additions for Gemini and Bing Chat). These contrasting trends highlight how public perception can differ across media channels, with news driving initial interest and web searches reflecting ongoing engagement.

For Robotics, GT data shows that the general field has had significant growth in both search and news coverage over the last 5 years, with peaks in mid-2024 on both measurements (web and new searches), while the specific field of AI (smart) robots displayed very low results for web searches and close to cero on news (Fig. 10). Once again, these results significantly differ from the analysis performed by Gartner on its hype cycle regarding potential overhype and disillusionment.

Global news coverage measured using the GDELT Project's 0-100% scale reveals ChatGPT as the dominant force among the analyzed LLMs. Following its launch, ChatGPT generated explosive media attention, peaking at nearly 6% of all global news in February 2023. This surge coincided with several key milestones, including

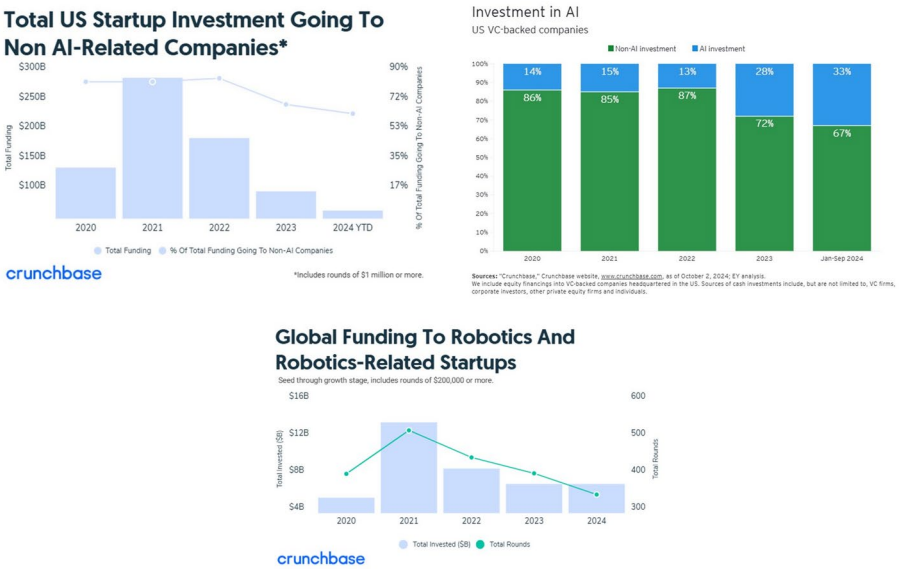


**Fig. 3** Total venture funding in US dollars for Global AI and Non-AI related startups (top right) [49], US AI related startups (top left) [50], and for Global Robotics startups (bottom) [51] between 2020–2024, Source: EY, Crunchbase.com

surpassing one billion visits and the launch of its paid tier [57]. While the initial wave subsided, news coverage surged again in November 2023 and May/June 2024, likely driven by the announcements and releases of new model versions such as GPT-4 and GPT-4o.

While ChatGPT led in media coverage, Gemini and Bing displayed similar trends. Both experienced surges at different points in 2024, likely influenced by the broader attention surrounding ChatGPT. However, their declines were more gradual. Gemini exhibited higher peaks in the first half of 2024, while Bing saw prominent surges during 2023 and August 2024. These patterns closely mirror the news search trends observed on Google Trends, suggesting a strong correlation between media coverage and public interest in these LLMs.

Gemini and Bing's coverage have also started to gradually reduce in the last half of 2024. While Gemini's intensity surged, likely due to Google's major Gemini model updates promising to surpass ChatGPT, Bing's coverage dipped after no major releases have been announced after 2023. This contrast highlights the dynamic media response to LLM advancements and their impact on public perception.

For all three assessed LLMs, global news coverage, measured by GDELT, was significantly lower than for the broader field of AI. AI exhibited consistent and substantial media attention over the last four years, with peak coverage reaching close to 20% and average coverage consistently hovering between 10% and 15%. This observation suggests that while LLMs like ChatGPT, Gemini, and Bing have garnered significant public and media attention, they may not fully represent the overall hype and excitement surrounding the broader field of AI (Fig. 11).

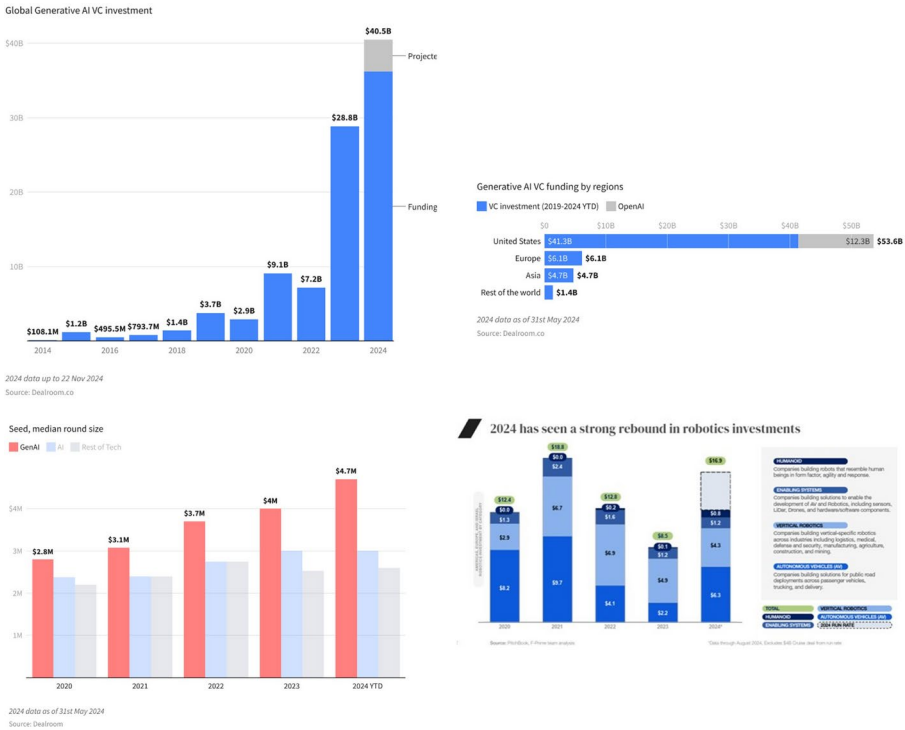


**Fig. 4** Global GAI Venture capital investments between 2014–2024 (Top right) and segmentation by regions between 2019–2024 (Top left), median seeding round size for GAI and all other startups venture investments between 2020–2024 (Lower right), and global VC investments in robotics per segment between 2020 and 2024 (Lower left), Sources: [52] and [53]

Interestingly, GDELT data revealed a surprising lack of strong positive or negative sentiment (above 5 or below −5) for the main LLM applications and for the AI field during the analyzed period. This neutrality contradicts Gartner's hype cycle predictions of a "trough of disillusionment", related to negative media coverage. Notably, Bing had brief negative dips in late November 2022 and February and March 2024, while Gemini experienced a moderate positive peak at the end of 2023 (Fig. 12). Further research is needed to understand these particularities.

GDELT data reveals a contrasting pattern for Robotics and AI robots. While the general field of Robotics has exhibited relatively stable media coverage over the past three years, with limited peaks in early 2023 and 2024 surpassing 15% of all global coverage at times, AI robots have garnered significantly less media attention, with select peaks reaching figures between 5% and 8% of global coverage. This observed pattern for AI robots deviates significantly from the broader media attention surrounding the general field of Robotics and challenges the expectation of a pronounced "hype cycle" for this specific subdomain.

In terms of tonality, Robotics media coverage has generally exhibited a neutral sentiment, while AI robots have shown a higher frequency of positive coverage peaks (above 5 on the proposed scale – Fig. 13) over the last three years. This finding con-

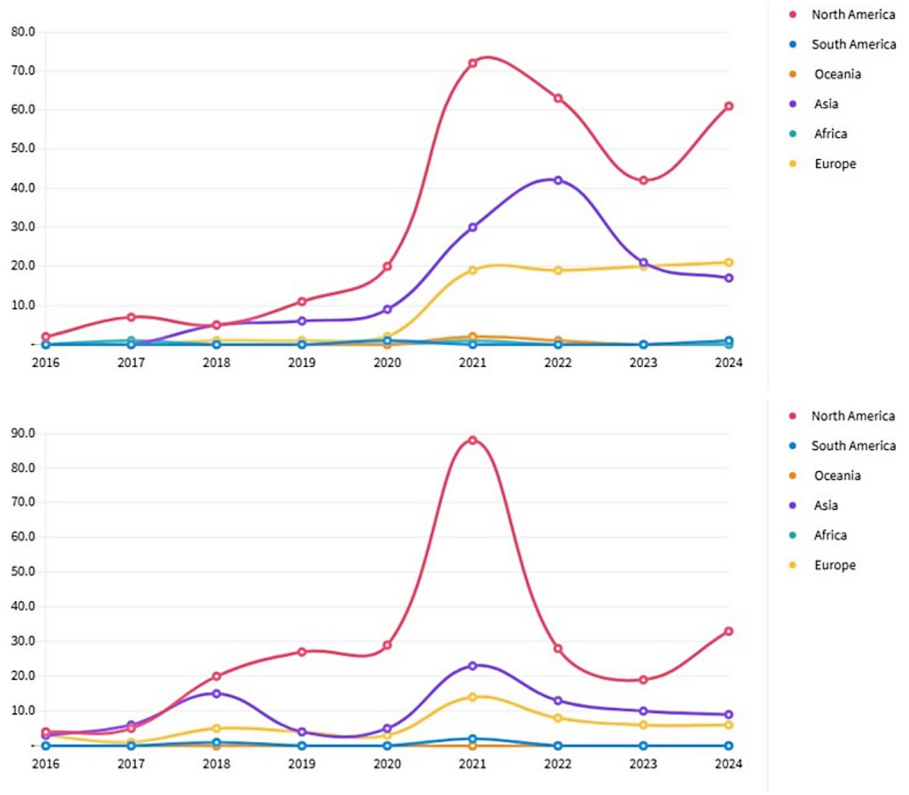


**Fig. 5** Number of potential (top) and actual (bottom) *Unicorn* startups producing AI, ML, DL or NLP offerings, segmented by Continent and year between 2016–2024 (September). Source: Own elaboration based on data and tools from Dealroom.co

tradicts the anticipated trajectory for AI robots as depicted in the latest Gartner Hype Cycles, which often predict an initial surge of excitement followed by a *trough of disillusionment*.

## 4 Conclusions and implications

GAI is rapidly changing the organizational and consumer landscapes, acting as a disruptive force. Large Language Models (LLMs) such as ChatGPT, Gemini, and Bing Chat, with their frequent updates and global reach, are attracting significant interest because of the extended capabilities they provide.

Backed by extensive media coverage and support from major IT companies, GAI tools promise to revolutionize productivity across various industries, including retail [58]. In the retail sector, GAI's impact is multifaceted, ranging from personalized recommendations and automated customer support to increased operational efficiency and cost reduction, that in turn can result in enhanced customer experience and engagement, prediction of future trends, positively impacting sales. These advances

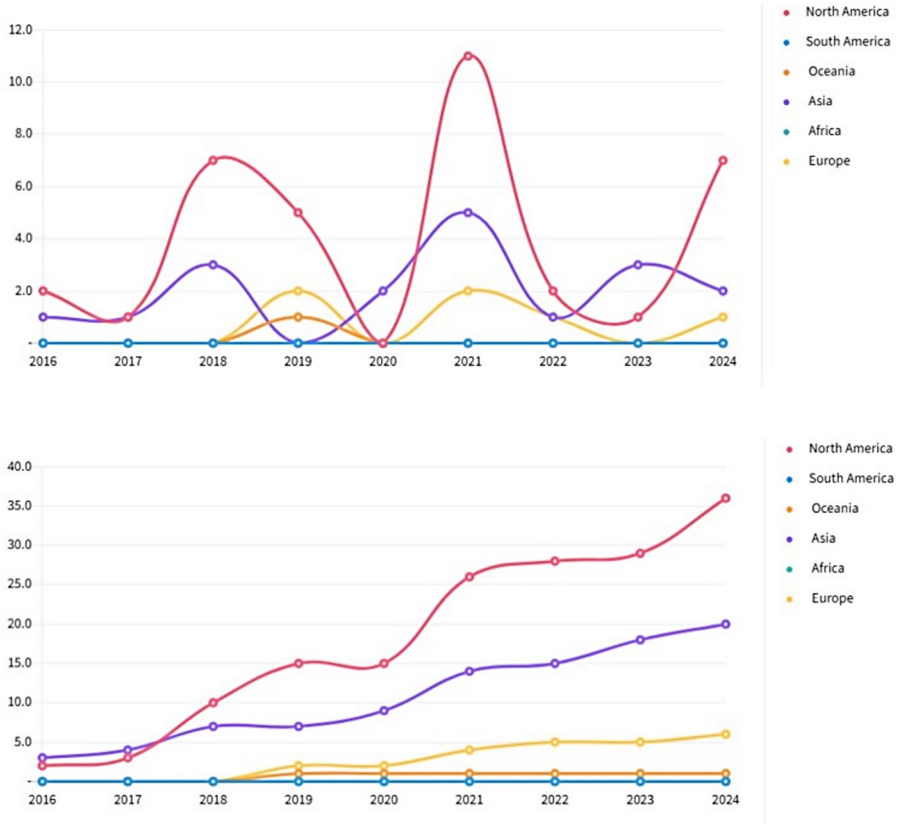


**Fig. 6** Number of new (top) and actual (bottom) *Unicorn* Robotics startups, segmented by Continent and year between 2016–2024 (September). Source: Own elaboration based on data and tools from Dealroom.co

complement recent efforts to reduce inefficiencies in e-commerce through innovative approaches such as return credits, which have proven effective in minimizing satisfaction-related returns and improving policy design [59].

While academics have attempted to assess the dynamics of AI adoption in e-commerce using frameworks like the Technology Acceptance Model (TAM), which emphasizes the positive influence of perceived usefulness and ease of use on technology adoption [60], there's a growing concern that traditional models may not adequately capture the unique characteristics and rapid evolution of emerging technologies such as GAI.

The emergence of frameworks like the Gartner Hype Cycle, while popular among practitioners, highlights the need for more dynamic and nuanced approaches to understanding the adoption trajectories of emerging technologies. These frameworks attempt to account for the rapid cycles of innovation, hype, and disillusionment that often characterize the evolution of new technologies.

Fueled by media attention, Gartner Inc. has explored whether GAI is experiencing a *Hype Cycle* – a period of inflated expectations followed by potential disappoint-

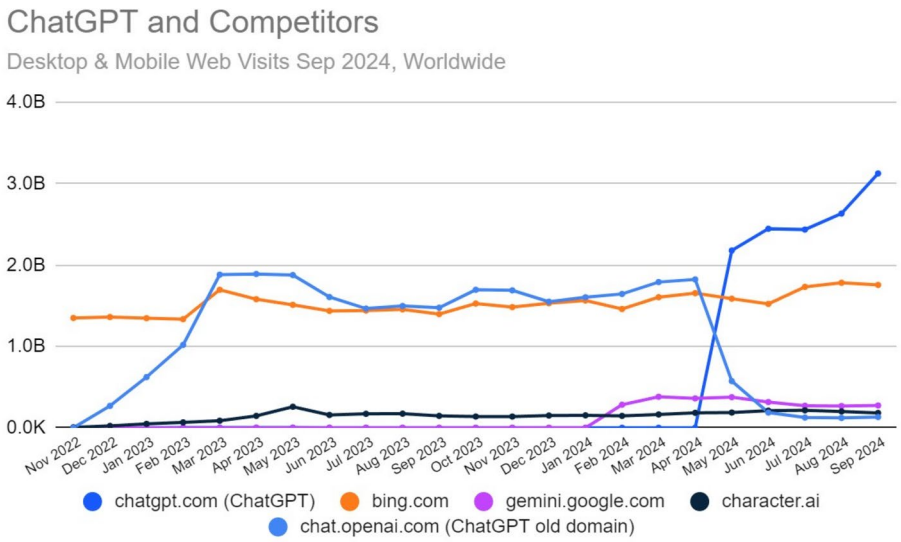


**Fig. 7** Monthly evolution for web traffic figures for top three LLM websites between November/2022 and September 2024.

ment. This framework, applied over the last 20 years with mixed success to other emerging tech trends, aims to predict its dissemination and adoption. However, its subjectivity and black-box methodology have raised concerns among academics, while being highly esteemed by practitioners.

To enhance the findings of our analysis, we contrasted the observed trends for GAI with those of another AI technology depicted in Gartner's Hype Cycle over the past five years, exhibiting a distinct trajectory (smart robots). Our findings suggest that GAI adoption may not follow the typical path predicted by the Gartner Hype Cycle, as observed in previous cases with emerging ICTs such as Big Data, podcasting, or desktop search platforms.

Venture capital data from Crunchbase, Dealroom.co and F-prime contradicts a potential *trough of disillusionment* for GAI. Despite a decline in non-GAI funding across 2023 and 2024, GAI funding has experienced explosive growth. This trend, further mirrored by a rise in GAI unicorns, underscores strong investor confidence in GAI technologies. This contrasts sharply with the observed trajectory of Smart Robots, currently positioned further along the Gartner Hype Cycle. While Smart Robots may have experienced a period of slower growth, they are currently showing signs of recovery with renewed VC investments and Unicorn creation in 2024.

Website traffic data provided valuable insights. SimilarWeb data revealed a surge in monthly visitors for leading LLMs (ChatGPT, Gemini, Bing Chat) from November 2022, followed by a dip in June 2023. This dip could be attributed to factors like seasonality or market saturation rather than solely user skepticism. In fact, a rise in the number of visitors observed from September 2024 suggests that this decline was only temporary, contradicting the notion of unmet expectations and a *trough of disillusionment* typically associated with this phase of the Gartner Hype Cycle.

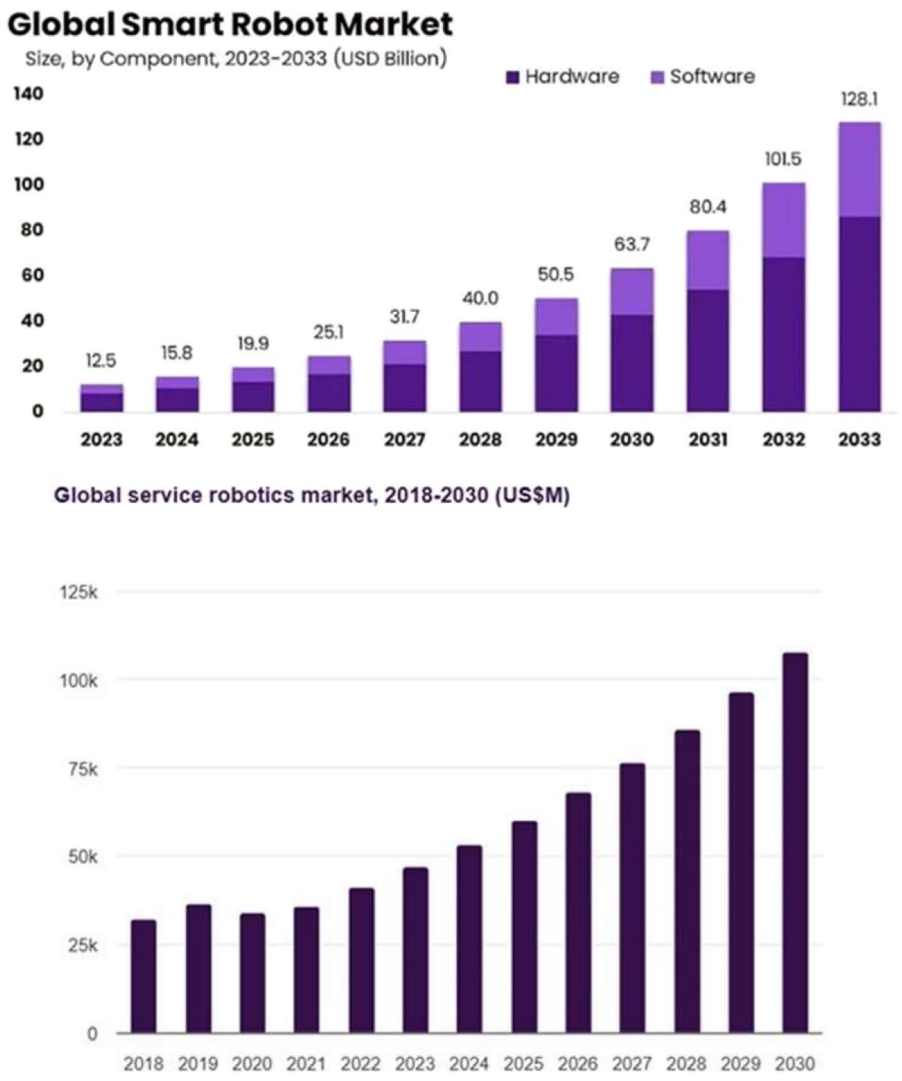


**Fig. 8** Yearly estimations for market sizes evolution of Smart robots between 2023 and 2030 (top) and Service robots between 2018 and 2030 (bottom). Sources: [55] and [56]

These incorrect conclusions from Gartner's Hype Cycle could be the result of an excessive focus on organizational technology adoption while also considering public interest through media coverage. This blend might explain inconsistencies in the observed results when applied the methodology to disruptive technologies like GAI, which appeal to both individuals and organizations.

Furthermore, analyzing an alternative proxy for Smart Robot engagement, such as market size estimations, reveals different observed and projected trajectories. Unlike the potential dip observed in LLM website traffic, which may reflect temporary fluctuations in public interest, market size estimations for smart robots consistently dem-

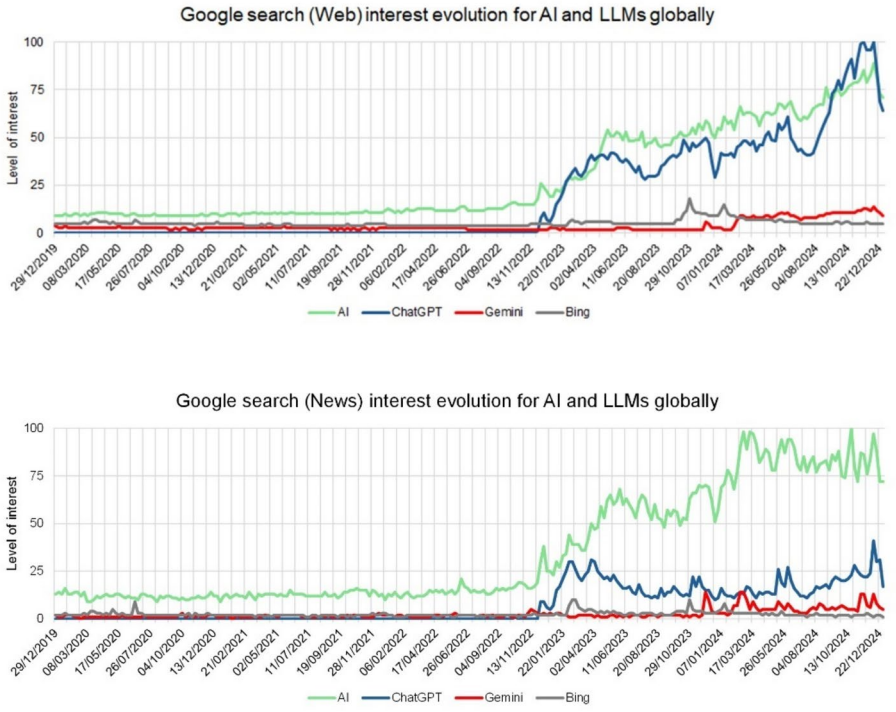


**Fig. 9** Weekly evolution for global Google interest index for web (top) and news (bottom) searches related to general AI and selected LLM platforms between January/2020 and December/2024. Source: Own elaboration based on data obtained from Google trends

onstrate sustained growth. This growth indicates continued interest and investment in this sector, suggesting a more robust and enduring market demand for smart robot technologies and contradicting the expected pattern of a *trough of disillusionment* as depicted in the 2024 Gartner Hype Cycle.

Data from Google Trends (search and news interest), GDELT (news coverage), and SimilarWeb (website traffic) reveal contrasting trends. ChatGPT initially enjoyed global dominance, with a significant dip in public interest across all platforms observed between May and October 2023.

This dip could be attributed to factors like seasonality or market saturation rather than solely user skepticism. However, a remarkable rebound occurred in September 2024, with interest surging across all metrics and even surpassing the initial peak witnessed in November 2022, following the release of significant updates and new features. Notably, interest and coverage across all three platforms for leading LLMs (ChatGPT, Gemini, Bing Chat) consistently were well beyond those observed for general AI technologies, suggesting that widespread media hype may not be the primary driver of current public interest.

These trends differ from the ones predicted by the Hype Cycle's trajectory for GAI. Rapid development cycles employed by major IT providers such as Microsoft and Google might be helping to manage expectations, similarly as with other ICTs such

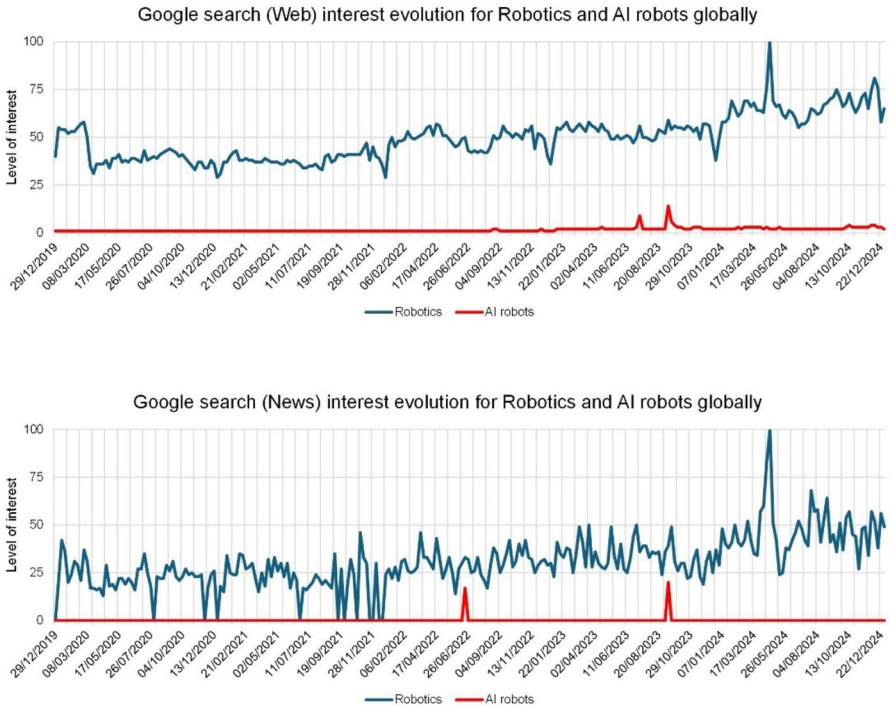


**Fig. 10** Weekly evolution for global Google interest index for web (top) and news (bottom) searches related to general Robotics and AI Robots between January/2020 and December/2024. Source: Own elaboration based on data obtained from Google trends

as 3D-printing [61]. Continuous improvement and user feedback integration could explain that in terms of search and news coverage the lack of a peak or a subsequent *trough of disillusionment*, because of continuing innovation and feature launches.

These results are aligned with the ones observed for Google trends and GDELT for Smart Robots, where obtained data denote that interest in the general field of Robotics is notably higher than that observed for this subsegment, and that in fact, no clear peaks or significant reductions can be completely mapped against changes in the proposed trajectory defined by Gartner.

In fact, our observations show that in recent months a decline in media coverage for GAI applications was seen, while venture capital investment remains steady. This suggests that a potential deviation from the Hype Cycle pattern could be happening. Therefore, the trough of disillusionment could be shorter than predicted by Gartner in their last publication, or GAI might be transitioning to a phase of steady improvement (Slope of Enlightenment) fueled by continuous updates.

While our findings present a contrasting perspective to Gartner's placement of GAI in the trough of disillusionment, it is crucial to acknowledge that the Hype Cycle still provides a valuable high-level overview for emerging technological advancement. In this context, our research seeks to offer a complementary, data-driven methodology that can refine its predictions rather than substitute it.

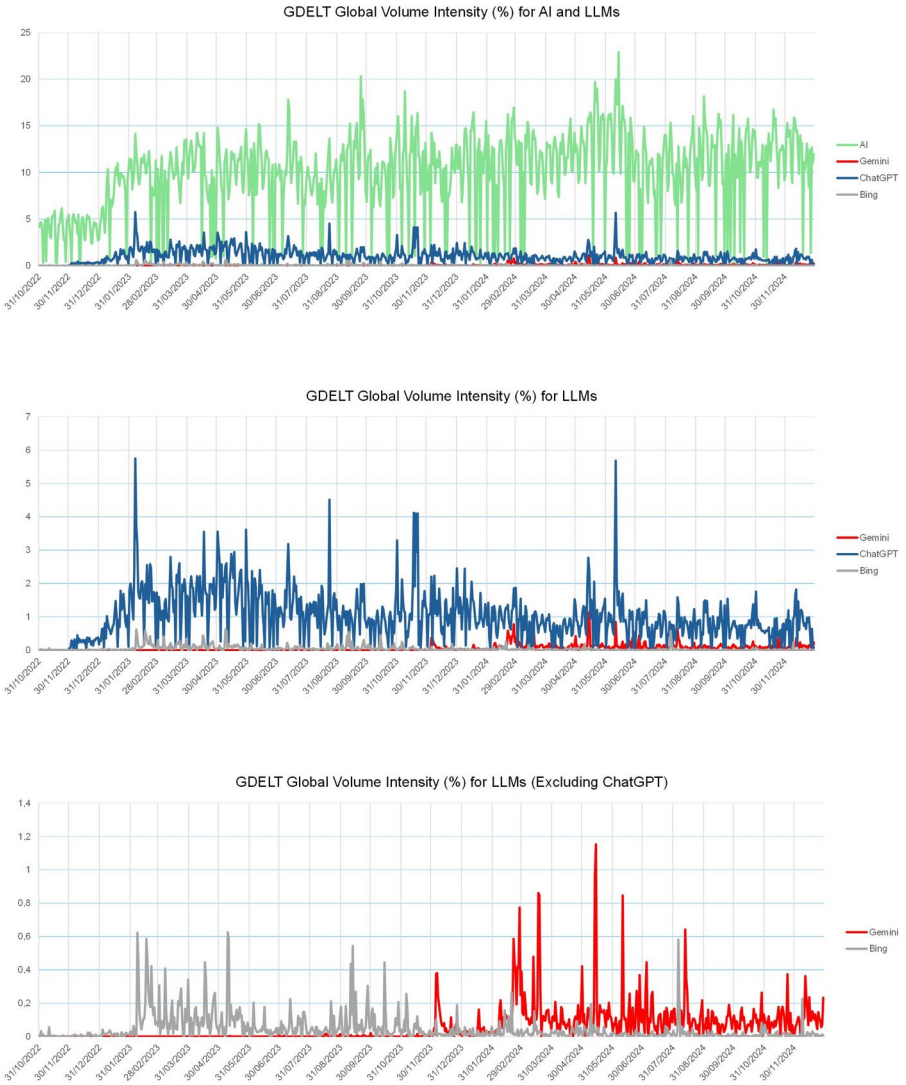


**Fig. 11** Daily evolution for GDELT global Volume intensity index for AI, ChatGPT, Gemini, and Bing (top), for ChatGPT, Gemini, and Bing (mid), and for Gemini and Bing only (bottom) between November/2022 and December/2024.

The granularity afforded by our multi-faceted approach, incorporating venture capital data, website traffic and Google Trends figures, and GDELT information, allows for a more nuanced understanding of technology adoption trajectories based on open and publicly available sources. This refined methodology is particularly relevant in the context of rapidly evolving technologies such as GAI, where traditional qualitative assessments may struggle to capture the dynamic interplay of market forces, user behavior, and media attention.

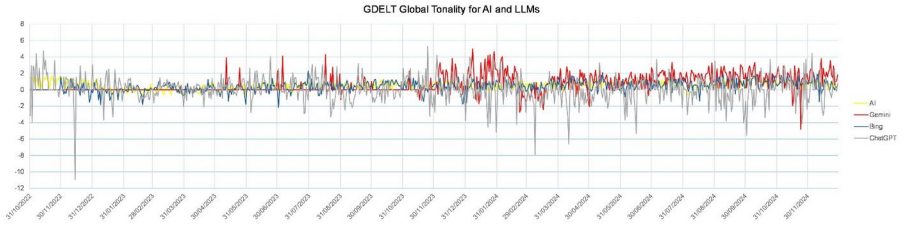


**Fig. 12** Daily evolution for GDELT global news tonality for AI, ChatGPT, Gemini, and Bing applications between November/2022 and November/2024. Source: Own elaboration based on data obtained from GDELT V2.0 API

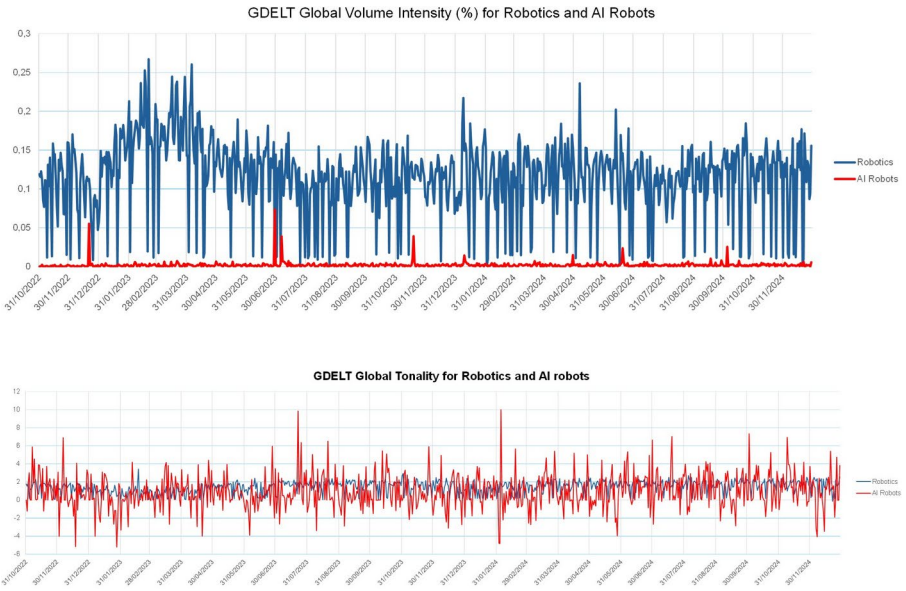


**Fig. 13** Daily evolution for GDELT global Volume intensity index for Robotics and AI Robots (top) and for GDELT global news tonality for Robotics and AI Robots (bottom) between November/2022 and December/2024.

As such, organizations in the retail and ecommerce industry leveraging open-source data and independent analysis can gain a more objective understanding of the hype surrounding emerging technologies like AI. This may empower them to make informed decisions regarding technology investments, prioritize resources effectively, optimize the timing of technology adoption, mitigate risks associated with overhyped technologies, and develop more informed technology strategies. Ultimately, this approach can enable organizations to navigate the complexities of the technology landscape more effectively, achieve greater success in the competitive e-commerce market, and maximize their return on investment in emerging technologies.

For managers, our study offers valuable actionable insights. Sustained investment interest and increasing user engagement in GAI suggest that these technologies are not merely a passing trend, as some analysts have suggested. Companies should in

fact prioritize GAI initiatives cautiously, focusing on identifying specific business cases that align with their strategic objectives.

Continuous advancements and incremental capabilities offered by GAI technologies can prove to be valuable for organizations looking to increase automation, reduce complexity and increase operational efficiencies, although considering that they need to be extensively tested to validate for potential unsubstantiated claims made by IT vendors for marketing purposes. Therefore, investments in talent development are essential to ensure that organizations have the necessary expertise to effectively implement, manage, and optimize GAI tools, maximizing their return on investment.

Our research also contributes to academic literature by providing an empirically grounded critique of the Hype Cycle methodology. Our findings offer an opportunity to revisit and extend existing technology adoption theories, such as TAM and TOE, in the context of GAI. For instance, the rapid adoption of GAI may challenge the traditional emphasis on perceived ease of use, suggesting that perceived usefulness and social influence may be stronger drivers in this context, and that as such, the trend of rapid and continuous improvements that LLMs have experience over the last two years may explain why projecting a *trough of disillusionment* for GAI technologies could be a oversimplistic take on its future evolution.

## 5 Limitations and future research

While the results of this study shed light on the applicability of the Hype cycle methodology for GAI technologies and potential alternative and open means to validate its results and projected trajectories, its results cannot be completely generalizable to all emerging ICTS assessed by Gartner methodology. Therefore, a key recommendation for future research involves expanding the scope of this study.

Specifically, we propose mapping the trajectories of other highly popular emerging technologies that exhibit some degree of similarity to GAI in terms of their technical characteristics over different periods of time. By analyzing these comparative cases at different moments, it could be determined whether they exhibit similar inconsistencies with the Gartner Hype Cycle as observed in our analysis for GAI, further confirming our findings.

We would also recommend that this mapping should consider performing segmented analysis based on various geographic locations and industries or with the hope of determining if particularities or specific factors for emerging technologies adoption trends such as GAI exist.

This comparative approach would allow for generalization of our findings, and to gain a deeper understanding of the factors that influence the actual trajectory of emerging technologies, either to potentially refine the predictive capabilities of the Gartner Hype Cycle methodology or find alternative ways for organizations to perform their own individual evaluations.

Future studies could also build upon the framework presented here by incorporating advanced statistical modeling techniques. For instance, regression-based analyses or time-series modeling could be applied to individual datasets to test causal relationships or to assess the predictive value of specific hype indicators over time. Such

approaches could provide deeper analytical granularity and contribute to refining the interpretation of hype dynamics across sectors and technologies. While this was beyond the scope and intent of the current exploratory study, it represents a promising avenue for expanding the robustness and applicability of our methodology.

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