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Generative AI in the European Startup Landscape 2024

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Content

Table of Figures

Executive Summary

This report was initiated by the appliedAI Institute for Europe in cooperation with the European Commission with the objective of gaining a deep understanding of the status of generative AI Startups in Europe. For this purpose, together with several other European AI Initiatives (Hub France IA, AI Sweden, Ignite Sweden and The Netherlands AI Coalition), we distributed a large-scale survey among generative AI Startups in Europe and conducted an in-depth analysis of the European generative AI Startup Landscape.

The insights of this report reveal that the European generative AI Startup Landscape, while being highly diverse on many dimensions, is confronted with several noteworthy challenges and requires significant additional support to thrive further. Thus, as part of this report, we also identify several potential areas for action on how the European generative AI ecosystem can be further accelerated in order to achieve global leadership or least competitiveness in the crucial domain of generative AI.

The key highlights and takeaways of this report are as follows:

- There are approximately 6300 AI Startups in the European Union, of which approximately 10,6% can be classified as generative AI Startups. These generative AI Startups are scattered among the whole European Union, with most of the generative AI Startups being located in Germany (19,9%), France (17,5%), Netherlands (10,9%), and Sweden (8,2%).

- Public funding plays only a minor role for the development of generative AI Startups. With respect to private funding, European generative AI Startups have so far received approximately 2,37 billion €.

- European generative AI Startups employ 10 employees on average.

- Most generative AI Startups are (1) developing downstream applications on top of existing large foundation models, followed by (2) working on providing development tools and infrastructure for generative AI models, and at last (3) developing foundation models. Each of the three layers of the tech stack is characterised by a high diversity of topics.

- Generative AI Startups are confronted with several major challenges, especially with regard to financing, data, compute power, talent, and regulation. In order to thrive, they require significant additional support for dealing with each of these challenges.

- 51,6% of the European generative AI Startups respondents would like to access the EuroHPC JU's supercomputers to train their models, which underscores the significance of computational resources for the development and refinement of generative AI models.

- Europe is well-positioned for taking a worldwide leading role in the development of generative AI. This, however, requires swift and significant additional support for the European generative AI ecosystem to achieve global leadership or least competitiveness. For this, six most relevant areas for action with the aim of protecting and accelerating the development of generative AI in Europe emerge.

01. Forewords

A | Foreword appliedAI Institute for Europe

It comes without doubt that generative AI has already changed the way we work and live in terms of how we generate and consume information. And this is, most likely, only the beginning of a much larger revolution. With enormous boosts in productivity and huge opportunities for value creation, being at the forefront of generative AI is of utmost importance for our economy, our competitiveness, and our European values.

Acknowledging generative AI as a strategic and transformative technology, our shared objectives align with the principles outlined in national AI strategies and the European AI framework. As the leading open-accelerator for trustworthy AI in Europe, our mission is clear: We want to increase the competitiveness of Europe and foster digital sovereignty. This will only be possible through trustworthy AI, with generative AI solutions based on European values in the highest quality. Importantly, this needs to be done today - the global AI race is ongoing, and Europe needs to take an active and leading position in shaping the future.

In the pursuit of global leadership in artificial intelligence, both at the national and European levels, this report provides an in-depth analysis of the current status of generative AI Startups within Europe. Informed by feedback from the European AI Startups Ecosystem, this report delves into the status of our European generative AI Startup Landscape and the significant challenges our generative AI Startups are facing. As such, this report aims to contribute a pragmatic perspective to ongoing discussions on generative AI in Europe. It underscores the urgent need for significantly accelerating the development of generative AI in Europe by creating a European AI Ecosystem that allows Startups to flourish.

Only by acting now, Europe will play an active role in shaping the trajectory of generative AI development. Otherwise, we will only passively watch from the sidelines.

Dr. Frauke Goll
Managing Director
appliedAI Institute for Europe

Dr. Andreas Liebl
Founder and Managing Director
appliedAI Institute for Europe

02. Introduction

Approximately one year ago, generative AI had its great breakthrough as a disruptive and extremely fast-paced acceleration of AI advancement. Before this only few enthusiasts and visionaries even knew about the enormous potential of generative AI, and particularly techniques related to Large Language Models (LLMs)[1]. Today, only a very short time later, it seems clear that generative AI already constitutes a major game-changer for individuals, businesses, and society as a whole. Indeed, its impact can hardly be overestimated.

Generative AI is likely to revolutionise human-computer interaction, fostering more intuitive, conversational, and adaptive experiences. Moreover generative AI has

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„As the adoption of generative AI solutions gains momentum globally, the potential becomes increasingly apparent. Studies show a dramatic increase in productivity, speed and quality among those who use generative AI versus the ones who don't. The productivity witnessed by early adopters indicates a broader impact on all sectors, which in the future will provide a significant boost in GDP and propel sustained economic growth throughout Europe."

Martin Svensson,
Managing Director, AI Sweden

the potential to increase efficiency and productivity throughout entire value chains and corporate functions. This not only reduces costs, but also opens up newand exciting opportunities for growth. With advancements in Natural Language Processing (NLP), even non-experts can use applications by simply giving instructions in natural language rather than technical code.

Indeed, almost anyone already can or will be able to benefit from generative AI, leading to significant opportunities for value creation and increased productivity. A study by McKinsey has estimated a potential annual value of $2.6 trillion to $4.4 trillion from generative AI, with the automation of 60-70% of employees' work activities. [2]

Additionally to the enormous economic impact of generative AI, severe ethical questions relating to trustworthiness arise as well. Trustworthiness is a foundational element in the widespread acceptance and adoption of AI technologies. Developing generative AI within Europe allows for the establishment and enforcement of robust ethical standards, focusing on transparency, fairness, and accountability based on our European values.

Europe's commitment to ethical governance in AI not only fosters trust among its citizens but also sets a global standard for responsible AI deployment. For this, the provisional agreement on the AI Act reached in December 2023 is a highly promising foundation. However, while the provisional agreement on the AI Act sets the regulatory framework for responsibly employing AI in the European Union, accelerating AI innovation and making Europe a leader in the field now becomes more pressing than ever. And for this, European AI Startups are an essential cornerstone.

Definition of Generative AI
For the purpose of this study, generative AI is understood as follows: Generative AI based on foundation models is a recently developed technology capable of generating new and unique content for various applications. These models are created by training a foundation model on large amounts of data and then fine-tuning it to improve its content generation capabilities.

Definition of a Generative AI Startup
A generative AI Startup is a newly established company that focuses on leveraging generative artificial intelligence technologies to develop innovative products, services, or solutions. These startups typically specialise in creating and deploying AI models, particularly those built upon foundation models, with the aim of generating unique and valuable content across various domains.
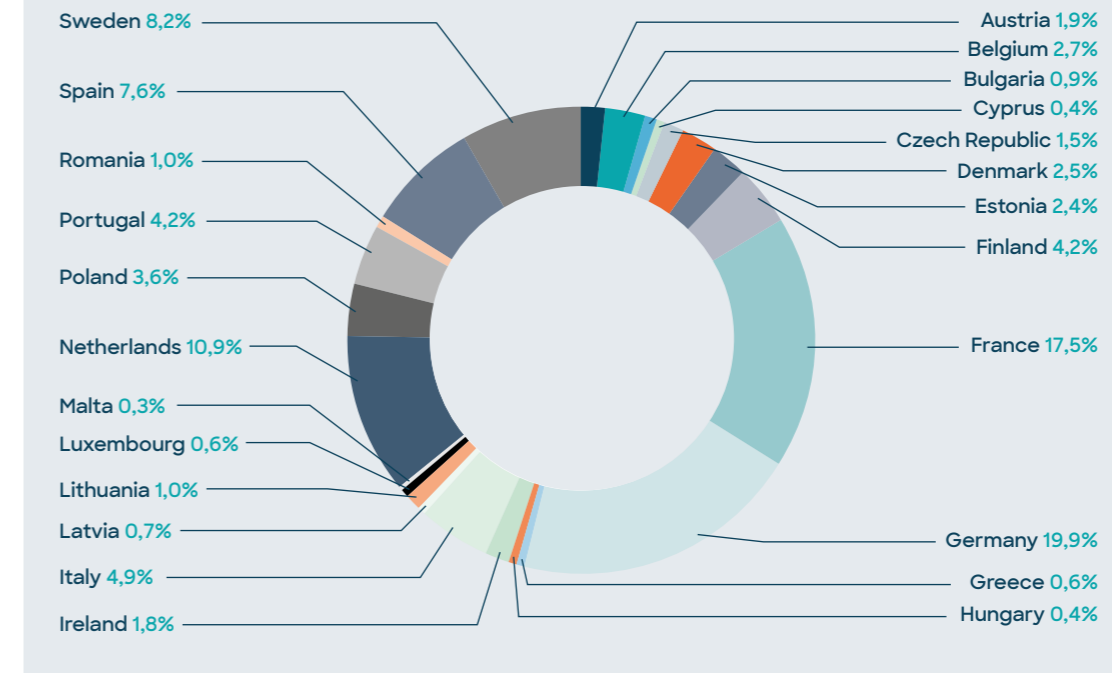

Figure 1: Generative AI Startups – Geographical Distribution in the EU

With that, besides new possibilities on the developing side, there is also a vast amount of new applications and business models coming up. At this point we see huge potential for European generative AI Startups to develop the next generation of generative AI models spanning the whole tech stack that embody European values and guarantee Europe's sovereignty in this critical field. These startups stand as a pivotal force in driving generative AI development in Europe and collectively elevate the technological prowess of the European (AI) industry. Moreover, they significantly contribute to Europe's global competitiveness, attracting investments, partnerships, and collaborations that further stimulate economic growth.

Today, there are approximately 6300 AI Startups in the European Union, of which approximately 10,6% can be classified as generative AI Startups.[3] These generative AI Startups are scattered among the whole European Union, with most of the generative AI Startups being located in Germany (19,9%), France (17,5%), Netherlands (10,9%), and Sweden (8,2%).

Thus, the absolute number of generative AI Startups can be considered as rather high and their geographical spread across Europe indicates the emergence of a European generative AI ecosystem.

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„Startups play an essential role when it comes to innovation and job creation. Thus, it is highly important that they find a supportive ecosystem with attractive framework conditions that make them stay in Europe. To achieve this, startups need a sufficient supply of financing options over the entire life cycle as well as a strong capital market so that IPOs increasingly take place in Europe. This means that we have to act immediately if we in Europe want to play an active role in generative AI development."

Dr. Frauke Goll,
Managing Director, appliedAI Institute for Europe

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[1] For further information on LLMs, cf. to the following publication of the appliedAI Initiative (2023): A Guide for Large Language Model Make-or-Buy Strategies. https://www.appliedai.de/assets/files/LLM-Whitepaper-final_Digital03.pdf

[2] McKinsey and Company (2023): The economic potential of generative AI: The next productivity frontier. https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/The-economic-potential-of-generative-AI-The-next-productivity-frontier#introduction

[3] These figures are based on an in-depth analysis with different sources such as the European AI Startup Landscape as well as data from dealroom.co. Classifying all AI Startups in the EU was subsequently done with an AI-based classification tool developed by the appliedAI Institute for Europe. For further information on what exact criteria need to be fulfilled in order to be classified as a generative AI Startup, please cf. to the chapter "Data Collection and Sample Selection Process".

03. Data Collection and Sample Selection Process

However, according to our data, European generative AI Startups have so far cumulatively collected only approximately 2,37 billion € of funding. This figure is alarmingly low: In contrast, for example, two major generative AI Startups from the US - OpenAI and Anthropic - have as of December 2023 collected approximately 14,3 billion € of funding. Put differently, these two non-European startups alone collected six times more funding than all of the approximately 669 generative AI Startups in the European Union combined. This, among several other factors, makes it extremely difficult for European generative AI Startups to compete internationally.

„The biggest breakthroughs in AI are typically made in well-funded private companies with significant resources. European startups in general do not have the same investment opportunities as startups in North America. We see no reason why the same dynamic would not apply for generative AI Startups in Europe and thereby impact Europe's overall competitiveness."

Martin Svensson,
Managing Director, AI Sweden

Besides the lack of sufficient funding, the overall status of the European generative AI landscape is so far unknown, and no comprehensive mapping of generative AI "made in Europe" exists. This study therefore serves as a reality check on the status of generative AI in Europe and answers some of the most pressing questions regarding the status of the European AI ecosystem: What are the major challenges that European generative AI Startups are currently facing? What key industries are they active in? What specific types of generative AI - such as foundation models or downstream applications - are they working on? And how can the overall framework conditions of the generative AI actors in Europe as a whole be improved?

These and several more questions are answered in this report, for which the appliedAI Institute for Europe - supported by Hub France IA, AI Sweden, Ignite Sweden and The Netherlands AI Coalition - conducted a large-scale survey among the generative AI Startups across Europe. The insights of this in-depth analysis reveal that the European AI Startups, while being highly diverse, are confronted with several challenges and require significant further support to further thrive. Thus, as part of this report, we also identify several urgent areas for action on how the European generative AI ecosystem can be further accelerated in order to achieve global leadership or least competitiveness.
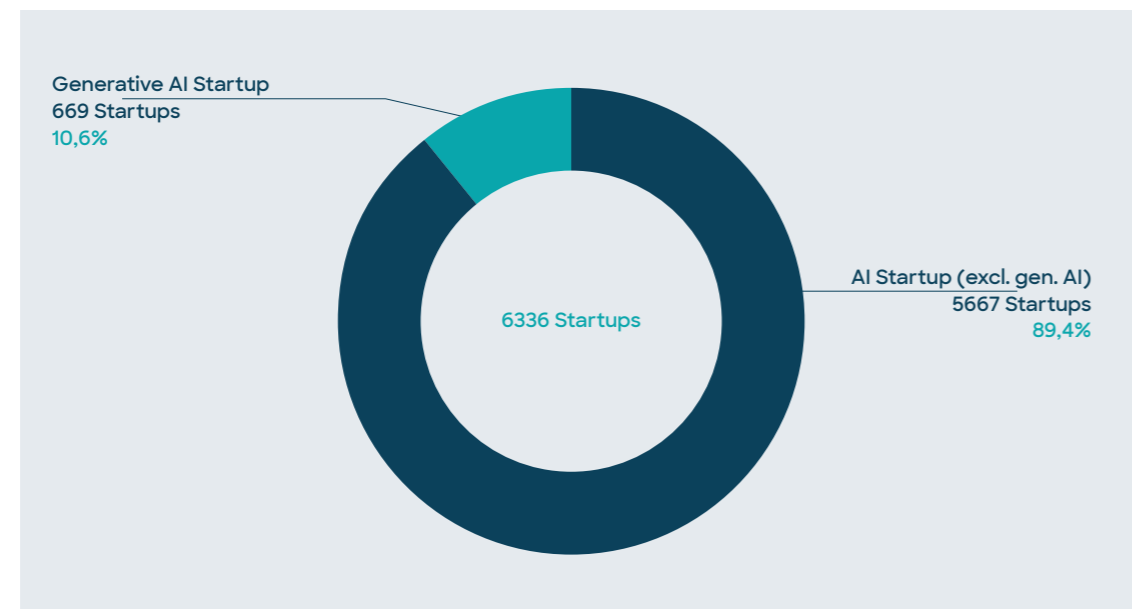
The primary objective of this study was to investigate the landscape of generative AI Startups in Europe. Together with our strong partners of the European AI Startup Landscape, the four most important EU countries in the field of generative AI were chosen for conducting an in-depth analysis and distributing a detailed survey: Germany, Sweden, France, and the Netherlands.

According to the requirements of the European AI Startup Landscape in total, approximately 1169 AI Startups are located in the participating European countries.[4] All AI Startups included in the European AI Startup Landscape are evaluated based on data, talent, AI methods, scalability, overall quality, and are subsequently clustered. The AI Startups are initially rated ('shortlisted' or 'discarded') by our AI Analysts to create a shortlist. To enhance the validity of our results, all startups are evaluated by several experts and the inter-rater reliability is calculated. Unclear cases - i.e. AI Startup evaluations with a low interrater reliability - were then individually evaluated in a larger expert group, resulting in a final "shortlist" or "discard" decision.

In order for a startup to be approved for the European AI Startup Landscape, they must meet the following requirements:

- Be a registered company.
- Have been founded less than 10 years ago or pivoted their core business model to AI less than 10 years ago (including 2013).
- The startup's headquarter must be situated in Europe.
- They should have a minimum of two Full Time Equivalents (FTEs).
- They should have a minimum of one FTE with AI competence.
- They should have AI at their core or exhibit a significant usage of AI.
- The start-up respectively its business model has a high face validity (e.g., professional website, convincing business model, etc.).

As of December 2023, there is no comprehensive mapping of generative AI Startups in Europe available. Thus a major hurdle of this study was to evaluate which of these AI Startups are active in the specific field of generative AI.[5]

In order to enable an objective and data-driven classification of each AI Startup, we developed an AI-based generative AI classification system for the sole purpose of this study. Specifically, this AI-based generative AI classification system was provided with the definition of generative AI and then crawled the website of each AI Startup. Based on the information extracted, it was then evaluated whether the startup is active in the field of generative AI. Moreover, to ensure the validity of the AI-based generative AI classification system, two AI experts independently validated the results. In case of any conflicting assessment, a third AI expert made the final classification decision. Overall, based on this process, 154 generative AI Startups within the participating European countries and which are part of the European AI Startup Landscape were identified. Additionally, further generative AI Startups which are not yet part of the European AI Startup Landscape - e.g., because they only reached the requirements after the last update iteration - were manually added.

The study employed a cross-sectional survey design to collect data, providing a snapshot of the current state of generative AI integration within the startup ecosystems of these European countries. Each of the generative AI Startups identified was contacted by experts from the respective target country partner organisation. Participation in the survey was by invitation only, ensuring a focused and relevant respondent pool. Invitations were extended through multiple channels, including phone outreach, personal contacts within the country-specific startup ecosystems, and email invitations. This approach ensured a very high degree of participation of approximately 62% among the generative AI Startups.

Figure 2: Generative AI Startups Percentage of Total AI Startups in the EU
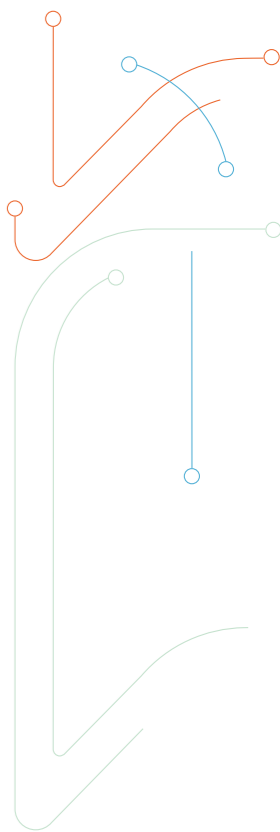
Data collection occurred over a 4 week time frame from 23 October 2023 until November 17 2023. The survey was administered in English to facilitate the analysis of the results and to minimise language-driven biases Responses were collected through a GDPR-compliant online tool.

Participants were provided with detailed information about the study's purpose, objectives, and the expected time commitment. Informed consent was obtained from each participant, emphasising voluntary participation and the confidentiality of their responses. Moreover, each participating AI Startup could choose whether it was open for being contacted for an in-depth

interview about the topic. At last, each participating AI Startup could also indicate to be treated anonymously.

The survey questionnaire was carefully designed to capture both quantitative and qualitative data relevant to generative AI adoption. The questions were structured to elicit information on the startups' current usage of generative AI, perceived benefits and challenges, as well as their future plans for integration. The instrument underwent pre-testing to ensure clarity and relevance. The complete survey can be found in the appendix of this report.

[4] This figure only includes high-quality AI Startups, i.e. which are part of the European AI Startup Landscape. A detailed mapping of all these AI Startups can be found on the following website: https://www.ai-startups-europe.eu

[5] The authors of this study would like to note that the number of generative AI Startups identified in the article of Sifted (cf. above) seems to be inaccurate and there is no information on the methodology followed. Specifically, only 150 generative AI Startups were identified in the article. The similar accounts to a publicly available database on Dealroom.co, where only 124 generative AI Startups are listed for Europe (as of December 2023). Even key players in the field of foundation models such as Aleph Alpha or Silo.ai are not included in their database.

Source: https://app.dealroom.co/lists/33530/list/f/slug_locations/anyof_europe?showGrid=false&showTransactions=false

04. Analysis of Survey Responses

4.1 | Methodology

The authors of this report conducted a very detailed both quantitative and qualitative analysis of the survey results. First of all, a meticulous data processing strategy was implemented to ensure the reliability and representativeness of the obtained insights. The survey responses underwent a thorough data cleaning process to eliminate inconsistencies and incomplete entries, thereby enhancing the overall quality of the dataset. The gathered survey responses were complemented through additional data sources, such as Dealroom.co. This allowed us to paint a more holistic picture and also to externally validate the responses received. Subsequently, depending on the insights to

be generated, the data was analysed either quantitatively or qualitatively. The synergy between quantitative and qualitative data not only enhances the depth of the results but also allows for the validation and triangulation of results, reinforcing the overall validity and reliability of the research outcomes. Moreover, this mixed-methods research is particularly valuable in exploring complex and multifaceted topics, and therefore ideally suited for the purpose of this study. Overall, our rigorous and multifaceted approach aimed to provide a nuanced and reliable portrayal of the state of generative AI Startups in Europe.

4.2 | Sample Description

Overall, 95 of the contacted generative AI Startups participated in the survey. Given that the sample size represents approximately 62% of the total generative AI Startup population in the participating European countries (based on the startups being part of the European AI Startup Landscape) and approximately 15% of all generative AI Startups in the European Union, the results of this survey can most likely be generalised to the whole population.

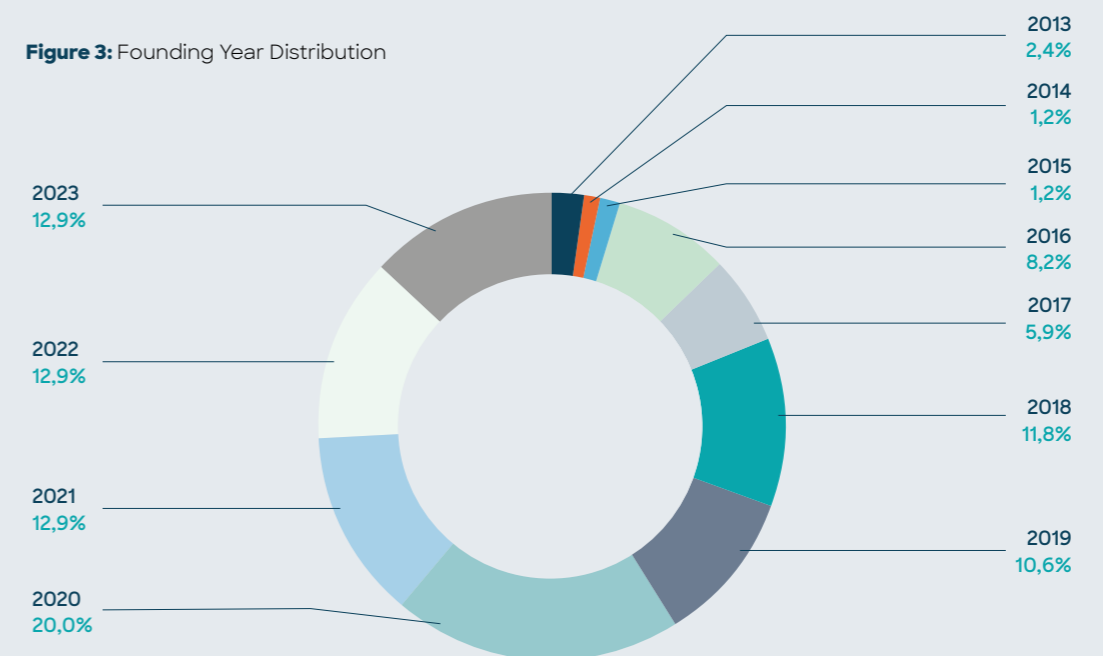Overall, the sample has the following characteristics:

Founding year:
The founding years of the generative are distributed among the years 2013 – 2023, with only 2,4% of the generative AI startups founded in 2013 and the largest share (20%) of generative AI startups founded in 2020.

Figure 3: Founding Year Distribution

2013 2,4%
2014 1,2%
2015 1,2%
2016 8,2%
2017 5,9%
2018 11,8%
2019 10,6%
2020 20,0%
2021 12,9%
2022 12,9%
2023 12,9%

Country:
Most generative AI startups participating in this study come from Germany, followed by Sweden, France, and the Netherlands. Furthermore, one startup from Luxembourg was included in the study as it is significantly involved in the French ecosystem.
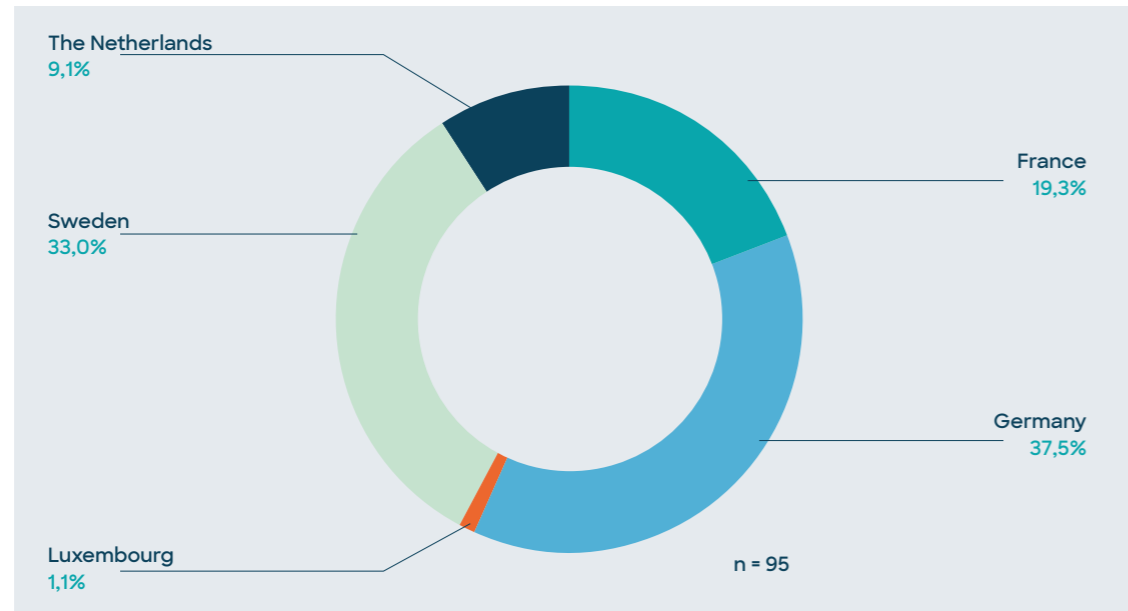

Figure 4: Gen. AI Startup Distribution via Countries

Public and Private Funding:
Only 35 generative AI Startups indicated that they received noteworthy public funding, with an average of 490.000€ of public funding received. Thus, public funding currently plays only a minor role for the development of generative AI Startups. Usually, public funding is received in temporal proximity to the actual founding of a startup (i.e. in an early stage) and required especially for initial prototyping and talent acquisition.

Surprisingly, receiving public funding is not a valid predictor for receiving significant private funding at later stages. This may indicate that either public funding is on average so low that founders decide it's not worth the bureaucratic effort or that public funding agencies are unable to pre-select the most promising generative AI Startups.
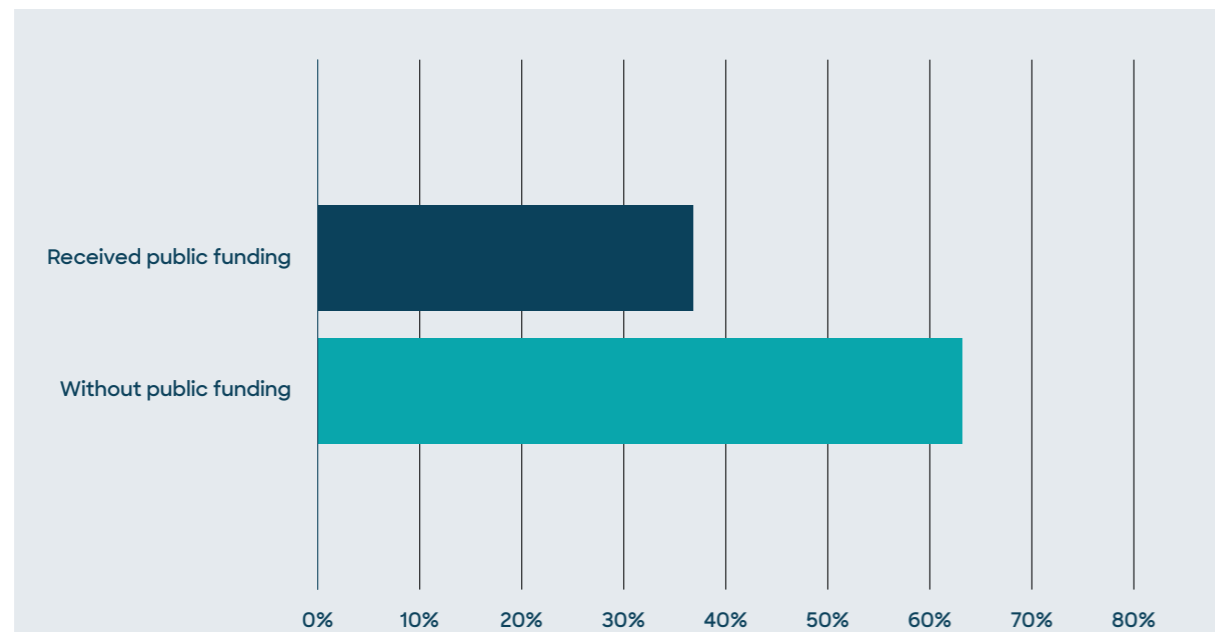

Figure 5: Distribution of Generative AI Startups receiving public funding

In contrast, 63% of the generative AI Startups indicated that they received significant amounts of private funding. With a median of approximately 550.000 € of private funding received, i.e. the large amount of overall funding is significantly distorted by very few major outliers.[6] For comparative reasons, the median of private funding received for the whole population of European generative AI Startups is approximately 1,5 million €.[7] Noteworthy, there are no relevant differences between the median of private funding received among the participating countries in our sample.
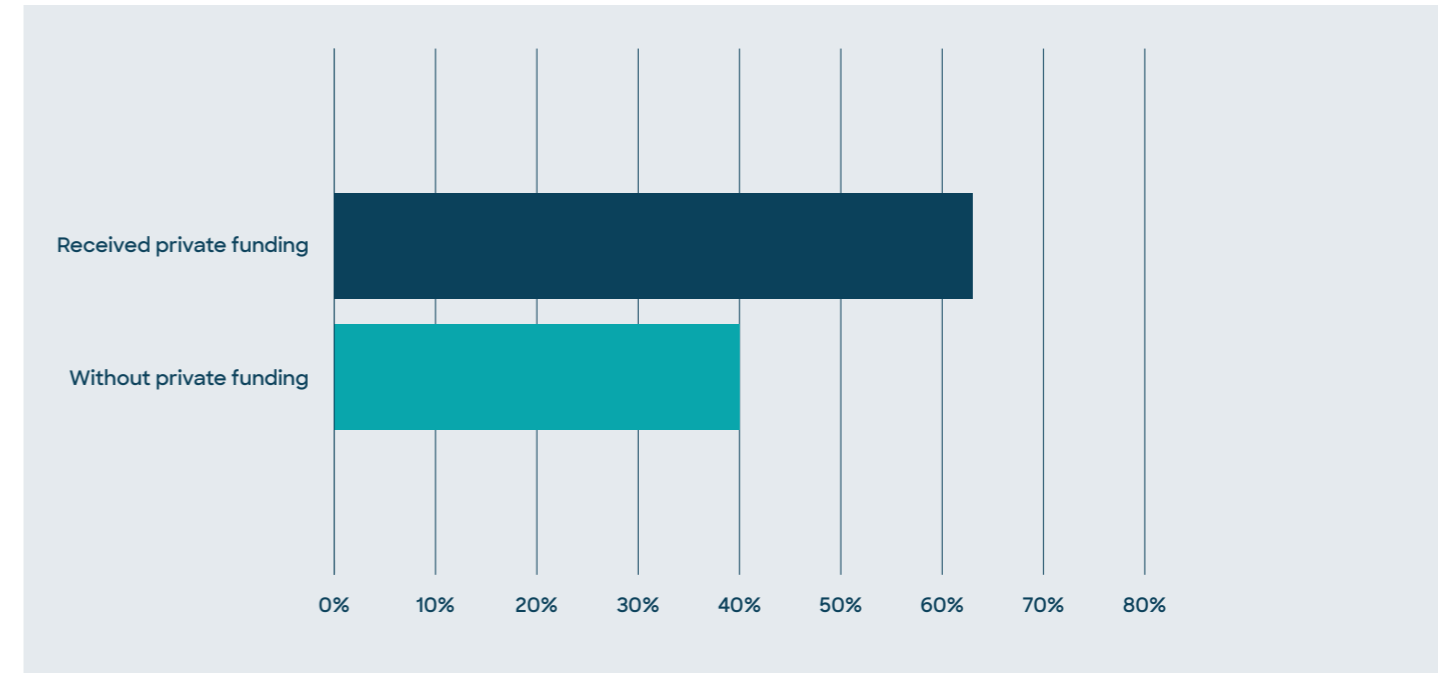
Figure 6: Distribution of Generative AI Startups receiving private funding

Team size:
Approximately 38,8% of the participating generative AI Startups have a team size between 1-5 or 6-10 each. Approximately 8,2% have a team size between 11-20 employees, whereas 14,1% of the generative AI Startups have more than 20 employees. The generative AI Startups have 10 employees on average. Naturally, team size and startup age are positively correlated with each other.

Figure 7: Team Size of European Generative AI Startups

4.3 | Insights of the Status of Generative AI in Europe

The generative AI Startups indicated whether they are (1) currently working on developing foundation models, (2) currently working on providing development tools and infrastructure for generative AI models, and/or (3) currently developing downstream applications developed on top of existing large foundation models. Naturally, several selections were possible, i.e. startups could for example indicate that they develop both foundation models and downstream applications on top of these foundation models.

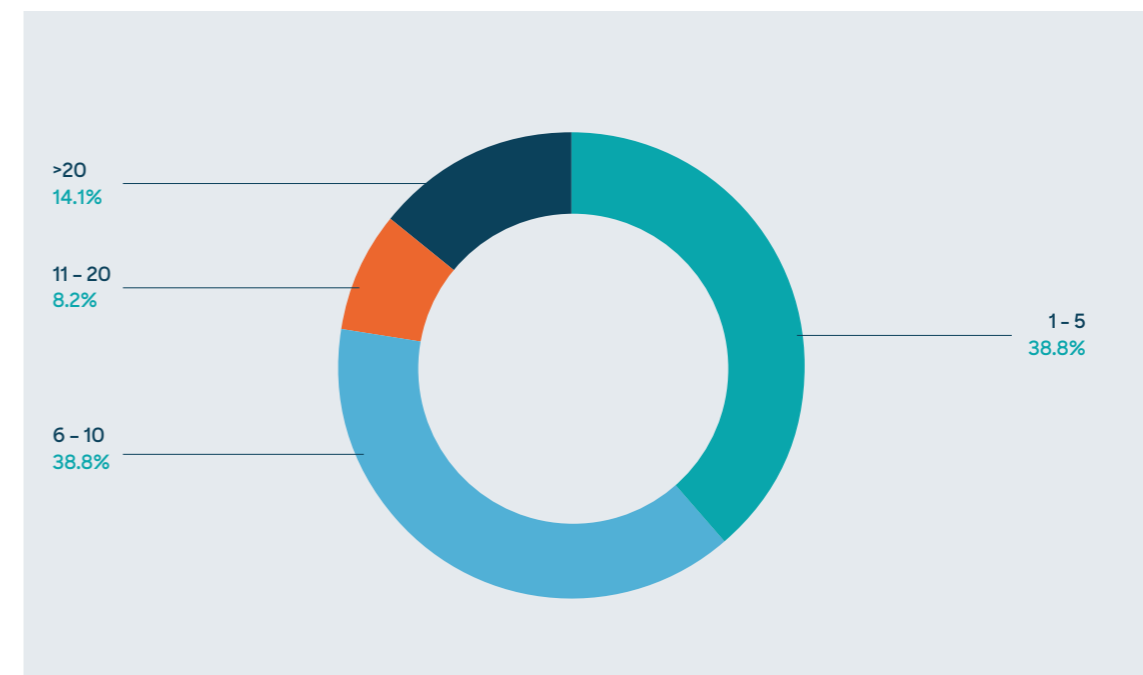Regarding currently working on developing foundation models, 31% of the surveyed startups affirm their current involvement in developing foundation models, while 69% indicate that they are not pursuing such endeavours.

With respect to currently working on providing development tools and infrastructure for generative AI models, 41,6% of the partici-

pating European generative AI Startups are working on this. In turn, 58,4% of the startups indicated that the provision of development tools and infrastructure for generative AI models is not within the scope of their work.

Moreover, 62,9% of the generative AI Startups are developing downstream applications on top of existing large foundation models. As such, 37,1% of the generative AI Startups are not active within this field of development.

As already outlined, multiple selections of the field of action were possible. Thus, for the case of two or even three selections, it is interesting to analyse which cross-dependencies along the tech-stack exist. Approximately half (52,6%) of the European generative AI Startups focus their activities on a single layer of the tech stack. In turn, 15,4% of the startups indicated that they are active along the whole generative AI value chain, i.e. work on developing foundation models, development tools and infrastructure as well

as downstream applications. Moreover, approximately 23% note that they are actively involved in both development tools/infrastructure and downstream applications. 7,7% of the respondents noted that they are both developing foundation models and

downstream applications. Only 1,3% of the generative AI Startups are simultaneously developing foundation models as well development tools / infrastructure.
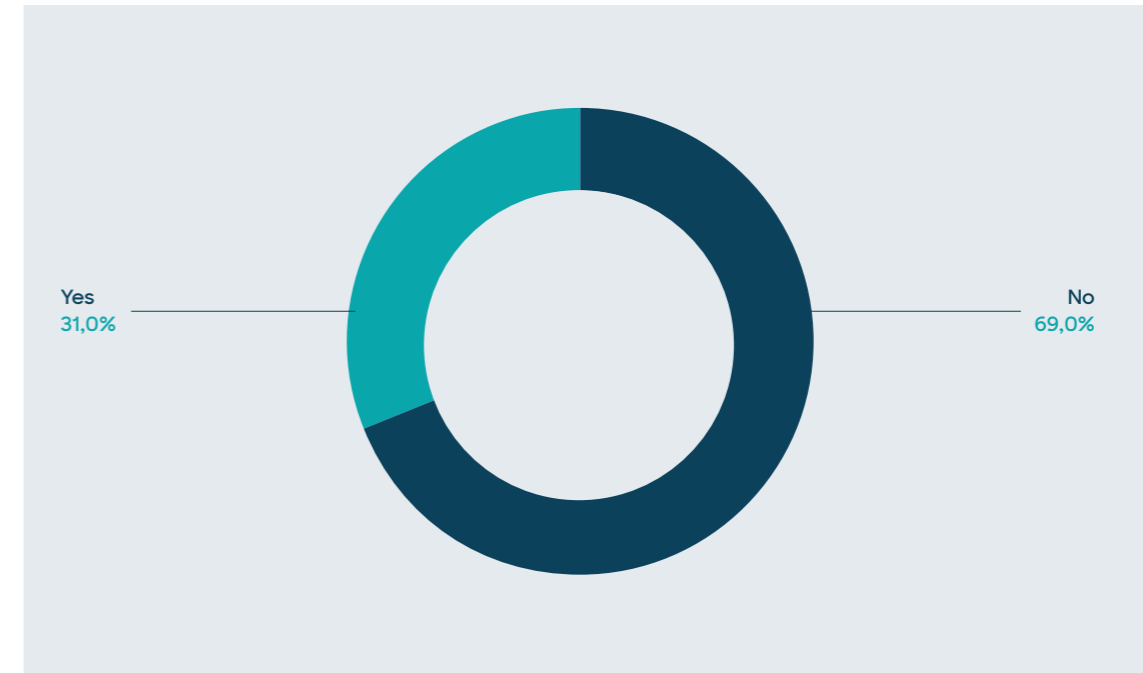
Figure 9: Percentage of gen. AI Startups Developing Foundational Models

Figure 8: Overlap of technology stack
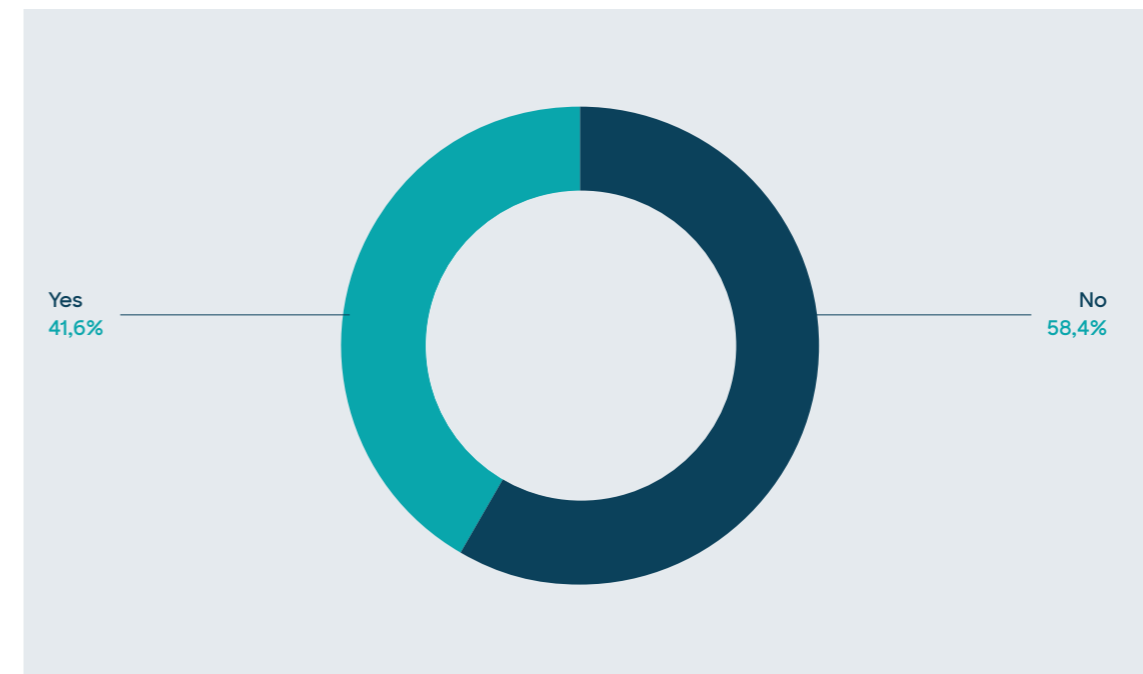
Figure 10: Percentage of gen. AI Startups working on development tools and infrastructure
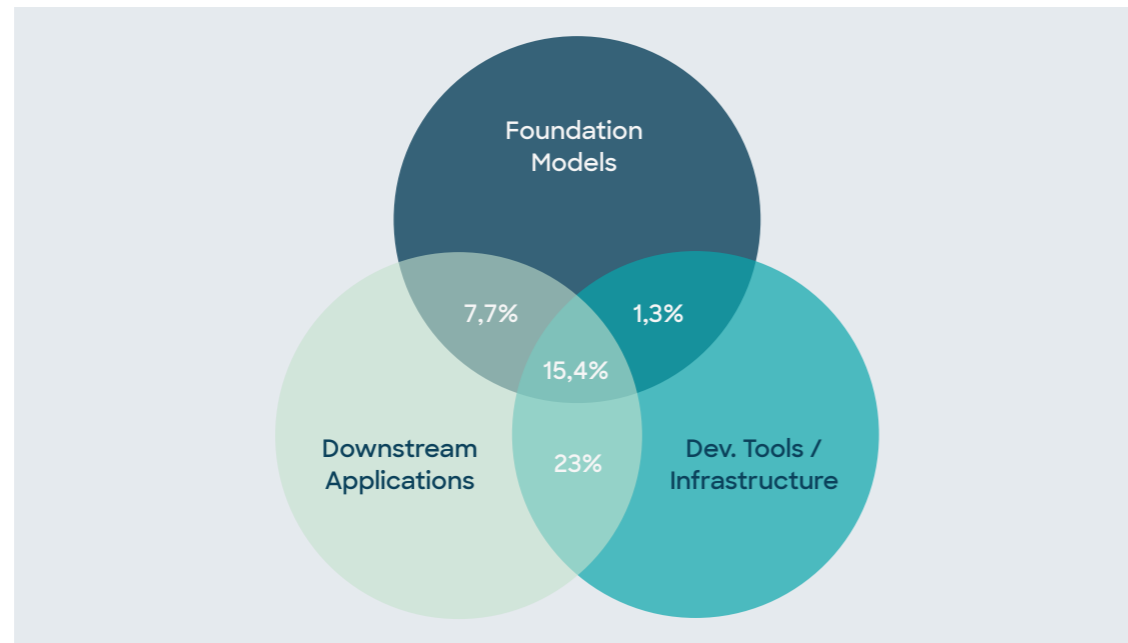
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6 Several generative AI Startups indicated that their private funding is not to be disclosed. Thus, this figure only contains the private funding where complete private funding was disclosed and could be externally validated.

7 Based on our own calculation from all AI Startups listed on dealroom.co and subsequently classified by our AI-based generative AI classification tool.
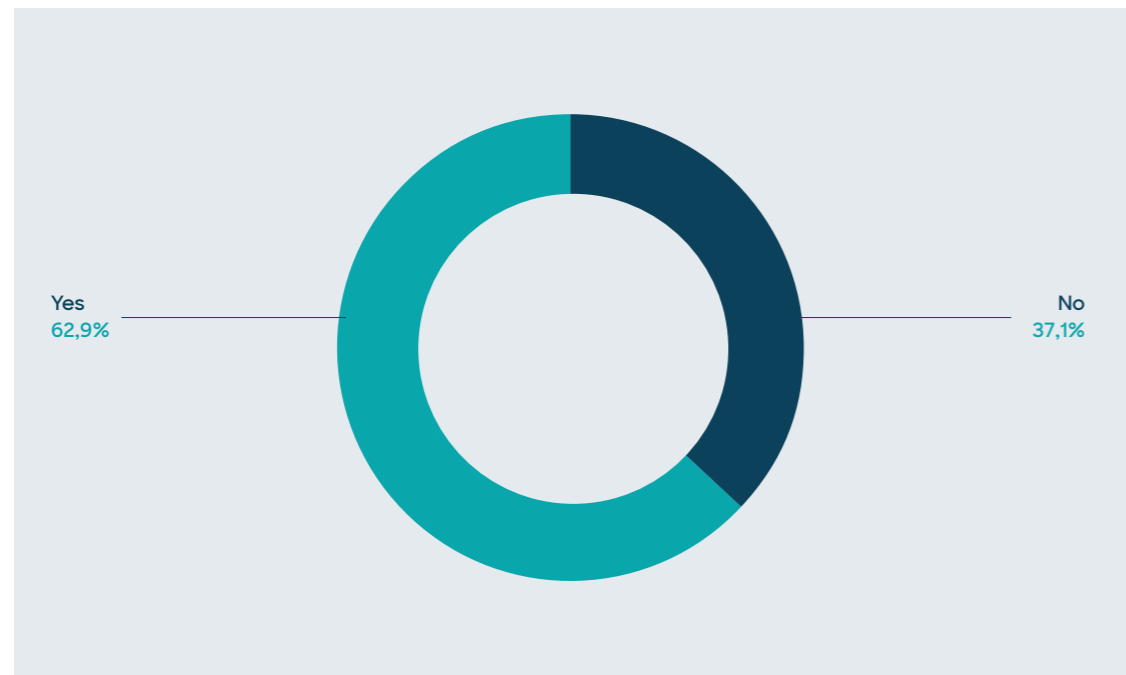
Figure 11: Percentage of gen. AI Startups working on developing downstream applications

Yes
62,9%

No
37,1%

"It is important to preserve European languages. Models in the languages of the European Union are essential to make these models accessible to everyone, not just English speakers, for example, and to preserve the use of languages. From a legal and ethical point of view, there are also major differences between our continents on these issues. Europe, for example, places the protection of fundamental rights at the heart of the game, unlike its competitors, who often give priority to economic success."

Chloé Plédel,
Head of European and Regulatory Affairs, Hub France IA

Deep-Dive on Foundation Model Development among European Generative AI Startups

"It is important to develop European foundation models because it also helps to preserve European culture. A foundation model trained only on American data will produce results from an American perspective. The result is a single view of the world. The danger of a foundation model based on one geographical area or one type of data is that it rewrites history through a single prism."

Caroline Chopinaud,
General Manager, Hub France IA

Generally, the generative AI Startups working on foundation models can be classified into the following broad categories:

Multimodality: Multimodal foundation models are a type of AI model that are designed to process and understand information from multiple modalities or sources. In the context of large language models (LLMs), "multimodal" refers to the ability to handle and generate content that involves more

than just text. Put differently, these models are trained to comprehend and generate information across different modalities, such as video, text or audio. Multimodal foundations models are especially valuable in real-world scenarios where information is conveyed through various forms as they enable more natural and flexible interactions with users and different data sources.

Multilinguality: Multilingual foundation models involve the construction of specialised models tailored to multilingual applications. Multilinguality refers to the ability of the model to understand and generate content in multiple languages. A multilingual foundation model is trained on data from various languages, allowing it to comprehend and generate text in languages beyond the one in which it was initially developed. Given that the European Union has 24 official languages, advancements in the field of multilinguality seem especially important to adequately reflect this multilingual diversity in Europe.

Domain-specialisation: Respondents also noted that they are building domain-specialised models, which are also referred to as vertical foundation models. The integration of vertical foundation models refers to employing specified LLMs for specific industries. In this approach, foundation models are adapted on

domain-specific data for domain and industry-specific applications in a first step. This leads to having highly specialised vertical models combining open-domain with domain-specific knowledge. Subsequently, in a second step, further fine-tuning on application-specific data (such as text or image data) results in an application-based vertical model. The advantage of such a vertical model value chain lies in the very high degree of specialisation compared to generally pre-trained models without a specific industry focus.

Synthetic Data: Foundation Models require vast amounts of data. This data is often not available, leading to an increasing popularity of creating and utilising synthetic data. Synthetic data is artificially generated data replacing "real" data. Its main purpose is often to protect privacy and confidentiality, especially when dealing with sensitive information. Synthetic data can be used in various applications, including research, training machine learning algorithms, data analysis, and testing software products. In turn, synthetic data is also increasingly being used to train and test foundation models.

Additionally, startups are developing foundation models in the fields of medical imaging, automatic music transcription generation, automatic programming of industrial robots, and ethics.

Deep-Dive on Development Tool and Infrastructure Provision among European Generative AI Startups

Generally, the generative AI Startups working on development tools and infrastructure can be classified into the following broad categories:

Accessible AI Development: Creating no-code tools for non-technical domain experts lies at the core of generative AI as it allows more people to benefit from AI solutions, thereby democratising artificial intelligence. With low-code tools, developers can utilise visual interfaces and pre-built components to design and build applications, reducing the need for extensive coding. No-code tools take this a step further, enabling users to create functional applications through intuitive, drag-and-drop interfaces without any coding whatsoever.

Workflow Automation: Workflow automation using AI development tools is revolutionising how firms or individuals can optimise their processes and increase efficiency. These tools leverage artificial intelligence to intelligently automate routine tasks and decision-making by reducing manual intervention. For example, one respondent noted that "For the end user it only takes a couple of minutes to set such a workflow up, with no prior experience." AI-driven workflow automation tools can learn and adapt over time, improving their ability to handle complex tasks and changing business requirements.

Scalability and Performance: The development of scalable infrastructure is designed to support the deployment and operation of generative AI models. Robust training pipelines and deployment solutions are essential for meeting the computational demands of sophisticated AI systems. For example, one responding startup noted that their activities "are centred around facilitating a smooth and efficient development process with user-friendly interfaces, robust training pipelines, and scalable deployment solutions with the aim to empower developers to easily create / deploy generative AI models across various applications".

Deep-Dive on Downstream Application Development among European Generative AI Startups

The distribution of downstream application development across industries reflects a varied European landscape among the surveyed generative AI Startups (cf. Figure 12). Moreover, several startups also indicated that they are active in small niches (such as wellness, fashion, or defence). Overall, this distribution shows that the European generative AI landscape is characterised by a high diversity of industries.

> "In one way or another, generative AI will disrupt all major industries. It is therefore extremely important that generative AI downstream applications are developed across different industrial sectors. This enables these industries to benefit from the rapid generative AI developments and offers new opportunities for value creation as well as increased productivity."
>
> **Dr. Philip Hutchinson,**
> Senior AI Strategist, appliedAI Institute for Europe

Main Opportunities for European Generative AI Startups

The survey results indicate that European generative AI Startups perceive acquiring new client relationships as a primary opportunity, with 38% of the responding generative AI Startups recognizing its significance. This underscores the importance placed on expanding market reach to drive growth. Additionally, the opportunity for establishing competitive advantage in creating or improving foundation models aligned with EU values and future regulations is recognized by 28.5% of respondents. This reflects a strategic focus on compliance and ethical considerations, underlining the importance of the EU being at the global forefront on trustworthy AI development.

The increasing value of existing client relationships, also at 28.5%, underscores the continued emphasis on cultivating and enhancing established partnerships. Finally, 11.4% of respondents identify other opportunities, such as positioning the EU as the world's leading continent for trustworthy AI research.

Figure 13: Main Opportunities for European Generative AI Startups

Major Challenges of European Generative AI Startups

The generative AI Startups in Europe are confronted with several major challenges, especially with regard to financing, data, compute power, talent, regulation, non-regulatory matters, security, and a lack of a level playing field. These challenges are each discussed in detail in the following. The following figure 14 provides an overview of the distribution of the major challenges for European generative AI Startups:
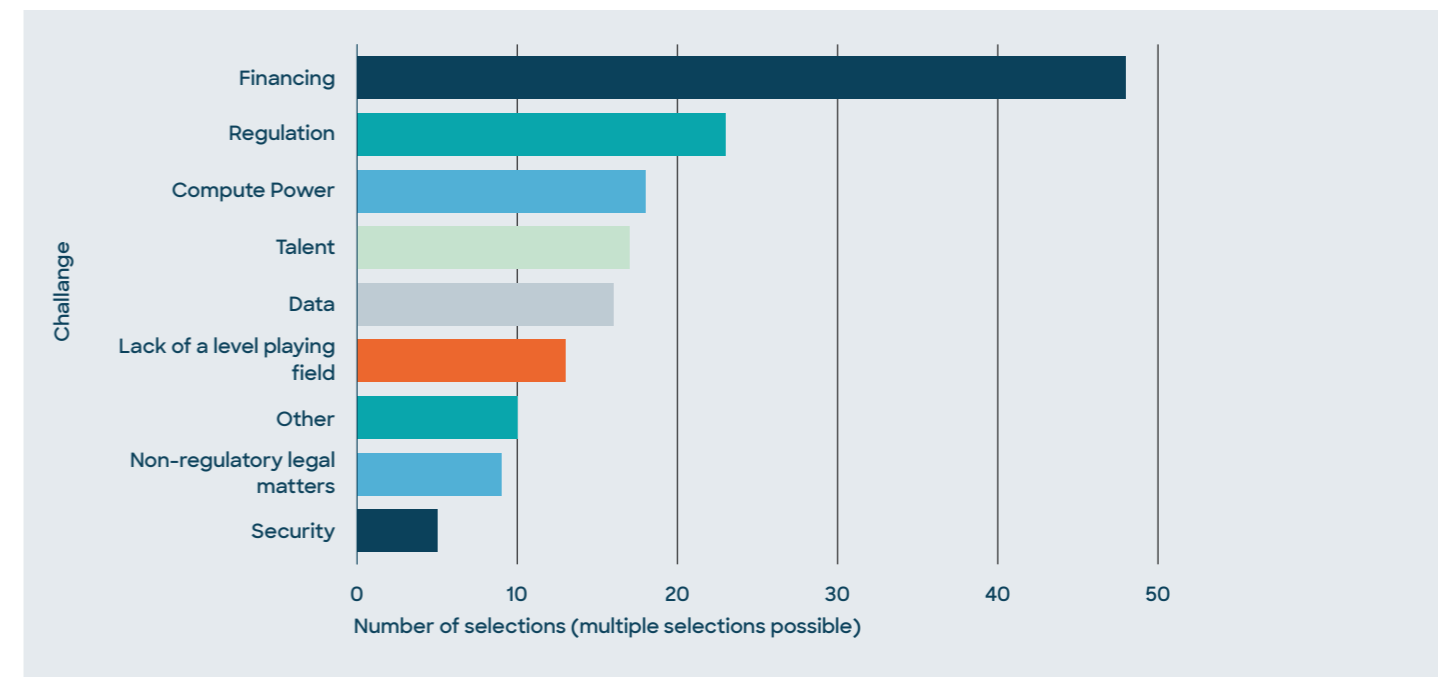
Figure 14: Challenges of Gen. AI Startups

Figure 12: Downstream Applications - Industry Distribution (%)

Financing: One of the main challenges mentioned by the Startups is the limited availability of funding in Europe, especially compared to the US and China. This is particularly problematic for Startups working in the generative AI space, as firms in Europe are less willing to invest large amounts of money. The dramatic state of the lack of funding as indicated by the Startups comes as no surprise, given that the VC investments in generative AI Startups are significantly higher in non-European countries than in the European Union (cf. introduction of this report for further information). The limited funds available to European generative AI Startups make model training, which is essential for their work, to some extent impossible. One Startup acknowledges this by stating, "Model training is way too expensive for us, given our limited funds." This also makes it difficult for these Startups to find seed funding ("Hard to find seed funding in Europe vs. the US").

The Startups also note a lack of financing opportunities in Europe, particularly for downstream applications. This is due to a reluctance from customers to invest in these projects. Furthermore, the current economic climate in Europe is described as "horrible," making it challenging for Startups to secure private and public funding.

Another hurdle for these Startups is finding investors who understand the actual potential of generative AI. As one Startup explains, "It is hard to explain the value of AI to investors. It's such a buzzword, but few see a tangible value." This leads to difficulties securing financing, as investors are focused on companies with a proven track record and steady revenue growth where they profoundly understand the business model and the underlying technological solution. Additionally, there seems to be a lack of understanding of the development costs for generative AI among VCs, making it difficult for generative AI Startups to secure the funding they need.

Data: Generative AI Startups also face several obstacles when it comes to accessing and collecting high quality data. One of the biggest challenges is navigating through the legal limitations set by various clients, especially in sensitive domains such as HR. One Startup mentioned, "Given the sensitive domain (HR) we're active in, GDPR compliance is a huge issue for us." Another hurdle is accessing data particularly in the healthcare industry. Startups mentioned that "Accessing the required medical data is heavily restricted due to data privacy laws and the bad IT infrastructure in the healthcare system." This not only creates a barrier for acquiring data, but also highlights the need for improving IT infrastructure in the healthcare industry.

In addition to legal limitations with respect to the availability of data, data sharing is also a major issue in the European industry. As one Startup stated, "The European industry is too conservative when it comes to sharing data. High quality data is our only chance to achieve long term competitive advantage." As high-quality data is essential to develop specific and non-imitable models, this is a huge obstacle that hinders European generative AI Startups from becoming competitive. Indeed, it was noted that acquiring high quality data is becoming increasingly difficult and time intensive. One Startup even mentioned, "It seems that it will be increasingly difficult to be competitive without access to high quality data, which is almost impossible to find without breaking copyright legislation." This highlights the importance of finding alternative solutions for acquiring data, such as through partnerships and collaborations as well as legal certainty.

Other data-related obstacles mentioned by the generative AI Startups include the lack of clean data, difficulty in establishing ground truth datasets, and limited access to customer data due to strict trade secrets in industries such as pharma. This leads to a "sparse data domain" and "fragmented data landscape", making it even more challenging for Startups to obtain the necessary data for training their models.

"Obtaining large, diverse datasets is crucial for training generative AI, but European Startups often encounter challenges in this regard due to the region's strict data protection laws and the more fragmented nature of data gathering, compared to other global regions."

Miriam Veronesi,
Chair of the Startup and Scaleup group, Dutch AI Coalition
AI Governance/Ethical Business Lead, TNO Vecto

Compute Power: The answers also reveal that one of the main obstacles European generative AI Startups face is obtaining sufficient compute power (reflected in quotes such as "Very expensive and not available" or "Getting enough computational power is a bottleneck."). The limited availability and high cost of GPUs, as well as the expense of using cloud services, are named as primary barriers to obtaining sufficient computational power. This is, for example, emphasised by a startup noting that "GPU processing is too expensive for high-volume cases."

The need for partnership with large cloud vendors to access high-level computational power is especially emphasised. Respondents furthermore note that there is a general lack of cloud-providers in Europe. This is evident in quotes such as "Too expensive, especially with limited VC" or "Low number of local (German) providers for high compute power GPU systems". This issue is further compounded by increasing demand for computational power as models become larger. These challenges further hinder the ability of generative AI Startups to effectively train and run their models.

"Computing power and data, for these two aspects, the main challenge is to significantly reduce the computing power needed to build domains by being frugal with data."

Caroline Chopinaud,
General Manager, Hub France IA

Talent: Another important challenge often explicitly referred to is the scarcity and cost of talent. This was described as "too few, too expensive, [and] too high demands" with the required AI talent being "super rare" and "scattered across Europe". The additional challenge of hiring highly qualified individuals from outside the EU due to the complexities of the blue card process was also highlighted. This was said to contribute to "too much bureaucracy" and make it "difficult to identify and hire talent".

The European generative AI Startups also especially face challenges in recruiting highly experienced talent, for example when it comes to finding senior machine learning engineers. This holds true especially for early stage companies, who struggle to attract and afford such experienced talent.

„One underlying premise for developing the world's leading trustworthy AI solutions is to employ the world's best AI talent. For this, top talent needs to be both retained as well as attracted. And this, in turn, of course correlates with funding availability."

Dr. Philip Hutchinson,
Senior AI Strategist, appliedAI Institute for Europe

**Regulation:** Multiple generative AI Startup companies expressed their concerns about facing significant obstacles due to regulations and uncertain legislation. In some cases, the regulations have been perceived as overly complex and restrictive, making it difficult for these companies to operate and thrive. One startup stated, "The EU AI Act is too complicated. This would destroy our company." Another noted the

limitations on data acquisition for training, creating a disadvantage compared to the US. Other companies expressed concerns about high costs and uncertainty caused by the EU AI Act.[8]

Yet, despite these challenges, many companies expressed the importance of regulations that protect European values and society as a whole. Regulations are set to protect the creative industries, who see their copyrights threatened as foundation model providers train their models without consent of content owners. As AI-generated text and images are increasingly indistinguishable from reality, the AI Act aims to protect consumers and other groups from manipulation. Moreover, the regulation is intended to counteract the growing power imbalance between a few (predominantly non-EU) providers of foundation models and thousands of downstream adopters in the EU. The expected transparency requirements of the AI Act shall provide new market entrants with a performance benchmark.

However, there were also concerns about unreasonable burdens of proof and compliance for small businesses, and the paralysing effect of data protection on potential customers. In addition to regulations, the paper-heavy administrative processes in Europe were seen as an additional hindrance, as well as copyright law. Overall, it is evident that regulations, although generally welcomed, are perceived as significant obstacles faced by generative AI Startups.

> "Regulating generative AI and foundation models is necessary to protect the society, environment and the economy from unreasonable risks. The same rules should apply to all, EU-native or not, but models trained on non-EU data are less likely to be attuned to EU-users. Consequently, the EU Ecosystem should go 'all in' to give rise to local champions in generative AI who can compete on a global scale and thereby foster Europe's safety and sovereignty by local innovation."

Dr. Till Klein,
Head of Trustworthy AI, appliedAI Institute for Europe

As such, Startups require detailed expertise and clear guidelines on how to implement the requirements of the EU AI Act, especially with regard to use-case specific risk-classification[9].

Non-regulatory legal matters: A small number of generative AI Startups indicated that non-regulatory legal matters pose a major challenge. Specifically, respondents noted that potential clients are hesitant to adopt generative AI solutions due to potential legal implications that are difficult to evaluate. One generative for instance noted that "GDPR, data protection and further policies are sometimes extremely hard to push through." This is a significant concern as proper compliance with regulations is crucial for the success of Startups and an essential cost factor.

Specifically, IP issues pose a substantial challenge for generative AI Startups, primarily due to the intricate nature of AI technologies and the potential for inadvertent infringement. Generative AI often involves building upon publicly available data. As a result and partially also due to the novelty of this issue, generative AI Startups seem afraid of encountering legal complexities and the risk of lawsuits. Indeed, the high costs for securing and defending IP rights can strain the limited resources of startups.

Security: Regarding security, the main challenges refer to high costs of hiring external consultants and the need for additional resources to build secure applications. One startup pointed out that customers often request more security options in their products, but the company lacks the resources to fulfil these demands. This sentiment is echoed by another Startup which stated "It is hard to impossible to prove to customers that their data is safe end-to-end when interacting with our models."

Additionally, one Startup explicitly addressed the challenge of being targeted by foreign countries or hackers due to their work in the defence sector. This highlights the importance of additional security measures and support for Startups which may handle highly confidential information.

Lack of a level playing field: Many generative AI Startups face various challenges and obstacles when it comes to competing in

the global market. One of the most prominent obstacles mentioned by the startups is the lack of a level playing field. For example, one generative AI Startup specifically noted this disadvantage, stating that "US players don't have the same constraints and leverage deep integration of the current product to push new AI service at cost or at loss." This makes it especially difficult for Startups to compete against heavily funded players from the US.

In addition, generative AI Startups face difficulties due to overbearing tax structures and compliance requirements, which makes it difficult to compete with the US. Another obstacle mentioned is the significant amount of funding and data available to US tech-giants, making it hard for European generative AI Startups to compete with their resources.

Furthermore, Startups often struggle with the legal and documentation efforts required and ultimately lose out to incumbents with inferior offerings as a consequence. One Startup highlighted this issue, stating, "We can't afford the legal and documentation efforts as a Startup, and lose out to incumbents with inferior offerings as a consequence." This is a significant disadvantage for generative AI Startups trying to break into the global market.

Additionally, as already outlined previously, there is a scarcity of funding compared to the US. For example, one generative AI Startup mentioned that "Regarding regulations that allow us to work with new technologies, the environment in Germany is rather restrictive compared to other countries. Additionally, funding is scarce compared to the States." This again makes it challenging for Startups to compete with other players on a global scale.

Lastly, another obstacle Startups face is the economies of scale for large companies. Startups have a significant disadvantage due to the resources and market position of large companies. One Startup highlighted this issue, stating, "Big actors are adopting tech faster, but there are no middle-ground

actors gaining traction in the masses." This makes it challenging for Startups to establish themselves in the market, especially when competing with established players.

Overall, generative AI Startups face various obstacles, including a lack of a level playing field, challenges with regulations and adoption of new technologies, limited funding, and economies of scale for large companies. These obstacles hinder their growth and success in the market and require significant efforts and resources to overcome. As one Startup noted, "The road to success is steep, but with

> "Generative AI Startups are pivotal for Europe's competitiveness and innovation, as they spearhead new technological advancements, stimulate economic growth by creating new markets and jobs, and ensure Europe remains a key player in the global technology landscape. Generative AI's role in pioneering and applying cutting-edge AI techniques is essential for maintaining and enhancing Europe's position in the global tech arena."

Elijah Aldana,
Startup Community Manager, Ignite Sweden

perseverance and innovation, we hope to overcome these obstacles and thrive in the ever-evolving AI market."

Other: One noteworthy additional topic emerged regarding the challenges generative AI Startups are faced with. Specifically, a number of Startups mentioned that "client access" is a major hurdle they often encounter. As such, Startups struggle gaining access to major companies, which highlights the necessity of an increased matchmaking between European generative AI Startups and (European) SMEs and larger corporations.

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[8] The provisional agreement on the Artificial Intelligence Act was reached in December 2023, i.e. after the survey was conducted. As such, some of the generative AI Startups participating in the survey may have altered their assessment of the regulatory impact of the Artificial Intelligence Act.

[9] A detailed assessment of the impact of use case specific risk assessment was published by the appliedAI Initiative GmbH (2023). For further information, please cf.: AI Act: Risk Classification of AI Systems from a Practical Perspective, https://aai.frb.io/assets/files/AI-Act-Risk-Classification-Study-appliedAI-March-2023.pdf.

Major Challenges of European Generative AI Startups
The survey results indicate a predominant reliance on cloud-based resources among respondents with approximately two-third of the European generative AI Startups relying on cloud infrastructure. In contrast, only 16,2% of the European generative AI Startups indicate the use of on-premises infrastructure, emphasising a preference for maintaining control over their computing environment or addressing specific data security and compliance considerations. Moreover, 16,2% of the European generative AI Startups employ a hybrid approach, combining both cloud-based resources and on-premises infrastructure.
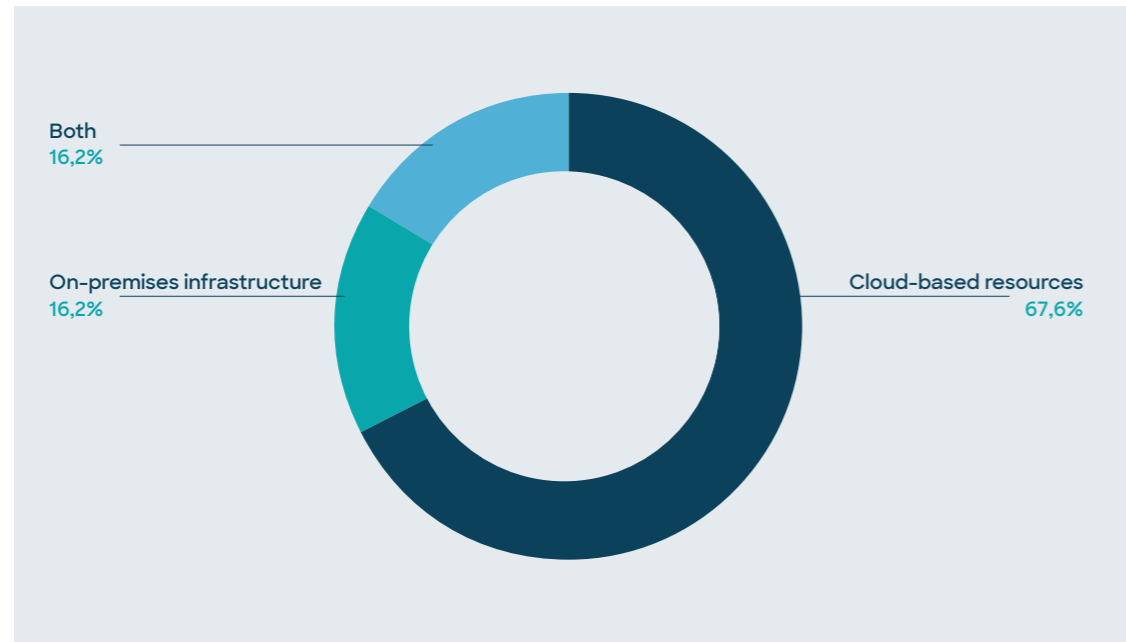

Figure 15: Cloud-based resources vs. on-premise infrastructure
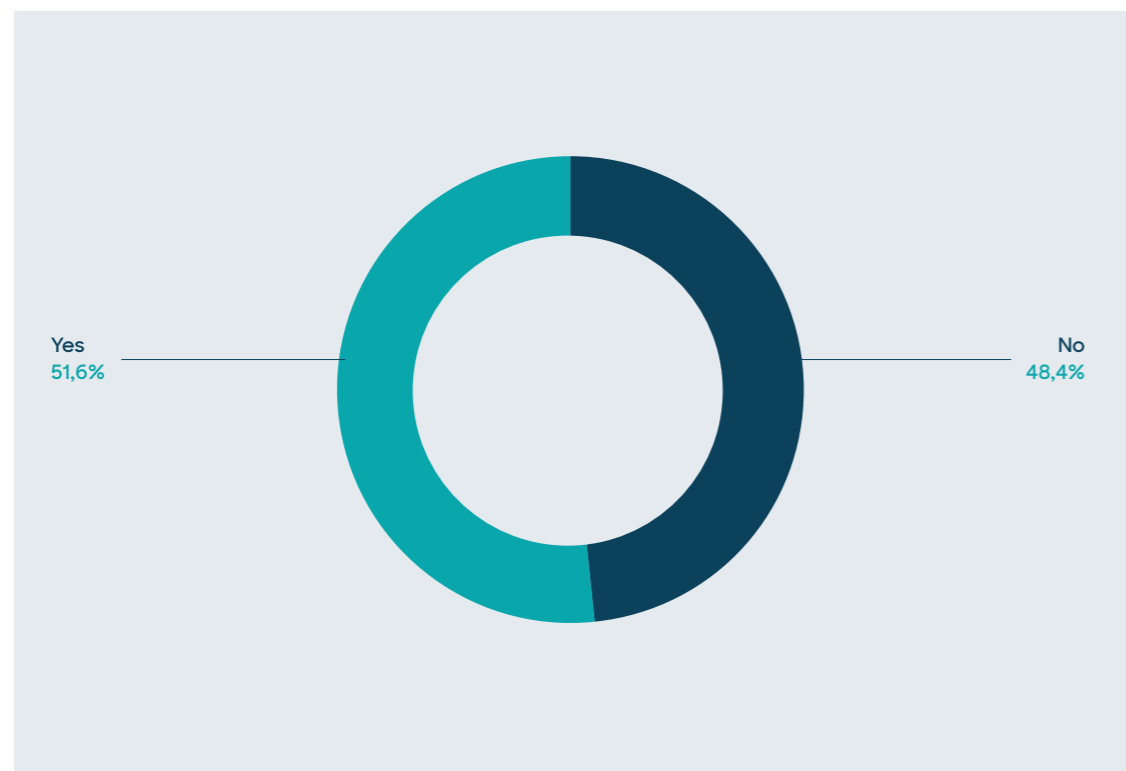
EuroHPC JU access

Figure 16: Percentage of gen. AI Startups requiring EuroHPC access
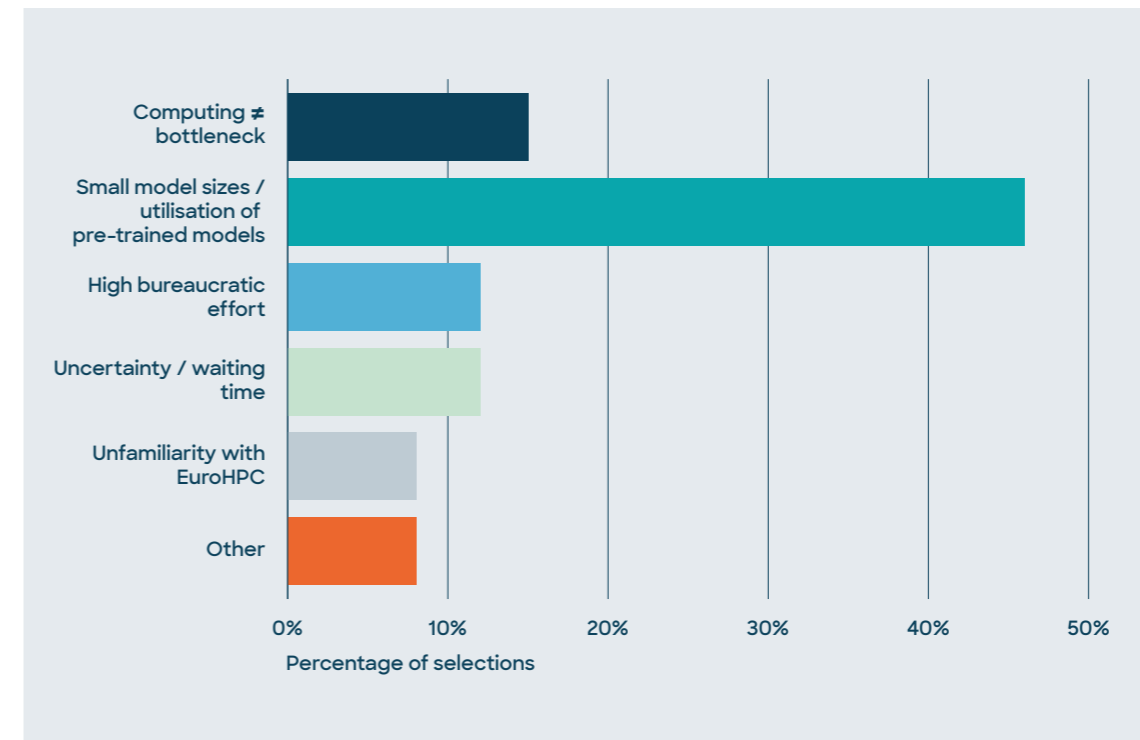

Figure 17: Reasons for not requiring EuroHPC access

The survey data indicates that approximately half (51,6%) of the European generative AI Startups respondents would like to access the EuroHPC JU's supercomputers to train their models. This insight underscores the significance of computational resources for the development and refinement of generative AI models. On the contrary, 48,4% of the respondents express the view that such access would not bring any (perceived) added value to their Startups. The European High-Performance Computing Joint Undertaking is an initiative of European states and private partners aimed at advancing high-performance computing in the European Union. Currently EuroHPC has procured nine supercomputers Lumi, Leonardi, Marenostrum 5, Meluxina, Karolina, Discoverer, Vega, Deucalian, and Jupiter. These computers offer a high-level of computing power to European companies which is crucial for addressing complex scientific problems and training large language models.

The most common reason for not needing access to one of the supercomputers was that this is not required due to comparatively small model sizes or utilising pre-trained models (46%). Moreover, 15% of the Startups noted that computing is not a major bottleneck for their operations. 12% of the respondents highlighted that the bureaucratic effort for applying for access to the EuroHPC JU's supercomputers to train their models is perceived as too high. Furthermore, 11% of the responding generative AI Startups claimed that the uncertainty about the specific benefits/ process of applying as well as the overall waiting times for receiving access are perceived as too high respectively uncertain. Additionally, a number of respondents (8%) indicated that they are unfamiliar with the EuroHPC JU's supercomputers, which highlights the necessity of raising more awareness among generative AI Startups about this possibility. At last, 8% of the respondents not requiring access noted "other" reasons, which predominantly refer to possible technical restrictions.

05. Accelerating the European Generative AI Ecosystem

Based on the in-depth analysis of the European generative AI Startup Ecosystem, a number of areas for action to protect and accelerate the development of generative AI "Made in Europe" emerge:

1) Building Trustworthiness around Generative AI

Despite the fact that the European Union is leading the world with respect to trustworthy AI – for example, displayed in the EU AI Act – firms remain hesitant to adopt generative AI solutions. As one founder put it "Trust is key: Otherwise, the customers are not willing to provide critical data of processes and internal documents for training / processing of AI models." Some of the challenges that businesses are facing can be explained by lack of trust regarding the safety and explainability of AI solutions as well as a lack of understanding about the specific impact and technical functioning of generative AI.

While on the one hand firms need to be guided on establishing confidence in the trustworthiness of generative AI solutions, it must also be ensured that these solutions themselves are deserving of trust. The focus should remain inventing and making radical innovation possible within a trustworthy regulatory framework as laid out by the EU AI Act.

> "Generative AI Startups are crucial for maintaining competitiveness and driving innovation. By quickly identifying new approaches, Startups not only advance technology but also create new employment opportunities and help retain top talent in Europe. The increase of skilled professionals fosters a dynamic ecosystem, strengthening Europe as a global leader in cutting-edge and trustworthy AI solutions."
>
> **Martin Svensson,**
> Managing Director, AI Sweden

To achieve this, establishing the following processes could be considered:

a. Accelerate the setup of the AI Office to enable timely support for generative AI Startups
b. Invest in the development of open products and services that lower compliance cost and reduce time to compliance
c. Draw on Europe's generative AI experts to staff the scientific panel at the AI Office

This would build additional trust about generative AI and, as a consequence, increase the rate of adoption by companies. Noteworthy, startups cannot be left alone with the resource-consuming certification tasks but require close guidance as well as additional resources.

2) Attracting VC to European Generative AI Startups

As extrapolated from the data, financial support remains pivotal for generative AI Startups. A demand for increased funding mechanisms including grants, funding programs tailored for early-stage Startups, and better routes to access funding were explicitly mentioned. This component underscores the importance of substantial and accessible financial resources in accelerating the research, development and innovation within the European generative AI ecosystem.

European policymakers already support a number of significant funding initiatives which have increased the number of (generative) AI Startups over the past years. However, in comparison with other countries, European countries still lag behind in terms of VC funding. When comparing general AI Startup investment between countries, the United States leads the EU nearly eight-fold (OECD).[10] When zooming in on generative AI, the cumulative difference in venture capital investment rises to over a hundred-fold. Not surprisingly, a chief concern of generative AI Startups in Europe remains funding. To close the gap even further Europe will require a multifaceted approach between investors, policymakers, and the startup ecosystem.

> "Knowledge and experience in the field of generative AI is necessary to evaluate startups and their solutions. Thus, strong partners, a trusted ecosystem and high-quality ressources are the essentials for fruitful decisions and investments. For this, additional support is needed from experienced experts to foster the European AI Startup Ecosystem."
>
> **Dr. Frauke Goll,**
> Managing Director, appliedAI Institute for Europe

A successful approach includes enhanced matchmaking activities between European generative AI Startups and internationally acting VCs. Moreover, as the generative AI Startups participating in this study highlighted, there seems to be a lack of understanding of the development costs for generative AI among VCs, making it difficult for generative AI Startups to secure the funding they need. Thus, it seems vital to further enhance the technical competencies of potential investors as well as to enable Startups to better explain their business models to non-technical audiences.

3) Incorporating Generative AI in Public Procurement

To boost generative AI Startups and to accelerate trustworthy AI adoption in Europe, public institutions could pose as a huge domestic purchaser to support the establishment of a European generative AI market by adopting AI trustworthy applications in public-sector processes. So far, the purchasing power of the public sector has been underutilised. As one founder stated "The EU should use their purchasing power to become a consumer of generative AI applications. Using more data-centric services would be a huge boost to innovation." Indeed, the employment of generative AI offers huge opportunities for the public sector.[11] For example, a recent study estimates the global productivity value of generative AI at approximately $1.75 trillion across the public sector.[12]

Indeed, the use of trustworthy AI in European public services would not only boost Startups but also significantly enhance the establishment of a powerful European generative AI economy. Moreover, the use of generative AI in public services will require developers to adhere to regulations, transparency and fairness which will in turn enhance the trustworthiness of generative AI solutions.

> "The high demands in the public sector requires generative AI Startups to raise their quality to higher standards, which they can leverage with customers in the private sector as well. However, such initial efforts for the AI Startups are only sustainable if public procurement departments are skilled, authorised and resourced to acquire AI-based services in general and from startups in particular. This way, public purchasing can not only foster AI Innovation, but also enhance their citizen-oriented services."
>
> **Dr. Till Klein,**
> Head of Trustworthy AI, appliedAI Institute for Europe

[10] Source: OECD.AI (2023), visualisations powered by JSI using data from Preqin, accessed on 14/12/2023. https://oecd.ai/en/data?selectedArea=investments-in-ai-and-data&selectedVisualization=vc-investments-in-ai-by-country

[11] For further information, cf. Farrell, E., Giubilei, M., Griciene, A., Hartog, E., Hupont Torres, I., Kotsev, A., Lobo, G., Martinez Rodriguez, E., Sandu, L., Schade, S., Strotmann, M., Tangi, L., Tolan, S., Torrecilla Salinas, C. and Ulrich, P., Artificial Intelligence for the Public Sector, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-04011-9, doi:10.2760/91814, JRC133826.

[12] Source: BCG (2023): Generative AI for the Public Sector: From Opportunities to Value, accessed on 14/12/2023. https://www.bcg.com/publications/2023/unlocking-genai-opportunities-in-the-government

To achieve this, establishing the following processes could be considered:

a. Define use cases where trustworthy generative AI can add value to European public services and encourage procurement in those areas. This would incentivize companies to begin customising building solutions toward these specific use cases.
b. Create a framework for innovation partnerships between public entities and generative AI technology providers. This could take the form of joint projects and research collaborations.

4) Access to High-Performance Computing

Access to computing remains a significant challenge for European generative AI Startups. The European High-Performance Computing Joint Undertaking (HPC JU) program is a great opportunity for generative Startups to increase their computing abilities. However, according to the responses of our survey, the perceived supply still does not meet the demand. Startups consistently emphasise the need for increased access to high performance computers. As one founder put it, "access to GPUs (graphics processing units) would open up an entirely new ballpark" for them, while another stated "We require support from European R&D Facilities with generous computing power to train powerful frontier models within clear, concise and not too detailed regulatory environments." Indeed, this survey revealed that approximately half (51,6%) of the European generative AI Startups respondents would like to access the EuroHPC JU's supercomputers to train their models.

> "Investing in the European startup ecosystem is crucial for advancing ethical AI that focuses on human values, and it's also key for encouraging teamwork between governments, academic institutions, and businesses. This combined effort, supported by strong policies, is essential for boosting Europe's AI industry."

Miriam Veronesi,
Chair of the Startup and Scaleup group,
Dutch AI Coalition AI Governance/Ethical
Business Lead, TNO Vecto

Generally, it seems alarming that 46% of the generative AI Startups not requiring access note that this is due to comparatively small model sizes or utilising pre-trained models. While using pre-trained models can reduce costs as the Startups don't have to build and train foundation models themselves, these services are currently largely offered by tech companies which predominantly come from the US, which means that European generative AI Startups relying on such services are often bound to these Non-European tech companies. As such, large parts of the generative AI value creation therefore created overseas. Moreover, for European generative AI Startups relying on these services, switching to training their own models would require additional resources. Indeed, Startups participating for example in inception programs of large tech companies are often locked in to these companies.

Based on this as well as due to the several reasons mentioned in our analysis for not requiring access to EuroHPC JU's supercomputers, the following steps to change these preconceptions may be taken into account:
a. Allocate a sufficient amount of HPC resources specifically to European generative AI Startups.
b. Minimise bureaucratic effort and facilitate the overall application process, so that AI Startups can focus their resources on developing novel technological solutions.
c. Establish clear and transparent guidelines for selecting eligible generative AI Startups, e.g., via establishing a neutral and objective jury that assesses all Startup applications on a regular basis. The timeline between application for EuroHPC JU access and a final decision by the jury needs to be as low as possible.
d. Provide specific research grants for Startups to access computing resources.
e. Increase visibility of EuroHPC JU across the European generative AI Startup ecosystem.

5) Accelerate European AI Startup Ecosystem Development

Harmonising the European AI Startup eco-systems is crucial for the growth of trustwor-thy AI innovation and achieving economies of scale. Many issues that Startups face - such as funding, talent, and market access - could be mitigated with greater conne-

ctivity to other ecosystems. Additionally, by becoming an active participant in level-ling the conditions for Startups, regulato-ry disconnect will be diminished and the di-alogue between regulators and innovation stakeholders will strengthen.

The European AI Startup Landscape[13] has begun the initial steps of providing an in-depth analysis of the European AI Startup ecosystem. This mapping is an important first step to gaining a deeper understanding of the state of AI innovation in Europe and to build a European AI community. Increasing the links between different European actors is essential to avoiding fragmentation and to benefit from the idiosyncratic expertise each country is equipped with. As such, the logical next step is to further strengthen the links between the European ecosystems as well as to provide opportunities for Startups and investors from different ecosystems to collaborate on a European level. To achieve this, establishing the following processes could be considered:
a. Strengthen the activities of the European AI Startup Landscape and integrate additional European partners.
b. Conducting regular assessments of the state of AI application, exploring the European AI Startup ecosystem, startup challenges and bottlenecks in various industries and following trends over time to enable targeted decision-making processes.
c. Supporting events that facilitate match-making between startups, investors, and industry stakeholders.
d. Establish public-private partnerships to leverage resources, expertise, and networks for the benefit of AI Startups.

6) Further enhance Data Accessibility and Data Sharing

A conspicuous theme that emerged from the responses is about data - its accessibility, utilisation, and the ability to share within the industry for collaborative projects. In a data driven economy, there is an increasing risk that data is accumulated in few companies. Such a data divide is not only harmful for competition but can also serve to reinforce biases within AI technologies.

Access to quality datasets is a significant challenge for small and medium sized Startups in training foundation models.

AI Startups in Europe have particular chal-lenges in finding data due dependence on US providers, legal uncertainty surrounding per-sonal data and limited European language data. This makes access to large high quali-ty datasets for European companies difficult. Indeed, AI Startups called for actions like the provision of dataset access and encouraged the creation of an environment where indus-try participants could share data and experi-ment collaboratively. This need stems from the fact that generative AI, like other forms of machine learning, is heavily dependent on large volumes of quality data for the training and fine-tuning of models. Moreover, data is critical not only for training AI models, but also for evaluating model performance and refin-ing them over time. As such, facilitating better access to diverse datasets, while ensuring adherence to privacy and security guidelines, can be a significant accelerator for the growth of generative AI in Europe.

Furthermore, the creation of "playgrounds" where data can be shared and models built collaboratively can help in fostering open innovation, promoting knowledge transfer, and amplifying the pace of AI advancement. An environment that enables secure, compliant data sharing and access could significantly stimulate creativity, experimen-tation, and innovation among Europe's generative AI Startups.

The Data Act and the Data Governance Act already set important regulatory frame-works to position Europe at the data fore-front. Additionally, and explicitly providing AI Startups with additional resources, the following may be considered:
a. Create a centralised open data portal at the European level with improved access, sharing, and the reuse of data specifically for the purpose of generative AI.
b. Prioritise open datasets with labelled data to train foundation models.
c. Allow safe spaces for experimentation with datasets and release specific guide-lines for Regulatory Sandboxes.

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[13] For further information, please refer to the website of the European AI Startup Landscape: https://www.ai-startups-europe.eu/

[14] For further information, please refer to: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3491

[15] For further information, please refer to: https://digital-strategy.ec.europa.eu/en/policies/data-governance-act

6. Limitations

This study on generative AI Startups across four European countries (Germany, France, Sweden, and The Netherlands) offers several important valuable insights into the European generative AI Startup landscape. However, as with every study, there are a number of limitations which need to be mentioned.

Sample Representativeness: First and foremost, the representativeness of the surveyed sample may be a critical limitation. The study may not fully encapsulate the diversity of generative AI Startups in the chosen countries, given the fact that only four countries in the EU were analysed. However, the four countries that were analysed are considered to be the most important generative AI hubs in the EU and thus, one can assume that the results achieved can be generalized to the EU as a whole.

Survey Language: A second potential limitation revolves around the reliability of the survey instrument. As the survey was distributed exclusively in the English language, biases or misinterpretations from non-native speakers may occur (although this seems rather unlikely).

Self-Reporting Bias: Thirdly, the reliance on self-reported data from generative AI Startups introduces the potential for bias. Self-reporting bias refers to the potential distortion of information provided by participating Startups. Survey participants may be inclined to present their startups in a more positive light, whether due to a desire to attract investment, maintain a competitive edge, or simply present a favourable image. This bias could influence the accuracy and reliability of the collected data. To address this, the authors of this study externally validated the survey responses wherever possible.

Dynamics of the AI Landscape: Fourth, given the dynamic nature of the generative AI landscape, startup activities, market conditions, and regulatory environments may have evolved post-survey. For example, the provisional agreement on the Artificial Intelligence Act was reached in December 2023, i.e. after the survey was conducted. As such, some of the generative AI Startups participating in the survey may have altered their assessment of the regulatory impact of the Artificial Intelligence Act.

Self-Selection Bias: Self-selection bias occurs when individuals can voluntarily choose to participate in a survey, leading to a non-random sample that may not accurately represent the broader population. In the context of this study, some startups may be more inclined to participate than other startups. However, given the fact that the sample size represents a very large proportion of the total generative AI Startup population in the participating European countries, the results of this survey can most likely be generalised to the whole population. On the other side, this study only includes generative AI Startups that are still in operation. This means that failed generative AI Startups did not participate in this study, potentially resulting in an underrepresentation of challenges and obstacles faced in the European generative AI landscape. Moreover, this also accounts for European generative AI Startups that moved their headquarters outside Europe, e.g. due to a higher funding availability in other continents. Considering these facts may paint an actually more dramatic picture of the European generative AI landscape.

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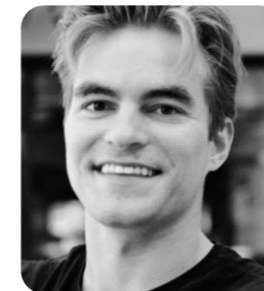
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Participating AI Initiatives

Initiator and Publisher:

The appliedAI Institute for Europe as non-profit organisation is the open-access accelerator for trustworthy AI and focussing on the empowerment of professionals to develop and apply latest AI technologies. It aims to strengthen the European AI ecosystem, develop knowledge around AI, provide research and trusted AI tools, and create educational and interactive formats around high-quality AI content. The appliedAI institute is a subsidiary of the appliedAI Initiative and a joint venture of UnternehmerTUM and Ipai (Innovation Park Artificial Intelligence). The appliedAI Institute for Europe is supported by KI-Stiftung Heilbronn gGmbH.

Contributors:

Hub France IA: Created in 2017, Hub France IA is a non-profit association that aims to unite the French AI ecosystem. The Hub France IA acts to accelerate the development and adoption of responsible, ethical and sustainable AI by the entire economic fabric.

AI Sweden: AI Sweden is the Swedish national centre for applied artificial intelligence. Our mission is to accelerate the use of AI for the benefit of our society, our competitiveness, and for everyone living in Sweden. We are broadly funded and not for profit, and we collaborate with speed and boldness in everything we do with our over 120 partners from the private and public sectors as well as academia.

The Netherlands AI Coalition: The Netherlands AI Coalition is a public private partnership in which the government, the business sector, educational and research institutions, as well as civil society organisations collaborate to accelerate and connect AI developments and initiatives. The ambition is to position the Netherlands at the forefront of knowledge and application of AI for prosperity and well-being. We are continually doing so with due observance of both the Dutch and European standards and values. The NL AIC functions as the catalyst for AI applications in our country.

Ignite Sweden: Ignite Sweden is a non-profit organisation that aims to establish tighter bonds between our vibrant startup scene, established companies and public organisations so they can initiate commercial collaborations. Our mission is to make it easier for startups to find their first large customer so they can grow their business.

Appendix A: Generative AI Startup Questionnaire

Introduction:

As part of the European Commission's ongoing efforts to promote technological advancement and strategic autonomy in Europe, the appliedAI Institute for Europe in collaboration with DG CONNECT is conducting a survey on generative AI Startups operating in the European Union. Additionally, survey responses will contribute to providing the appliedAI Institute with a more granular understanding of the generative AI start-up ecosystem in Europe. The results will serve as input to the innovation policy of the EC including its funding programmes. The results of this survey will be completely anonymous and the aggregate results will be shared with the general public.

The survey focuses on European generative AI Startups operating in at least Germany, France, Sweden, and the Netherlands. Start-ups located in different Member States are also welcome to contribute. Start-ups contributing to the survey can express their willingness to engage with the European Commission by sharing relevant points of contact. The European Commission may contact them at a later stage in case more detailed responses are needed.

This survey is conducted under the lead of the appliedAI Institute for Europe and supported by Hub France IA, AI Sweden, Ignite Sweden and The Netherlands AI Coalition.

1. When was your company founded?

2. Where is your company headquartered (city/country)?

3. How many employees does your company have?

4. What is the amount of your company's public funding?

5. What is the amount of your company's private funding?

6. Are you currently working on developing foundation AI models, such as the ones used in generative AI?
O Yes
O No

7. You answered yes that you are currently working on developing foundation AI models, such as the ones used in generative AI. If so, what are the main characteristics and focus of these foundation models?

8. Are you currently working on providing development tools and infrastructure for generative AI models?
O Yes
O No

9. You answered yes that you are currently working on providing development tools and infrastructure for generative AI models. If so, what is the focus of these tools and their infrastructure?

10. Are you currently developing downstream applications developed on top of existing large foundation models?
O Yes
O No

11. You answered yes that you are currently developing downstream applications on top of existing large foundation models. If so, in which branches of industry?

12. Where do you see your company's main opportunities?
O Increasing value of existing client relationships
O Acquiring new client relationships
O Responding to overall market demand
O Opportunity for competitive advantage in creating/improving foundation models or developing solutions in line with EU values and future regulation
O None
O Other (Please specify)

13. Does your company face any major challenges regarding…
O Financing
O Data
O Compute power
O Talent
O Regulation
O Non-regulatory matters
O Security
O Lack of a level playing field
O Other (please specify)?

14. What are your major challenges regarding…
O Financing
O Data
O Compute power
O Talent
O Regulation
O Non-regulatory matters
O Security
O Lack of a level playing field
O Other (please specify)?

15. What are the minimum compute needs/hardware requirements of your generative AI models? [This includes GPUs, TPUs, CPUs, memory, and storage.]

16. Are you using cloud-based resources or on-premises infrastructure?
O Cloud-based resources
O On premise-infrastructure

17. How many computing hours would your generative AI model ideally need in order to be trained?

18. Would access to a supercomputer to train your models such as one offered by EuroHPC JU's supercomputers bring down your computing needs/costs?
O Yes
O No (please explain why)

About the appliedAI Institute for Europe

The appliedAI Institute for Europe aims to strengthen the European AI ecosystem, develop knowledge around AI, provide trusted AI tools, and create educational and interactive formats around high-quality AI content.

As a non-profit subsidiary of the appliedAI Initiative, the institute was founded in Munich in 2022. The appliedAI Initiative itself is a joint venture of UnternehmerTUM and IPAI. The institute is managed by Dr. Andreas Liebl and Dr. Frauke Goll.

The appliedAI Institute for Europe focuses on the people in Europe. It pursues the vision of shaping a common AI community and providing high-quality content in the age of AI for the entire society. By promoting trustworthy AI, the Institute accelerates the application of this technology and strengthens trust in AI solutions.

With a focus on knowledge development, research and the provision of trusted AI tools, the appliedAI Institute for Europe provides a valuable resource for companies, organisations, and individuals looking to expand their knowledge and skills in AI. Through educational and interaction formats, the Institute enables an intensive exchange of expertise and fosters collaboration between stakeholders from different fields.

The appliedAI Institute for Europe invites companies, organisations, startups, and AI enthusiasts to benefit from the Institute's diverse offerings and resources.

The appliedAI institute is a subsidiary of the appliedAI Initiative and a joint venture of UnternehmerTUM and Ipai (Innovation Park Artificial Intelligence). The appliedAI Institute for Europe is supported by KI-Stiftung Heilbronn gGmbH.

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