Issues related to generative AI in Anti-monopoly Act and competition policy

# 1. Generative AI

## (1) Overview of Generative AI, Utilization Areas

Generative AI is a type of AI that generates various contents such as text and images in response to queries or work instructions ("Prompt"). Generative AI models are developed by creating foundation models that are pre-trained on a vast amount of base data and then fine-tuning them with a relatively small amount of data. Based on these models, various services utilizing generative AI that generate text, images, videos, etc. are provided.

Large technology companies called 'Big Tech' are also involved in the development of generative AI and the provision of services utilizing generative AI.

There are among generative AI, "conversational generative AI," which generates natural sentences and responds when users input voice or text, or "text-to-image generative AI," which generates images and illustrations when users input words or sentences. They have been rapidly evolving and spreading in recent years. They also have the potential to improve productivity in various industries and to change the way people live and work.

This is a social change similar to the IT revolution, which took place in the 1990s or the advent of full-text search, online malls, social networking sites, and smartphone applications since the 1990s. Some point out that there are already moves to change the game, such as having search engines implement AI functions, and that there are moves to drastically change the business structure. [*]1

## (2) Layer Structure of Generative AI Related Businesses

Generative AI related businesses can be roughly divided into three layers: (i) infrastructure supporting generative AI, (ii) development of generative AI, and (iii) deployment of generative AI, i.e. tools and services such as applications that utilize the developed foundation models or fine-tuned models.
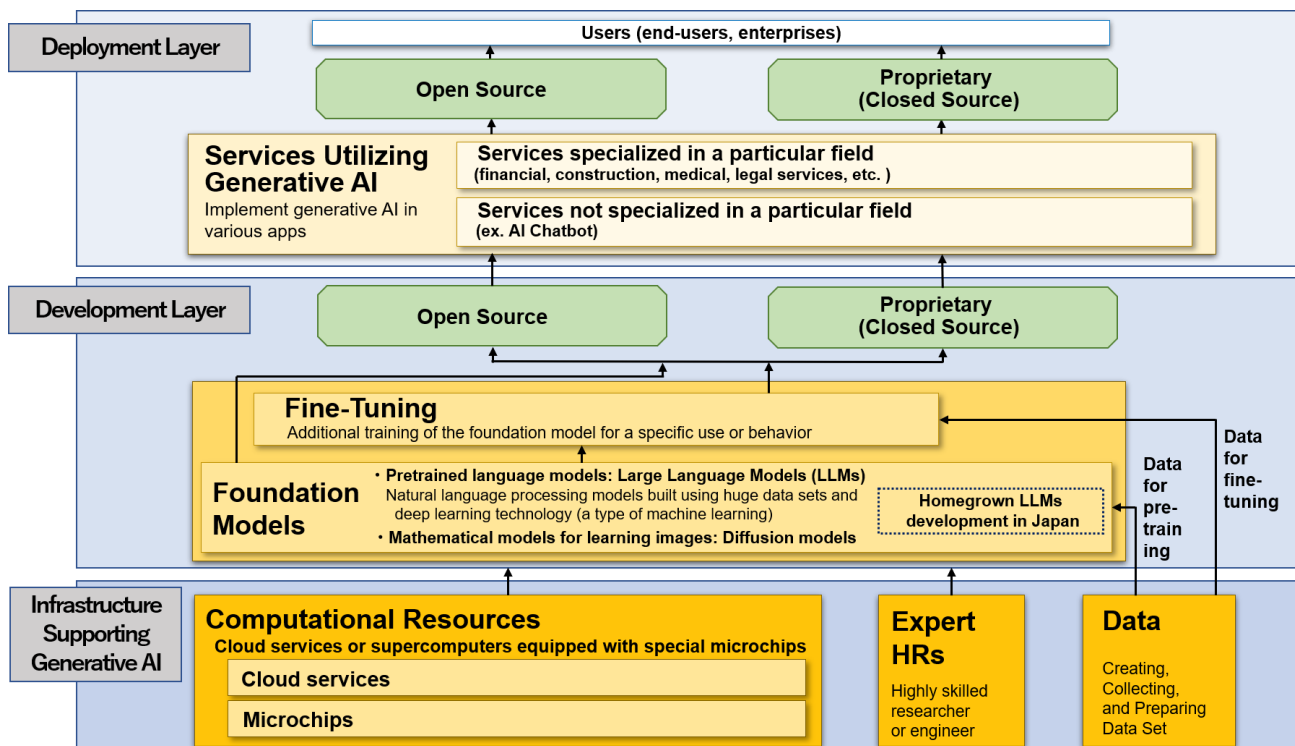


Source：CMA "AI Foundation Models: Initial review" (Revised by CPRC)

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1 Information and Communications Council Final Report on "Information and Communications Policy with a View to 2030" (June 23, 2023) (page 21)
https://www.soumu.go.jp/menu_news/s-news/01ryutsu20_02000001_00007.html

### a. Infrastructure supporting generative AI

There are three infrastructure supporting generative AI: Computational resources, Data, and Expert human resources.

### Computational resources

In order to perform effective pre-training, a large amount of computational resources is required, and special microchips, which accelerate the operations required for machine learning, and cloud services or supercomputers equipped with them are required. Developers who do not have their own computational resources develop by receiving cloud services from cloud service providers. [*]2

### Data

In pre-training of foundation models, it is necessary to use a large amount of data to build knowledge.

While fine-tuning does not require a large amount of data as in pre-training, it requires data specific to the purpose of improving the model. In doing so, significant effort and expense are required to preprocess, or cleanse, the data for fine-tuning.

### Expert human resources

Developing generative AI requires highly skilled researchers and engineers. This is true not only in the development of foundation models but also in fine-tuned models and the services utilizing generative AI.

### b. Generative AI development layer

This layer includes the development of foundation models that are pre-trained based on a large amount of underlying data. Foundation models include diffusion models to generate images and large language models (LLMs) that deal with natural language.

The form of offering is:

i. Open source software whose source code is published and can be modified, reproduced, and redistributed by the licensee under free licenses.

ii. Proprietary software (closed source software) whose source code is not disclosed and whose improvement and modification by the licensee are subject to restrictions. This type of the model is provided through APIs.

In some cases, large technology companies that provide cloud services necessary for the development of foundation models themselves or companies funded by large technology companies are engaging in the development and provision of the foundation models.

At present, major foundation models are developed and provided mainly by the United States companies, but there are also examples in Japan of developing and providing large language models, as well as R&D activities for technologies to efficiently perform large language models learning utilizing supercomputers. There, efforts are being made to learn Japanese language resources, but some point out that they are not as good as English models in terms of performance.

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2  It has been pointed out that the use of these computing resources to learn large language models (LLMs) generally requires enormous electricity consumption.

### C. Generative AI deployment layer

Many services utilizing generative AI in a wide range of modes such as text generation, code generation, image generation, video generation, and voice/music generation, have been developed by a large number of companies including startups, and are being provided to enterprises and general users.

In fact, services utilizing generative AI have been widely deployed in industries and fields such as finance, construction, medicine, law and so on.

There are examples of large technology companies that provide cloud services necessary for the development of generative AI themselves or companies funded by large technology companies in (i) using the cloud services to develop and provide services utilizing generative AI, and (ii) incorporating generative AI functions into their existing services.

## 2. Issues regarding the development, provision, and use of generative AI under Anti-monopoly Act and competition policy

### (1) Consideration of current competitive environment

The emergence of a new technology called generative AI has brought a variety of benefits, such as increased productivity of enterprises, provision of various services, and improved convenience for consumers.

#### Promotion and Diversification of Service Development

The active development and provision of foundation models have promoted the development of services utilizing generative AI to generate various contents.

Currently, there is a movement by leading large technology companies to develop highly versatile foundation models, and there are some cases where they provide such foundation models by integrating them into existing services such as their own search services or office applications, while permitting the use of such foundation models by other companies.

There are also some cases where companies except for major large technology companies develop and provide various foundation models such as image generative AI.

If these companies actively develop foundation models, competition in the field of development of foundation models will be promoted, and competition at various service levels will also increase, such as the development of services utilizing the foundation models and their functions being incorporated into existing services.

#### Existence of various options, including open source software

For business that provide fine-tuned models for a specific application, the ways to access foundation models mainly include (i) partnering with providers of established foundation models or using their API to pay for their use, (ii) investing capital to develop their own foundation models, and (iii) using publicly available open source foundation models.

In general, developing foundation models by themselves require high costs, so it is likely that foundation models are provided only by limited companies such as large technology companies with a bountiful capital. On the other hand, since various people can participate in the improvement and refinement of open source foundation models, there is a potential for models that meet various needs to be provided by various people and their quality to evolve.

The existence of open source models is considered to reduce the barriers to entry into the development and use of generative AI and to help ensure competitive environment. In particular, for new entrants and startups, which are

generally difficult to bear high costs, open source foundation models are considered to be crucial for maintaining entry and viability in the market.

On the other hand, the development of foundation models generally requires a large amount of resources, such as computing resources and electric power, and there are certain limitations on developing major foundation models in open source style. Therefore, in the future, rather than the emergence of countless foundation models, the trend may be to converge on infrastructure-based foundation models and use them through APIs. [*]3

This variety of options will ensure favorable competitive environments, such as enabling the entry of a variety of new enterprises, the promotion of new services and innovations, and the provision of a variety of options to customers.

## (2) Competition Policy Issues

The main issues related to competition policy discussed and observed during the research and dialogues with stakeholders to date are as following:

### Access

Pre-training or fine-tuning of foundation models requires large scale data set or specific data set for the purpose of use after fine-tuning. Enterprises that already have extensive access to the data set may already have strong competitive advantages that may last for a long time, and the difficulty of accessing the data set may be a barrier to entry for new entrants.

Business that already have extensive access to data set may restrict such access by new entrants, competitors, etc., thereby eliminating opportunities for competition by new entrants.

If providers of foundation models also provide services utilizing generative AI, competition in the field of services utilizing generative AI may be hindered by denying or restricting access to the foundation model by competitors in the field of services utilizing generative AI.

### Self-Preferencing

Providers of foundation models may develop the foundation models so that their own goods and services cam appear more favorably than others. Likewise, providers of services utilizing foundation models can treat their own goods and services more favorably in their services.

### Tying, Enclosing

A dominant player at one layer may tie together another service it provides at another layer, thereby inhibiting competition at that another layer.

For example, if a dominant player in cloud services ties together the use of its foundation model as a condition for providing its cloud services, the opportunity for competitors to compete in the field of foundation models may be compromised. In such a case, setting high fees for transferring data to other cloud services may restrict the emigration of customers.

Business combinations or alliances may be formed with the aim of incorporating technology or retained data, or of locking in highly skilled professionals.

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3 It has also been pointed out that providers of foundation models earn revenue through API usage fees, and users compete in terms of how to use the API to provide better services.

**Learning from Creative Data**

Large scale data used in the development of generative AI can include a wide range of creative data, including video, design, and audio, as well as written expression.

Such creative data may contribute to the development of various services and the realization of high-quality output as important inputs in the development of generative AI. On the other hand, since generative AI which learned by using such data is potentially in competition with creative businesses, the generative AI may establish and solidify potent competitive advantages over the creative businesses, resulting in undermining opportunities for competition for them.

## 3. Direction of approach

The technological progresses of generative AI have been remarkable. Therefore, competition authorities need to catch up with the rapid progress and make efforts to enable agile responses accordingly.

To achieve these ends, it is necessary to make continual efforts to understand the development and implementation of generative AI and the actual trends in transactions.