A Study on the Impact of Generative AI on Korean Economy Growth

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Abstract: This paper deals with studying strategy about impact of generative AI (Artificial Intelligence) on the factor of Korean economy growth. To study classification of impact factors Korean economy growth, we suggest dynamic equation of microeconomy and study methods on economy growth impact of generative AI. Next step is to suggest deep learning model to dynamic equation with Korean economy data with growth related factors to classify what factor is import and dominant factors to build policy and education. Generative AI give an influence in many areas because it can be implemented with ease as just normal editing works and speak including code development by using huge data. Currently, young generations will take a big impact on their job selection because generative AI can do well as much as humans can do it everywhere. Therefore, policy and education methods should be rearranged as new paradigm. However, government and officers do not understand well how it is serious in policy and education. This paper provides method of policy and education for AI education including generative AI through analysing many papers and reports, and experience.

Keywords: ChatGPT, Generative AI, Korean economy growth, Economic growth factors, Deep learning.

I.   INTRODUCTION

Nowadays, many areas are using ChatGPT to develop a new paradigm on how to do it and how much to use it for their business as well as industry after unveiled ChatGP 4.0 in March 2023 following ChatGPT 3.5 in Nov. 2022. The reports say its impact is over the steam of the 1700s.

Like these, ChatGPT developed by OpenAI is giving an impact on everything and everywhere in our community. The technology of this technology is not so high and difficult. Therefore, many companies and countries have a strong strategy to develop or how to use generative AI.

Basically, as this generative AI (ChatGPT: Chat Generative Pretrained Transformer AI) technology based on supervised learning, unsupervised learning, and reinforcement learning to train language, its model is also not difficult to understand technology. However, its impact is a very huge and is changing social as well as the paradigm of AI technology.

Generative AI has an influence on art, image, audio, music, and similar content. Of course, we cannot predict how much more do they have capabilities with continuously in the future. However, at least now, we see the its power in impact. Of course, a number of organizations are attempting to develop a new large language model (LLM) or a small language model (SLLM). They like to have an initiative advantage in economy and or capture knowledge property through solving customer services.

Generative AI model based LLM (Large Language Model) and TIM (Text-o-Image Model) is rapidly increasing for everywhere because a new generation of user-friendly tool (Generative AI: Chat GPT) is useful for texts, images, and videos.

About economic effect of generative AI, McKinsey, in June 2023, predicts the ramifications of generative AI such as automation by generative AI, heighten labor productivity by generative AI, higher education, and higher wages occupations.

That is, a new revolutionary AI of generative AI lead economic growth with the new content, AI collaboration swells, lifelong learning, and tasks. Its impact is wide and more profoundly in occupations such as content writers, translators, customer servers, marketing, legal professionals, document analyzer and makers, graphic designers, architects, artists, image generators, and visual content manipulation.

Some analyzers worry about its impact on all sorts of jobs and creativity that were previously thought to be human creativity and reasoning such as writing, drawing, analysis, music. However, its impact starts from everywhere.

Herein, what will generative AI impact on the economy in the future? some advanced countries and rich persons can have much chance to advance and property but underdeveloped countries and poor persons will not have a chance to survive because they do not prepare and do not consider to introduce. Even they do not know how much important generative AI. Basically, generative AI has an ability with human-like writing and additionally Google released Bard trained DALL-E2 model, which can generate images on demand by huge amounts of data. MS also developed another model LaMDA (it has two stages for trains like pre-training and fine-tuning with 1.56 trillion word, 137 billion parameters) for their completion against Google model (https://www.searchenginejournal.com/how-google-lamda-works/442064/#close).

MS announced Bing AI powered GPT-4 and they can use it on real time service. Also, many ventures and companies are trying to build new business by using these Chatbot technologies. That is, economic growth paradigms are changing because of this powerful generative AI and related technologies. The generative AI (Dinesh Katta, 2023) is a big power engine for economic growth and job changing.

As mentioned before, the generative AI is not complicated technology as we guess. However, with a passing day, these models are evolving and learning further based on their mistakes or new version.

The first aim of his paper is to provide study strategies on how generative AI and related technologies will impact on Korean economic growth and what factors will give an influence on Korean economic growth through analysing, and reviewing reports and papers. It is very important to understand and decide on how and what we have to do business, education, and decide milestones because of current confusion social and technological paradigm.

The second aim is to offer policy decision materials for government and official organizations or businessman because of almost case will be replaced by this generative AI.

II. THE IMPACT OF GENERATIVE AI

A. The Status of Generative AI

This AI technology has a very strong trigger role to develop new AI and has initiative in AI areas. There are several ChatGPT and related generative AI after releasing GhatGPT 3.5 and 4.0 for ChatGPT based technology. That is, many ChatGPT-based applications are developing it is changing for our economic growing pattern and job changing. This paper provides current patterns for ChatGPT technologies and its application.

B. ChatGPT of OpenAI

This AI technology has a very strong motivation to develop new AI and has initiative in AI areas (Dinesh Katta, 2023, (Liam Frady, May 2023). Fig. 1 shows the timeline of ChatGPT development. We can see on how competition is struggle from this figure. It means the event of ChatGPT is quite big impact on economic area and job changing.

OpenAI do open their parameter to train, but they guess that ChatGPT-3 175 billion parameters. About parameter, they describe like: GPT-1, 117 million parameters; GPT-2, 1.5 billion parameters; GPT-3, 175 billion parameters billion parameters (it is about 100 times larger than GPT-2). And ChatGPT has 170 trillion parameters (Arianna Johnson, Forbes Staff, March 2023).
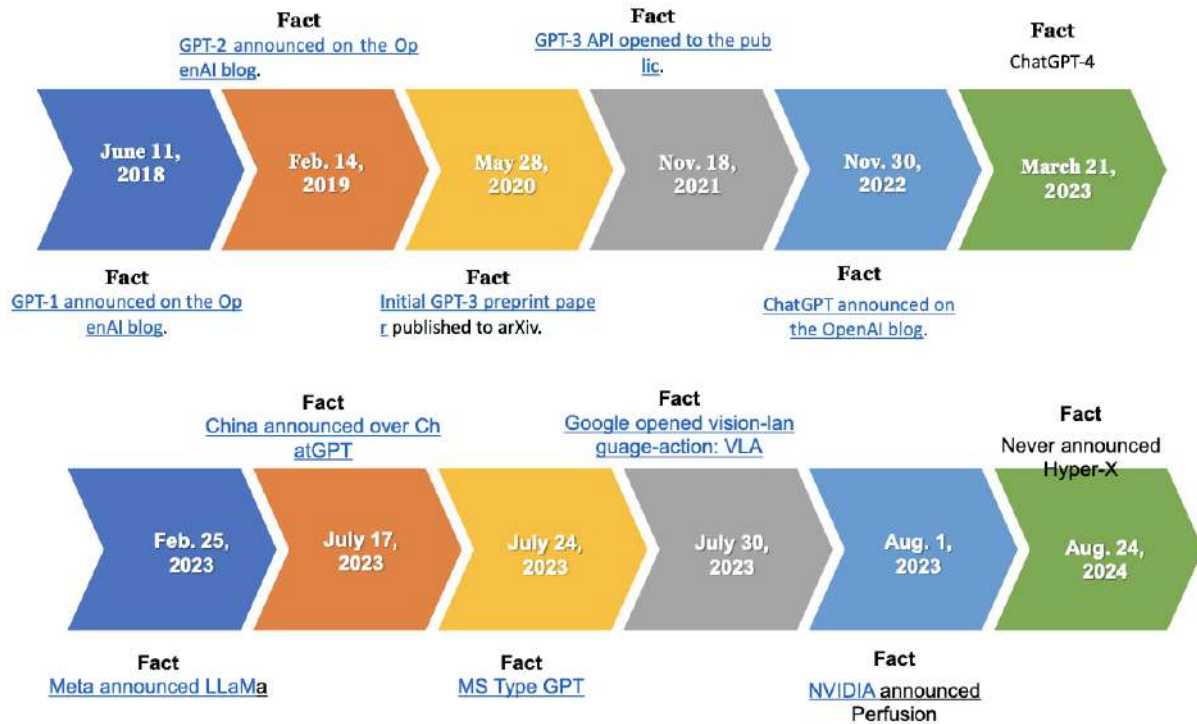
Timeline of Generative AI

Fig. 1. ChatGPT history.

In case of ChatGPT-4 (Sanuj Bhatia, March 2023), it has different parameter such as, positional parameter (it is function is to understand the order of words in sentence), learned parameter (which is making an accuracy of learning through weights and bias tuning), hyperparameters (Definition of the overall model structure and model behaviour), and model configuration parameters (definition of the number of layer and nodes in each layer).

The number of parameters in a language learning model means a measure of model capacity for learning and complex understanding. That is, a language model with more parameters can learn more detailed and nuanced illustrates of language. So, it allows model to generate more accurate and human-like sentence. However, it needs a vast amount of computing power and energy, and it can be overfitting (It starts to learn noise in the training data instead of the underlying patterns). The ChatGPT (Partha Pratim Ray, March 2023) has an impact for AI revolution in real for everywhere and for many. It is clear evidence that the AI revolution has real potential.

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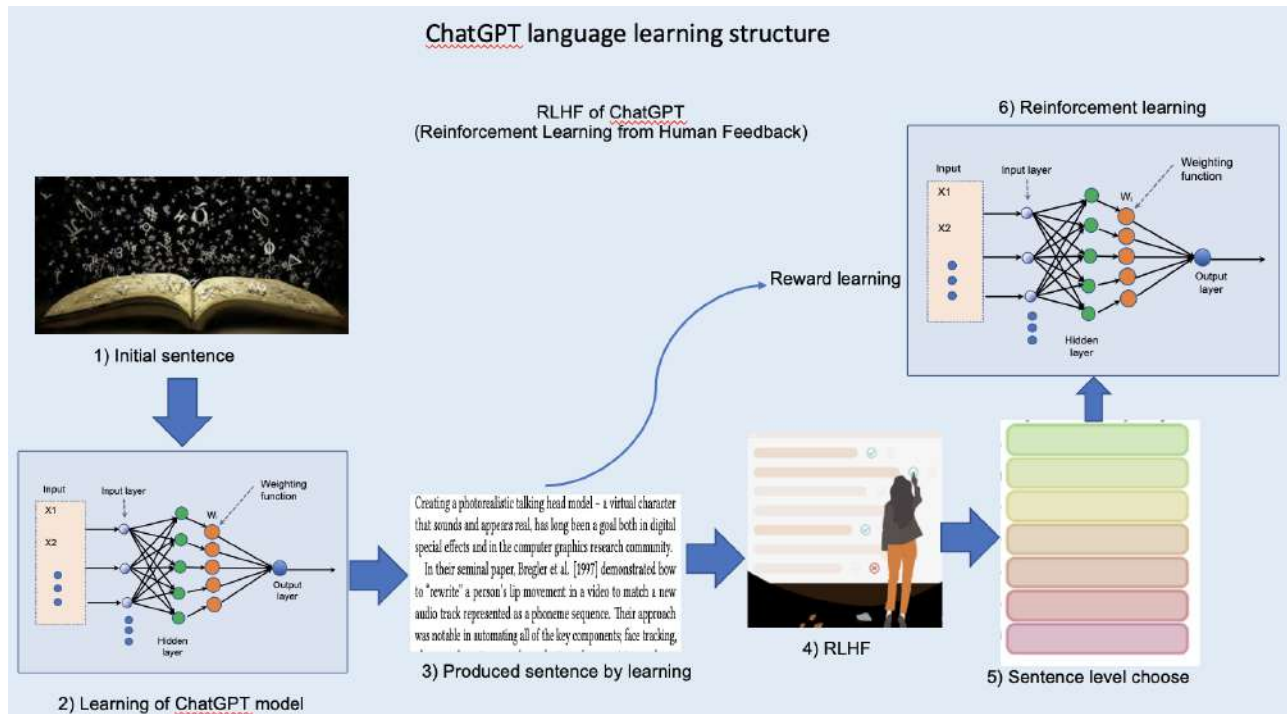

Fig. 2. Learning process of ChatGPT for sentence.

Fig.2 illustrates why GPT can understand well word and sentence.

MS decided to invest $ 10 billion in OpenAI to develop ChatGPT and introduce a new technology into their Bing search engine. MS also said that they invest a $250 million fund to develop generative AI for startups in March 2023.

There are some reports (MIT review, 2021) that generative AI will change such as jobs (especially, a leading expert on the impact of technology) and GAI (Generative AI) will give a big influence on education and expertise. Basically, the ChatGPT will change many things such as word conversion, image transfer (image to text or vice versa), storytelling, image combining (protection against fraud or fake), and others. Therefore, there is able to happen large-scale unemployment.

About this, they can say that replacement of job will be some social issues or problems unemployment. Despite this worry about GAI, AI developers will continue to provide human-like capability AI by their creation. And the other hand, using these related technologies, they can improve the productivity of their workforce, and many reports predict that GAI will extend trillions of dollars in economic growth. Because a majority of the economy is developed and boosted by knowledge and its related combination in the 4th wave.

Technologies depend on how to use this technology to transform businesses and make life as we did in the earlier revolution. It is, so far, just a little bit better to do the task because of the young age of AI. However, it will increase efficiency and productivity. It also will allow us to create new ideas and processes to develop for customers.

C. Microsoft 365 Copilot and Bing
Basically, ChatGPT is a natural language model to learn by using machine learning, deep learning, natural language understanding, and natural language generation to answer or conversation. It is designed to human conversation by understanding your question or question.

This technology can do well cover letters and resume, creating list, describe arts, write code, summarize content, song lyrics, and similar contents using stored data. However, ChatGPT cannot have the capability to search the internet and the most updated information.

As MS 365 Copilot provides AI-powered personalized assistance for tasks and activities, it does not just connect ChatGPT and combines the large language models (LLM) with user data in the MS graph such as calendar, email, chats, documents, meeting records, and others.

MS released ChatBing Feb. 2023 and it likes OpenAI in the search engine Bing. MS is extending to Chrome and Safari unlike they used only Edge of the browser of MS. MA also unveiled a tool called TypeChat to connect the gap between apps and natural language communication on GitHub on July 24, 2023 (https://www.onmsft.com/news/microsoft-introduces-typechat-empowering-apps-to-communicate-in-natural-language-with-users/). They have an intension to build super-smart AI that can understand human language through a special library of TypeChat that helps apps use language better. MS is studying robot control using ChatGPT as shown in Fig.3.

Fig. 3. Control structure of MS based on ChatGPT.

Google Bard the chatbot, which was released under AI just like ChatGPT on March 21, 2023 for conversation with human. ChatGPT can be used only on the web browsers but Google bard can help in doing tasks like planning a vacation, meal planning, finding some reservation, and etc.

D. Meta
Meta opened its LLaMa2 as open source, which was pre-trained using 7 trillion, 130 trillion, 70 trillion parameters on July 18, 2023. They announced that FAIR (The Fundamental AI Research) of Meta also is studying through cooperation with Boston Dynamics on July 26, 2023 (http://m.irobotnews.com). LLAMA Model (Version 1) was developed from Dec 2022 to Feb. 2023, which is an auto-regressive language model based on the transformer and it can be trained easier because it is a smaller parameter than another model.
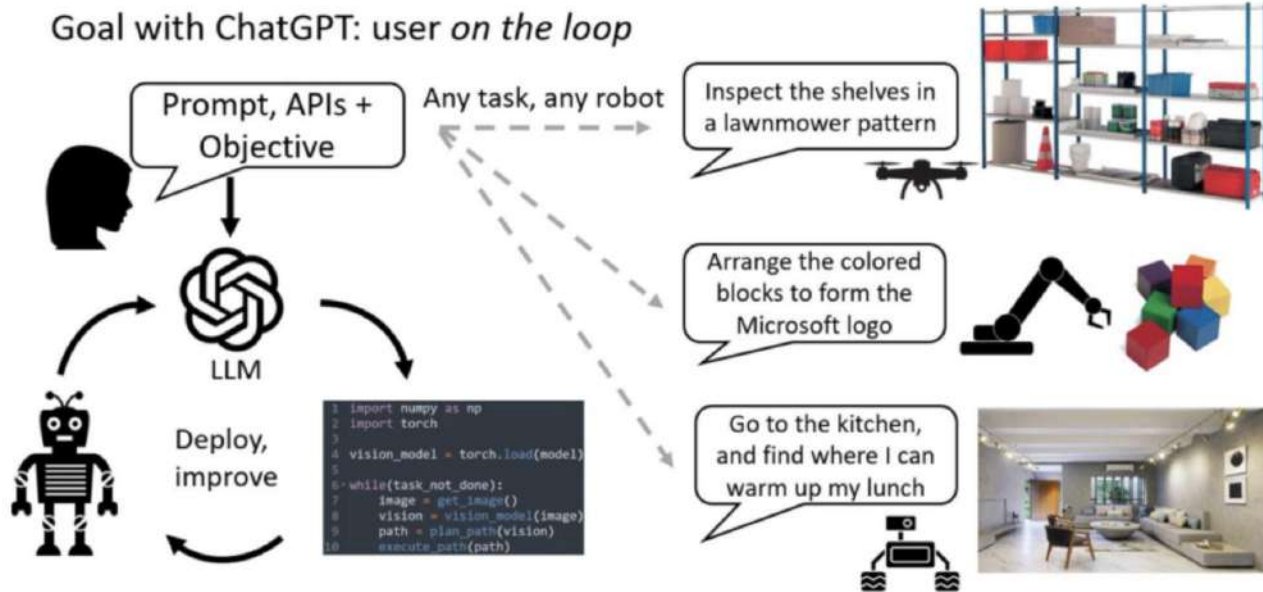
Fig. 4. AI robot of Meat can carry materials through conversation with ChatGPT.

MS vs. Google vs. Meta

Item	Microsoft	Google	Meta	Remark
Model name	Prometheus	LAMDA	LLaMA	
Open date	Feb 2023	May 2021	Feb 2023	
The number of Parameter	175 trillion	137 trillion	7 trillion 13 trillion 33 trillion 65 trillion	Meta: Source open Others: Not open
Service	Bing search Azure web	Bard (Google search)	Source open	
Description		mage (Muse) Music (AI MusicLM) Video (AI Imagen video)	Research 20 Language learning Service for content	

https://www.btcc.com/ko-KR/academy/financial-investment/meta-chatgpt-anti-ai-language-model-rama-released

Fig.5. Comparison MS, Google, and Meta of ChatGPT.

D. Other Chat Platform

There are other Chatbot platforms after releasing ChatGPT as we can see from Fig 1. It means its impact so big on the social, business, and job impact. For example, Google search with a text generator was opened by ChatSonic and AI. They also opened a test version of WriteSonic as free of charge, which lets users discuss topics in real time to create text or images.

The Jasper Chat platform enables content creators to specify keywords and tone of voice in users' prompts. Therefore, Jasper chat was focused on specially company's brand-relevant-brand content and conversations with customers.

YouChat is the AI chatbot of the German engine for fact-checking and source review. NeevaAI is a Germany search engine, which provides answers to quotes from original sources. Figure 6 shows the prediction of ChatGPT-based App, which will be developed in the future for their purpose quickly. As described in the previous section, ChatGPT will have an impact on many areas and jobs and replace their job patterns. Therefore, we must prepare and education will also be impacted from this related technology.

III.   THE ECONOMIC IMPACT OF GENERATIVE AI

Economic Growth Leading of Generative AI Techniques
As we mentioned earlier, many companies are developing generative AI for application models (Appl) as well as basic models, related technologies, and coding methods. Therefore, its impact on economic areas increases. Generative AI tools the marketing, art, industries, medical, and biotech as well as prediction and simple application, translation using GAN, transformer functions, and variational auto-encoders. When generative AI is inserted into robots, its results have much more impact on economic growth.

Fig. 6 shows how generative AI can give an impact on everywhere. How it is. First impact is closer technology and engineering and second influence will education, health, smart city, and others as shown in Fig. 6.
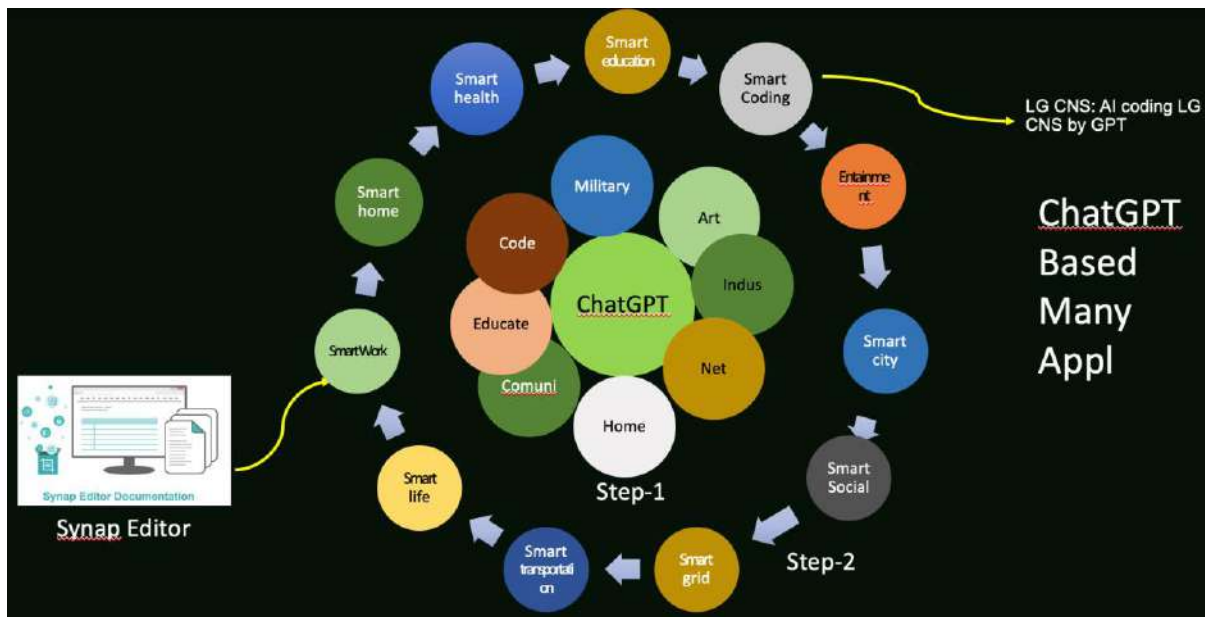

Fig. 6. Comparison MS, Google, and Meta of ChatGPT.

Developer and Technology areas
The S/W developer and high-tech developer area will paradoxically be one of the most risk or challenging job because of ChatGPt's good information and guidance for developing. Everyone must continuously work and update on their job areas (it is a skill). Without doing that, you will not have advantages for your works because ChatGPT will do general work and guidance.

ChatGPT will collect data easily for the market and researchers have to use their knowledge to analyze the market for the customer through social media for developers and analyzers. Then, ChatGPT will provide for you to understand various aspects such as the emotional makeup of users, political preferences, cultural choices, religious convenience, education level, local (region), etc. Now, ChatGPT-generated content is not allowed in official organizers. However, these trends stimulate a good social media strategy and will be allowed officially. Therefore, there will be risks and challenges in jobs of expertise and developer, jobs with a lack of creator, jobs of analytical skills, repeatable jobs, and traditional methods using simple skills as well as low-wage jobs. Of course, the economic leading factor will change.

Creator and Designer
Basically, a human has an idea that novelists and art, composers are unique for humans as well as the creators and designers such as interior designers and outdoor designers, picture drawers, novel creators, and storytellers. However,

these jobs will be impacted by ChatGPT because ChatGPT will make good overview conception and detailed thing. Especially, ChatGPT can use huge data and will make it immediately easier than humans.

By using unsupervised and supervised or reinforcement learning, generative AI processes enormous amounts of data to generate its own outputs by using network computing. Generative AI's abilities also go over human computing speed and high-quality content.

Through generative AI, computers can predict the most relevant patterns to input, allowing them to output corresponding content. During the training, a limited number of parameters are given to the generative AI models, enabling them to make their own conclusions and highlight features present in the training data. However, to get the most out of generative AI, human involvement is still essential, and that is both at the start and end of the training. It means creators and novelists will not be leading as economic growth impacts.

Arts

Artists such as music composition, drawing, and interior designers will be influenced by Generative AI. That is, AI is now frequently used in creative methods such as images, drawing, and using image data. AI-generated visuals of art models can be trained on a large number of paintings and later be used to generate new ones with similar features and slight variations in style as shown in Fig. 7.

Fig. 7. The drawing by Dali3 of OpenAI (https://www.aitimes.com/news/articleView.html?idxno=153832).

For instance, when we want our AI to produce similar materials to Leonardo Da Vinci, we just provide it with as many paintings of Da Vinci as possible. The model's memory functions take the characteristics of Leonardo Da Vinci's painting from painting to reproducing similar works. We can reproduce many ideas and materials that generate text, produce music, etc. through the same works. Another advantage of generative AI is that we change the feature we get to another one of the images and modify the different styles or specific areas of the image. This occurs when the generative AI

model copies the characteristics and aesthetic of your preferred painting and gives you an alternative version. It can also work with rough sketches or wireframes and offer a finalized version of the design.

Gaming
Generative AI can give many advantages to video games because generative AI easily gives levels of customer, dialogue patterns, entertainment areas. Generative AI can make new story through data-based experiences for players. Game's scenario can be developed by generative AI for game developers to train their generators to produce images according to the particular model of their games. Generative AI can give impacts for job pattern and economic growth factor.

Healthcare
Generative AI provides services for healthcare and medical to treatment idea and solution on time because generative AI has an analysis function and for healthcare applications such as MRI scans, CT, X-ray. Because generative adversarial networks (GANs) have a very powerful learning to create fake versions of underrepresented data, it can be used in training and developing a model. It means generative has powerful influences on healthcare.

Sound generation
Generative AI has function to classify audio data and musical genres or human voices. With this function, generative AI can transform from one genre to another one such as rock into classical music, and vice-versa. Generative AI-driven software engine generates new music, composition, making use of gestures, motions, codes, and much more. Generative AI will change music society patterns.

Media and advertising
Basically, generative AI can create and modify content through stored data. So, generative AI can change the media industry. It will change marketing technique. Generative AI can make better understanding for consumer level.

Generative AI and Policy
With the emerging of generative AI, many countries have policy and strategy for AI initiative. Fig. 8 shows the market size of generative AI suggested by market research.
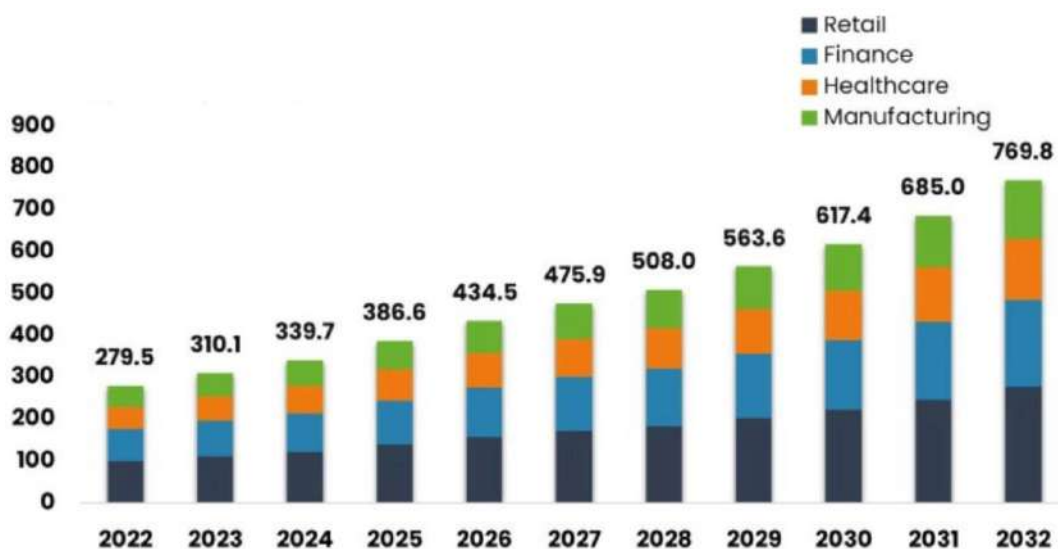

Fig. 8. The market size of generative AI (2022-2032 USD million, industry).

https://www.linkedin.com/pulse/generative-ai-sales-market-present-development-strategy-denis-green/

Major investments by Top 5 companies
Fig. 8 shows the market size of generative AI [ref.]. Apple's stock price increased by 36% in 2023. The company's growth was largely driven by solid earnings for a consumer slowdown. Microsoft's stock price rose by 37% in 2023. The company's growth was supercharged by the excitement over generative AI, a technology to which Microsoft has close ties. Alphabet, the parent company of Google, saw its stock price increase by 39% in 2023. Like Microsoft, Alphabet's growth was fueled by the hype around generative AI. Amazon's stock price grew by 44% in 2023.

The company's growth was largely driven by remarkably solid earnings that de260ed earlier expectations for a consumer slowdown. Nvidia, a leader in AI and graphics processing units, saw a massive surge in its stock price by 159% in 2023. The company's growth was driven by the excitement over AI-related advancements.

Job Patterns

The potential benefits of the generative AI are to transform technology by using confusion and speed up to developing terms. Generative AI also can easily estimate productivity growth using wide and huge data. It will give an impact on widespread adoption and add trillions of dollars a year to global economic output (WJS).
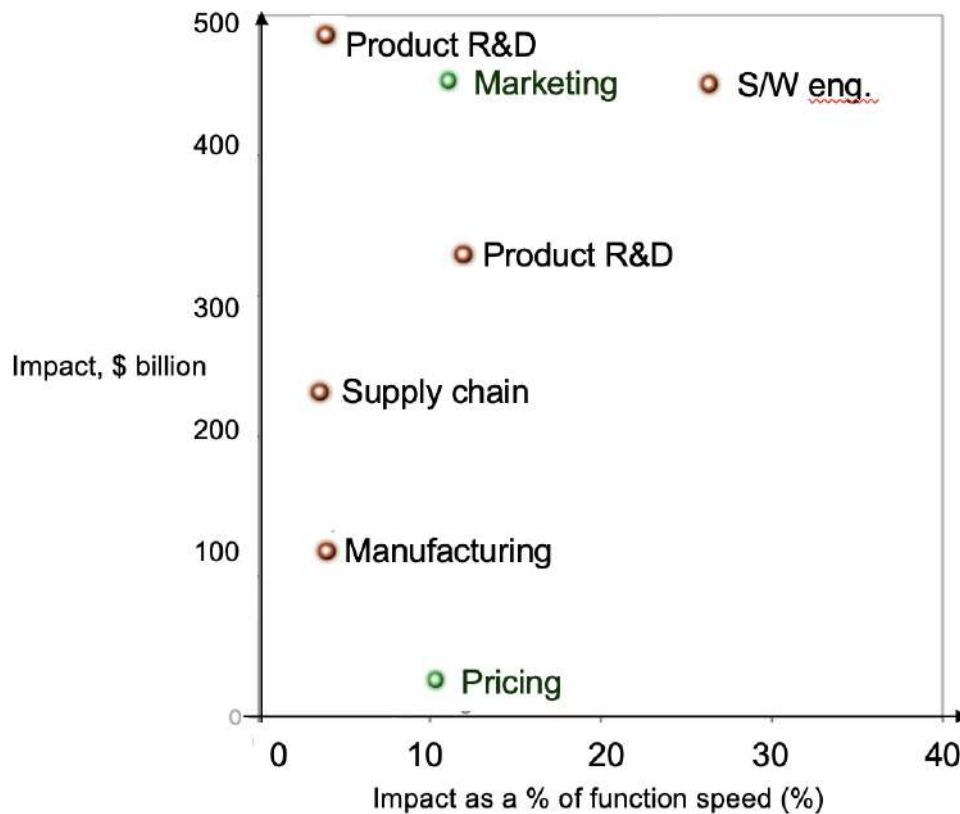
Fig. 9. Generative AI impact on each area.

Fig. 9 presents on how impact will give areas by generative AI. ChatGPT-based technology will be popular application and will take tasks from millions of employees higher than jobs have been diminished by only factory or warehouse robots. It means so-called knowledge workers and white-collar professionals will feel more pain because of these fusion technologies based on generative AI.

Applications of generative AI ready to penetrate into business, medical, legal documents, art, design, and so on. Many startups of generative AI develop chatbots system as well as generators for text, computer code, images, video, design, voice and music. Illustrators, healthcare workers, actors, educators, legal researchers, office workers and drug-company technicians could be the first occupations threatened with this new form of this AI.

Generative AI can play a crucial role using data-driven decisions and taking effective action. Research estimates that generative AI adoption in marketing reveals the potential saving of 40% of the average workday.

McKinsey's latest research estimates that generative AI and related technologies have the potential to absorb 60-70% of employees' time today.

As Fig. 9 is results reported by Mckinsey, the impact of generative AI by business functions do vary but the report notes very compelling specific examples: Generative AI could increase sales productivity by 3-5% of current global sales expenditures. Across 63 use cases, generative AI has the potential to generate $2.6 trillion to $4.4 trillion in value across industries.
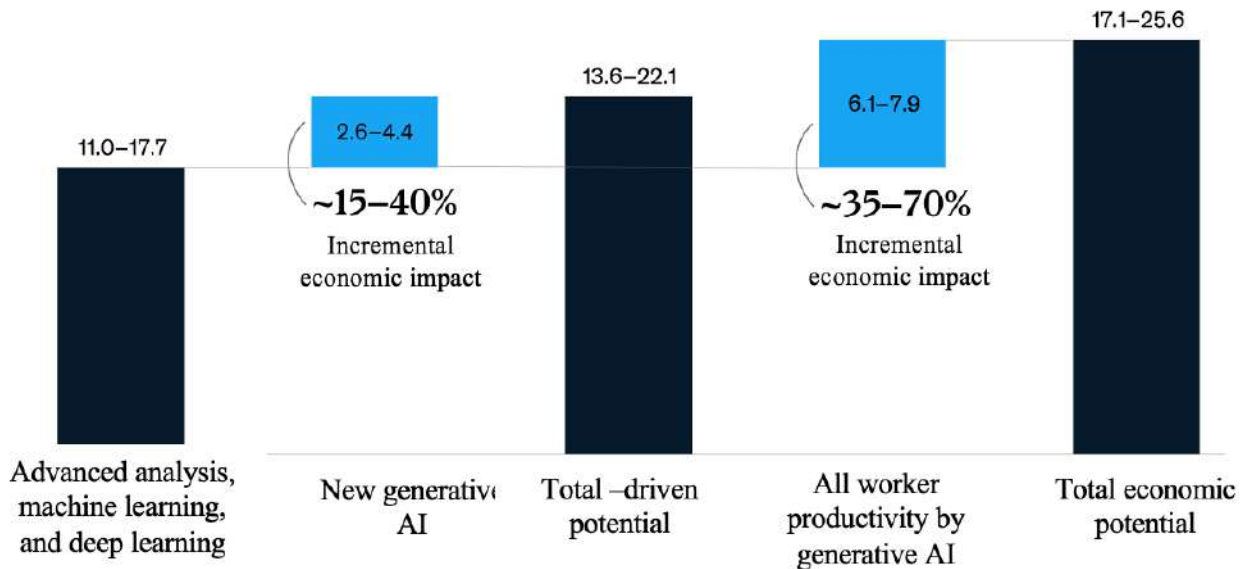

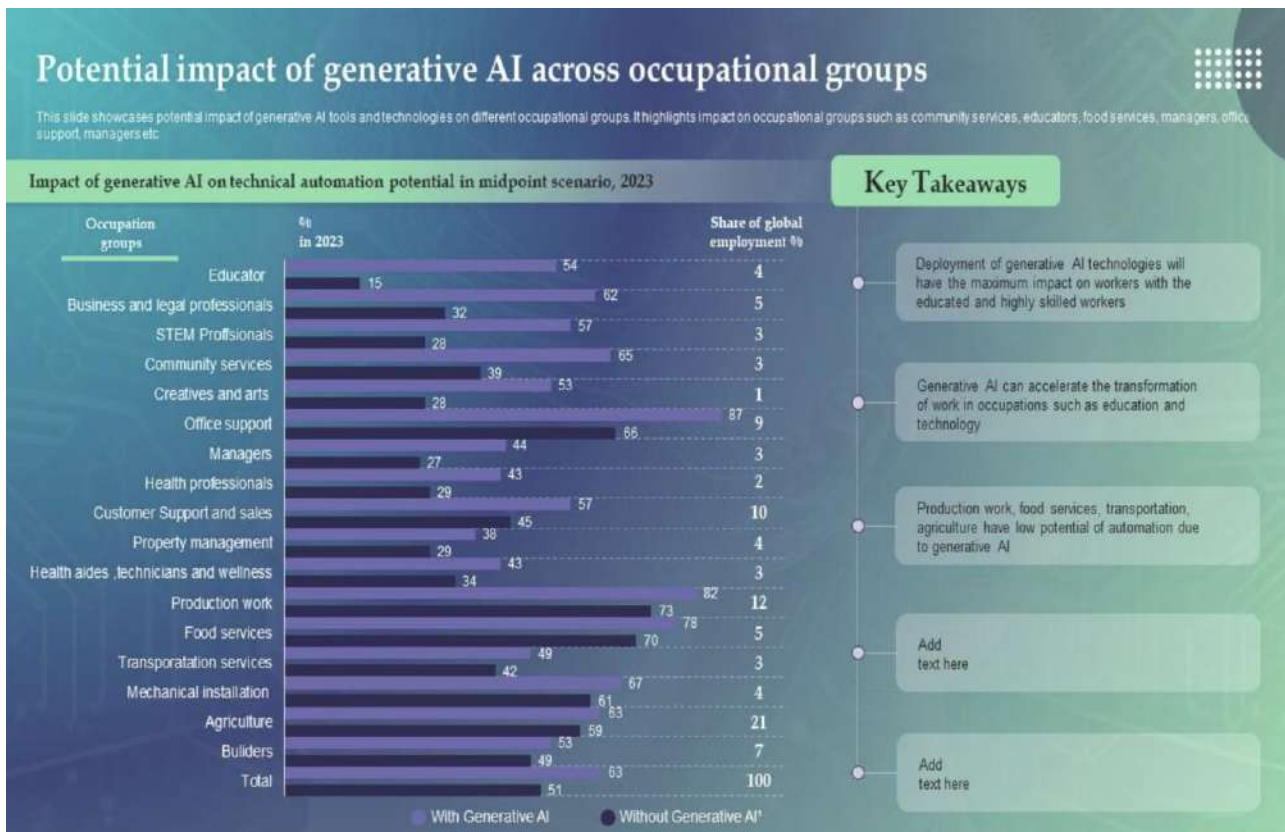Fig. 10. Generative AI impact on economic potential (trillion $ McKinsey & Com.).

Fig. 11. Potential impact by generative AI (https://www.slideteam.net/potential-impact-of-generative-ai-across-economic-potential-of-generative-ai-ss.html)

Fig. 10 shows generative AI impact on economic potential (trillion $ McKinsey & Com.) with 17.1-25.6% and Fig. 11 represents potential impact by generative AI on many areas.

Fig. 11 is impact % of generative AI on each occupation and employment.
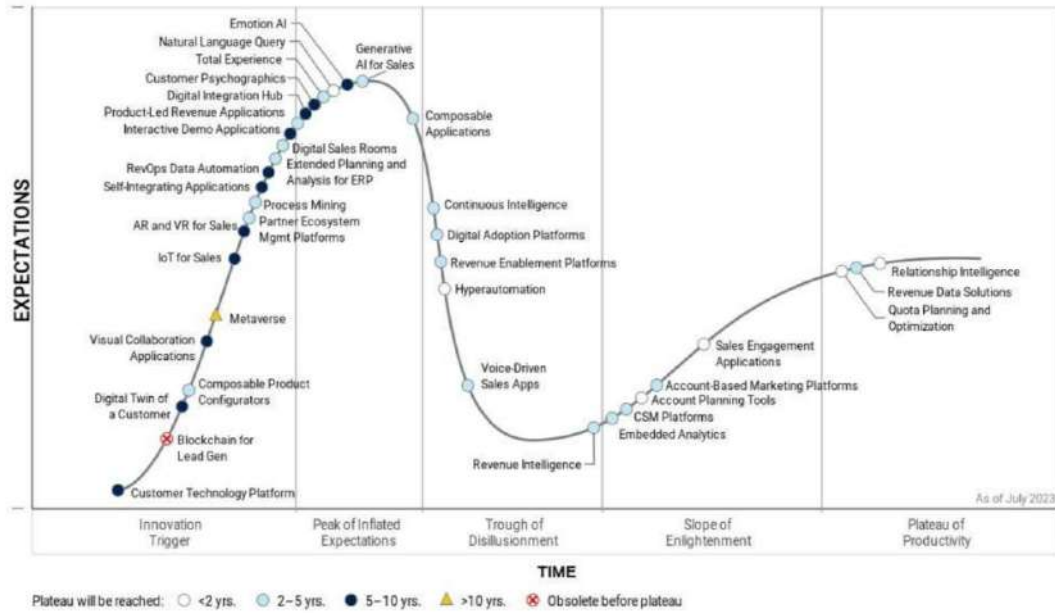

Fig. 12. Market position of generative.

Fig. 12. shows the market position of generative AI by Gartner (Aug. 2023, Hype Cycle for Emerging Technologies, 2023). This Figure shows generative AI is positioned on the peak of hype cycle for emerging technologies, 2023. It means that generative AI already has saturation position even it developed in March 2023 and we can understand well what we have to and how we have to create new opportunities and innovate new business.
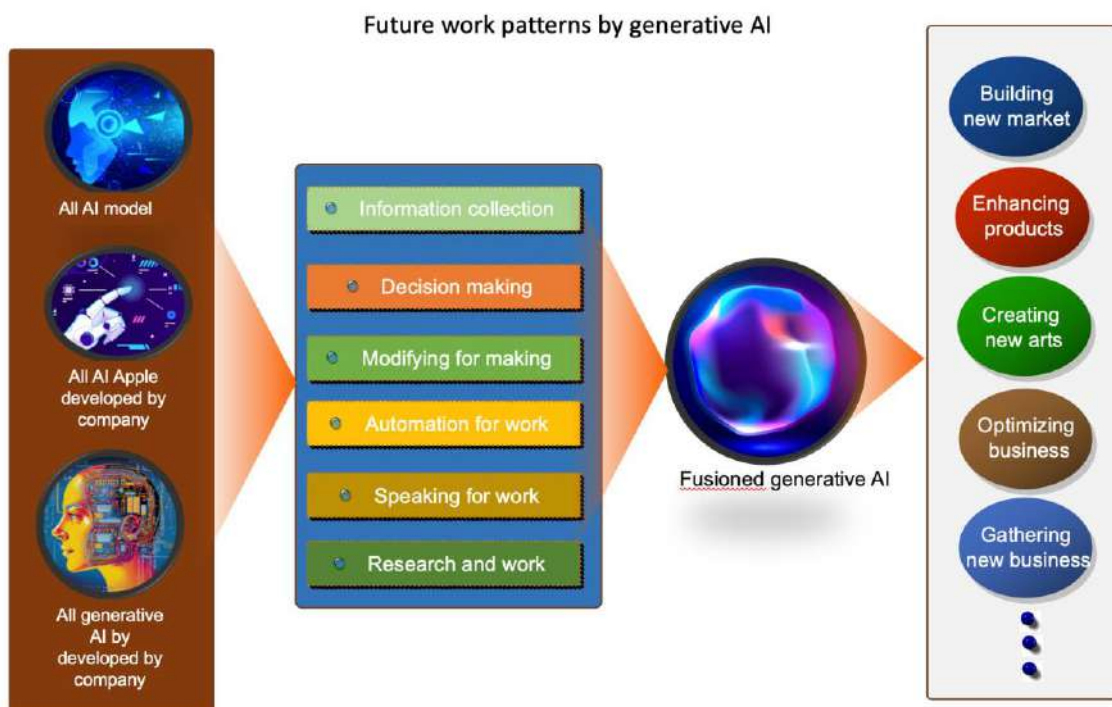

Fig. 13. Future impact by generative AI.

Fig. 13 shows future impact by generative AI through combined AI, the traditional work space, and generative AI.

IV.   THE RESEARCH STRATEGY AND METHOD ON IMPACTING FACTOR ANALYSIS OF KOREAN ECONOMIC GROWTH AT EMERGING TECHNOLOGY BASE ON GENERATIVE AI

This paper reviews many materials about the market position of generative AI and situation as well as basic technology, impacting factors. The issue is to obtain how we have to and what we have to have a solution for economic growth. To obtain this question, this paper suggests research schedule as shown in Fig. 14. At this point, this paper will not show all research results because of generative AI model is so many and something is not correct. However, its technology has a big power for impacting economy and this paper open how it has strategy.

$$m^k = m^{k-1} + arg \min_{h \in h} \left\{ \sum_{i=1}^{n} \left(y_i - m^{k-1}(x_i), h(x_i) \right) \right\} \tag{1}$$

First step is to make a proof dynamic equation suggested in this paper through validated data and the traditional simulation method as shown in equation (1). Because the traditional already was shown in several methods and papers like equation (1). This equation is already proven by the classical analysis method and we can believe on how its impact on economy. This paper's first aim is to establish dynamic equation to search (find) elements (factors) of the impact of Korean economic growth by generative AI and define why it impact on economy growth factor of through simulation by using equation (2).

$$(\alpha_1, \beta_1) = \arg\min_{\alpha, \beta} \sum_{i=1}^{n} \left(y_i - \alpha - \beta^T X_i \right)^2 \tag{2}$$

Equation is just assumption equation to analysis of generative AI impact by deep learning method. Therefore, we modify and correct this equation through study in the future. This paper builds the dynamic equation microeconomic and prepare data to input and proof how it is correct through comparing with the traditional method by using deep learning.

Second step is to tune this dynamic equation for generative AI to application. Till this step is just to prove dynamic equation.

Third step is to build deep learning structure or so AI model to learn dynamic equation. Basically, there are so many data and parameters to influence on economy growth. With the traditional, it is not easy to study and we have to change parameter whenever we study and it is not correct sometimes. This paper suggests automatic simulation method by AI and we have to develop new model for simulation.

Fourth step is to totally suggest deep learning based study model and structure for generative AI impact of Korean economy growth.
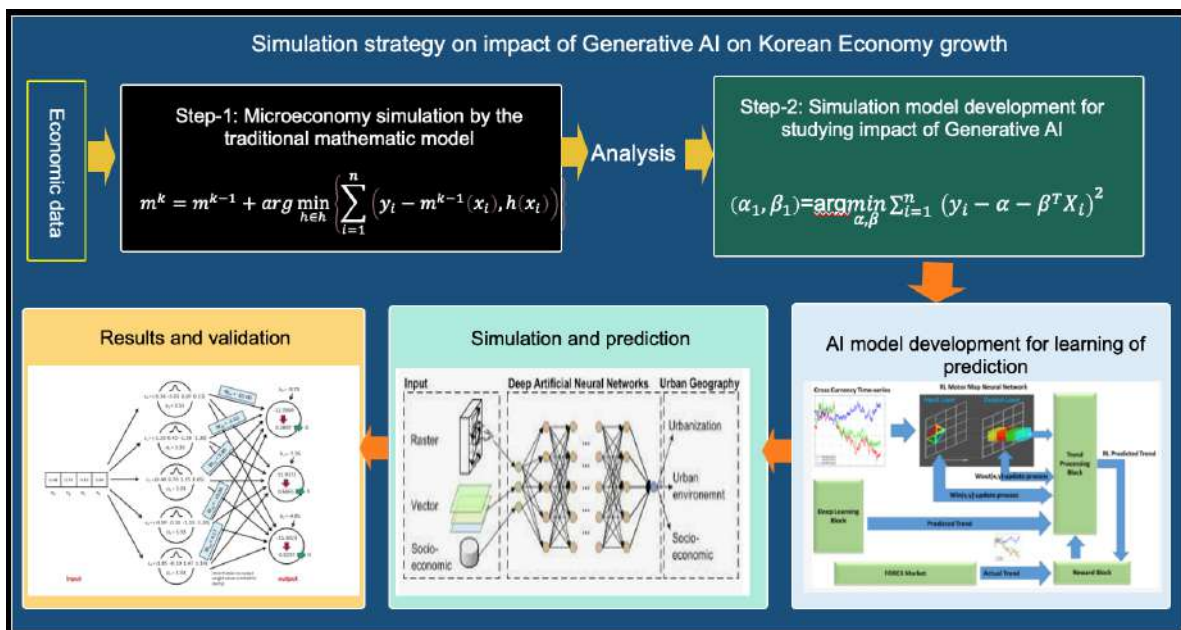

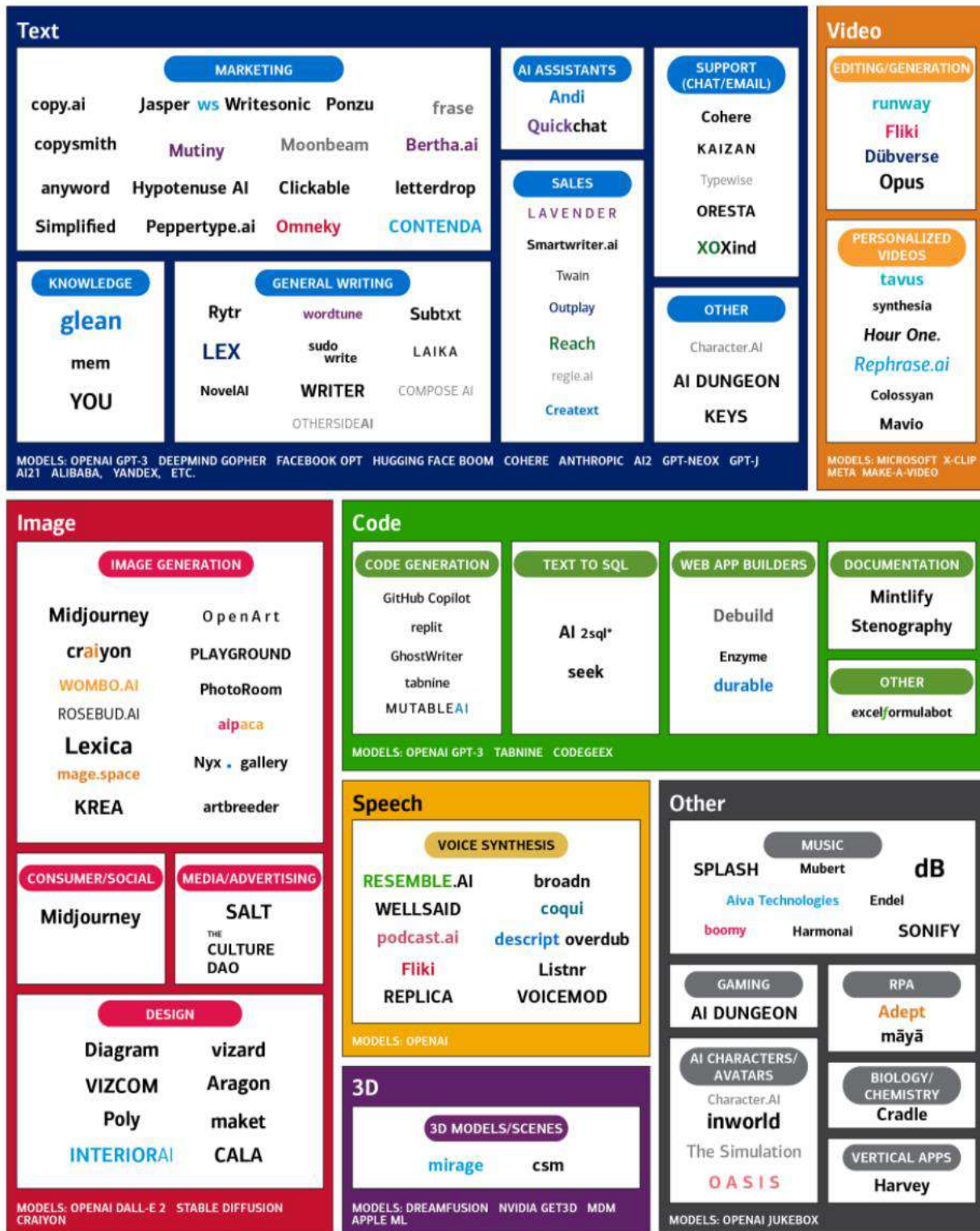Fig. 14. Research strategy for Korean economy growth factor and impact by generative AI.

Fig. 15. Application platform of generative AI (Bank of America Global Research, "Me, Myself and AI - Artificial Intelligence Primer," 28 February 2023).
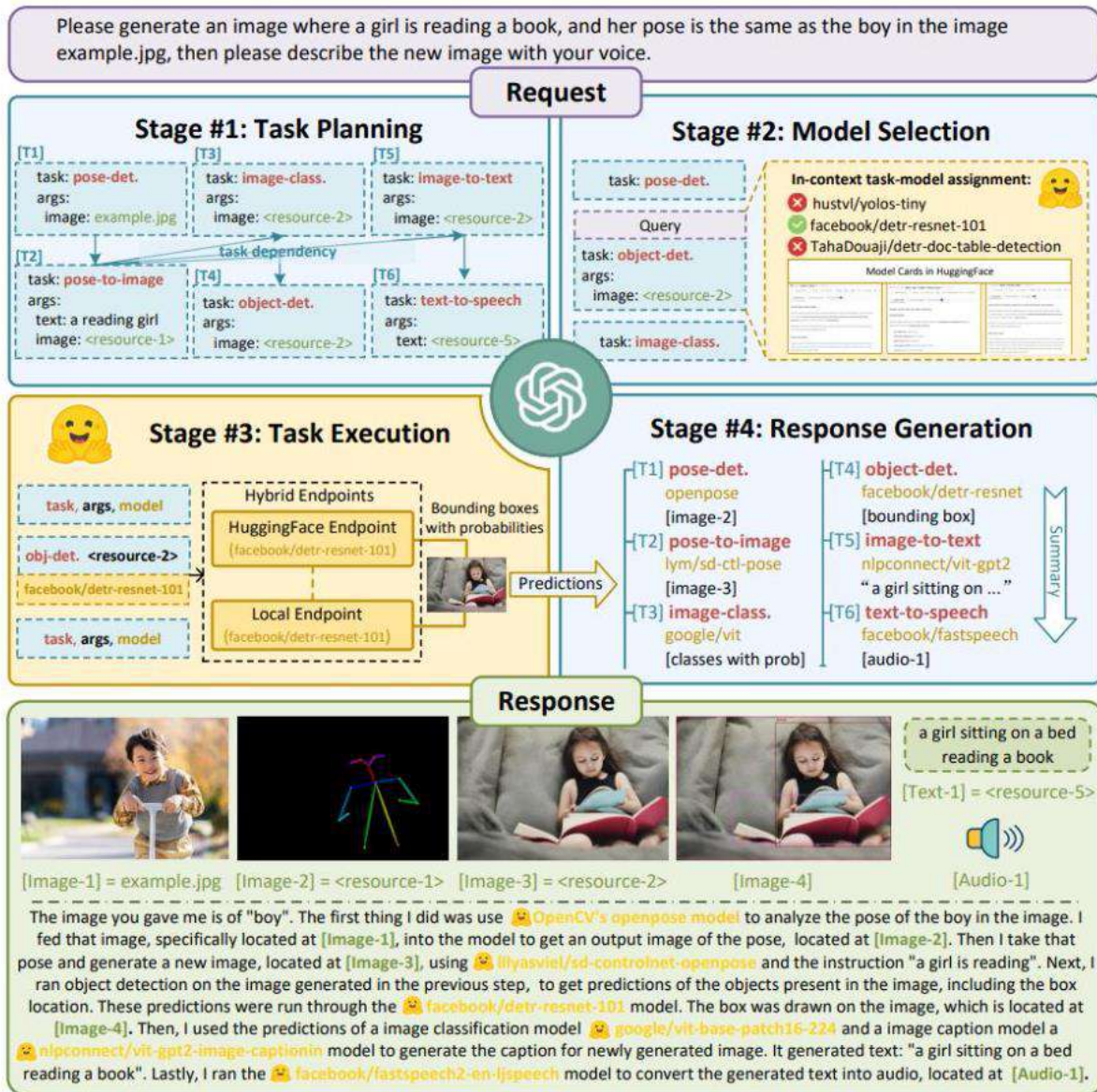
Fig. 16. Research method (H. Touvron et al., "LLaMA: Open and Efficient Foundation Language Models," arXiv preprint, 2023).

V. CONCLUSION

This paper research strategy through reviewing many reports and papers on how much generative AI impact on Korean economy and suggest strategy for policymakers and education system.

All materials shown in this reviewing mention that generative AI impact is so high and should prepare for the future. At this point, we do not figure out what factors will give an impact on Korean economic leading factor because of short data and limited simulation. However, we should study and classify what factor will impact and how much will lead economic factor as Fig. 8 illustrates well how much generative AI can increase economic growth and they say generative AI increase annual global GDP by 7 percent. Of course, some jobs will be disruptive by generative AI. Even though AI investment could approach 1 percent of US GDP by 2030.

As also shown in Fig. 15, there are many things to use it. Application of generative AI and research methods illustrated in Fig. 16. So, we should develop research method depending on situation. That is why we suggest this research strategy and method as shown in Fig. 14. The strategy of Fig. 14 is not finished completely. So, this paper suggests you should modify for your purpose.

ACKNOWLEDGMENT

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