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Nam, Jinyoung; Kim, Junghwan; Jung, Yoonhyuk

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Understandings of the AI business ecosystem in South Korea: AI startups' perspective

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Understandings of the AI business ecosystem in South Korea: AI startups' perspective

Jinyoung Nam[1], Junghwan Kim[2], Yoonhyuk Jung[3]

Abstract

Artificial intelligence (AI) startups are utilizing artificial intelligence technology to produce novel solutions across a multitude of sectors, becoming key players in the AI business ecosystem, signifying AI business networks consisting of technology, business applications, and various industry sectors. Particularly noteworthy is the substantial surge in the initiation and investment in AI startups within South Korea. To gain insight into the AI business ecosystem, this study explores how the ecosystem is collectively understood from AI startups' perspectives in South Korea. We conducted semi-structured interviews with 16 CEOs and managers in AI startups in South Korea. This study conducted a core-periphery analysis of the social representation of the AI business ecosystem. By doing so, it bridges an existing knowledge gap and enriches the body of research related to the AI business ecosystem, as well as the current opportunities and challenges it faces. Our findings not only inform and guide practitioners, governments, and businesses alike, but also suggest that continuous discussion among government agencies, large tech companies, and AI startups is crucial for establishing a more sustainable AI business ecosystem.

Keywords: Artificial intelligence (AI), AI startups, AI business ecosystem, Social representations theory

1 First author. Ph.D. student, School of Media and Communication, Korea University. E-mail address: skalara@korea.ac.kr
2 Second author. Assistant Professor, Transdisciplinary Studies on Human ICT, Media School, Pukyong National University. E-mail address: mediakim@pknu.ac.kr
3 Corresponding author. Professor, School of Media and Communication, Korea University. E-mail address: beyond@korea.ac.kr

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1. Introduction

Artificial intelligence (AI) represents the ability of autonomous entities that can understand their environment and concurrently evolve over time. Being a potent force transforming the business landscape, AI has multi-faceted, profound, and far-reaching effects on a broad range of businesses. Specifically, AI startups play a pivotal role in the diffusion of AI within the AI business ecosystem, which signifies AI-based business systems or networks consisting of AI technologies, business applications, and applied business sectors (Stahl, 2022). These startups, by developing innovative AI technologies, are driving the field forward. They are frequently more agile and willing to take risks than established corporations, allowing them to push the boundaries of what is possible in AI (Bughin et al., 2017). Furthermore, AI startups often disrupt existing markets and introduce competition, leading to superior products and services. Consequently, they often become acquisition targets for larger firms seeking to integrate novel AI capabilities into their offerings (Arora et al., 2018).

Given the critical role of AI startups in leveraging technological potential in the business domain, understanding their perception of AI businesses is essential for predicting the future of the AI business ecosystem. However, there has been insufficient research investigating their perspectives on and attitudes toward this ecosystem. While prior research has examined AI adoption in various fields including business-to-business (B2B) marketing, finance, and medicine, there remains a shortage of studies focusing on AI startups and the stakeholders' actual perceptions of the AI business ecosystem, a gap this paper aims to fill. Therefore, the central question posed in this study is: How do AI startups perceive the AI business ecosystem in South Korea?

South Korea is adopting proactive strategies to increase investment and promote the growth of the AI industry. The AI industry in South Korea is projected to attain an annual average growth rate of 38.5% and an estimated revenue of USD 8 billion by 2025 (KCIS, 2020). Factors such as the ICT infrastructure, high adoption of technologies, high levels of educational attainment, and strategic investments are encouraging the implementation of AI in private and public sectors, leading to industry growth. The implementation of AI startups in Korea is dramatically increasing, and the production and employment growth rates in the high-tech industry are centered on startups driving economic growth (Yin et al., 2019). Given this

dynamic, it is therefore meaningful to investigate AI startups' understanding of the AI business ecosystem in South Korea.

This study employs the Social Representations Theory (SRT) to explore how AI startups perceive their AI business ecosystem within the South Korean context. Specifically, our approach proposes a structure consisting of a central core and peripheral elements for the social representation of the given object (i.e., AI business ecosystem). The structural representation of the ecosystem as perceived by AI startups, which is a primary result of this study, can provide profound insight into the impact of AI on businesses.

2. Literature review

2.1. AI business ecosystem

Artificial Intelligence (AI) refers to the creation of machines capable of emulating intelligent behavior while performing task-specific activities (McCarthy et al., 2006). Artificial intelligence indicates the capacity of autonomous agents that understand the state of their environment, while simultaneously making advancements over time, through trial and error (Arulkumaran et al., 2017). As a general-purpose technology, it can have individual, economic, social, and political implications for the stakeholders and influence the daily lives of human beings. AI is one of the most disruptive technologies in this century transforming individuals, businesses, and societies. In the business ecosystem, companies co-evolve capabilities around innovation, and they work cooperatively and competitively to support new products, satisfy customer needs, and incorporate the next round of innovations (Moore, 1993). The business ecosystem is defined as "an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business" (Moore, 2016, p. 26). The key to a business ecosystem includes a group of business networks that focus on value creation by combining resources (Milinkovich, 2008; Tsujimoto et al., 2018). In the AI context, we adopt an ecosystemic perspective, where in the AI business ecosystem, AI, as a form of innovative technology, plays a vital role in configuring advanced products and services to create value (Burström et al., 2021). Specifically, AI-based business systems or networks are called AI business ecosystems, consisting of technology, business applications, and applied business sectors. AI business ecosystem consists of technology (e.g. machine learning, natural language

processing) and the applied business sectors (e.g. transport, healthcare, entertainment) (Stahl, 2022).

Within the ecosystem, AI business applications are critical to establishing the AI business ecosystem. The key business applications of the ecosystem include open-source software platforms, AI core technologies, and AI open platforms. Open-source software platforms refer to the case for AI and its use of open-source platforms, whereas AI core technologies contain algorithms, big data, and computing power technologies. AI open platforms are the operating systems for businesses to develop AI applications, and AI applications work in various industries that redefine value propositions and business models in the sectors (Quan & Sanderson, 2018). Furthermore, the AI business ecosystem cannot be described without relevant stakeholders that drive the growth of the industry. Most importantly, the stakeholders in the AI business ecosystem include various players (government, companies, startups, and organizations) that impact AI application production, consumption, and operation (Yoo et al., 2012). The stakeholders from the domains play a vital role in the platform businesses in the AI ecosystem.

AI adoption has been prevalent across various domains of finance, healthcare, telecommunications, media, IT, energy, agriculture, apparel, engineering, education, transport, and enterprise services sectors (Cubric, 2020). AI's contribution to the global economy in 2030 would be USD 15.7 trillion in 2030 (PWC, 2020). The AI industry is expected to reach USD 53.1 billion by the year 2026, marking a growth of 35.4% between 2019 and 2026 (PWC, 2021). Specifically, AI has also transformed the ways of doing business, and AI-enabled systems in organizations are expanding rapidly. Recently, major global companies such as Microsoft, Facebook, Apple, Google, and IBM are financing the R&D of applied intelligence and artificial intelligence (Mishra & Tripathi, 2021). Global companies develop or implement AI applications in their businesses, improving their efficiencies and gaining more efficient operations.

2.2. The role of AI startups

Big tech companies are acquiring companies to gain more presence in the AI industry. For example, Google has acquired various startups and companies and has become powerful as they absorb competence or resources. The acquisition of small-scale AI companies by tech giants like Apple, IBM, and Microsoft in relevant domains has increased. AI startups that have AI as a core component of their business model enable growth in the AI ecosystem. AI startups have

started businesses in various domains, considered important stakeholders leading the growth of the AI business ecosystem. The startups work in the domains of machine learning applications, machine learning platforms, natural language processing, computer vision applications, virtual personal assistants, and computer vision platforms. AI platform businesses operate in diverse industries including automotive, medical, services, consulting, education, finance, entertainment, and more. Reflecting on the growth of the AI ecosystem, many AI startups ventured into the industry. The corporate venture capital investment in AI startups increased marginally in 2020, which is one of the major factors driving the growth of the AI industry. By 2020, there were over 2,600 AI startups across 13 AI categories. They have cumulatively raised approximately USD 110 billion in funding from 2014 to 2020 (Statista, 2021). AI unicorns, such as UiPath, Google DeepMind, and SenseTime have grown at an unprecedented pace. There has been a 442% increase in AI unicorn births, from 12 AI unicorns in 2020 to 65 unicorn births in 2021 (CB Insights, 2019). AI startups can transfer potent machine learning models to other business cases and provide services that outperform people's tasks (Schulte-Althoff et al., 2021).

The global trend of the AI ecosystem is largely led by the two leading players, the United States and China, competing for AI world hegemony with the EU, South Korea, and Japan as the next players (PWC, 2020). The AI startups' global deal share by 2020 can be outlined with United States (39.5%), China (15.5%), followed by Japan and United Kingdom by 2020 (Statista, 2021). Countries that have seen broad adoption of AI include South Korea and Canada, which are catching up with the national strategic strategies and government (World Bank Group, 2021). Especially, South Korea is taking proactive measures for increased investment in the growth of the artificial intelligence industry. The AI industry in South Korea is projected to reach an annual average growth rate of 38.5% and an estimated USD 8.02 billion in sales by 2025 (KCIS, 2020). The ICT infrastructure, high take-up of technologies, and high educational attainment levels, as well as investment strategies, encourage AI implementations in private and public sectors that lead to the growth of the industry (Kotra, 2021). The number of AI startups in Korea is increasing, and the production and employment growth rates of the high-tech industry have centered on startups that also drive economic growth (Han, 2019). There has been investment into AI startups, however, still, there exists challenges posed to AI startups.

2.3. Research on the AI ecosystem

Related to AI adoption in various domains, prior research has examined artificial intelligence (AI) adoption in various fields, including business-to-business (B2B) marketing (Chen et al., 2021; Keegan et al., 2022), and AI applications in finance (Bredt, 2019) or medicine sector (Kulkov, 2021). On the ecosystemic level, a study examined how the use of AI enables business model innovations in industrial ecosystems (Burström et al., 2021). Prior research has examined the literary corpus on the role of AI and sustainable business models (Di Vaio et al., 2020), providing guidelines for the analysis of AI ecosystems in GS countries (Heng et al., 2021). Furthermore, a study investigated the impacts of AI, focusing on the relationship with technology, and the consequences of technology evolution beyond the narrow version of AI (Feijóo & Kwon, 2020).

On the regulation level, a study conceptualized emerging systems and developed a comparative typology, and applied it to an emerging regional ecosystem growing around AI (Hannigan et al., 2021). Broadly, a study described a set of ethical challenges encountered by Google and introduced virtue as a framework for ethical decision-making applicable to organizations (Neubert & Montañez, 2020). A study aimed to inform policymakers about key AI technologies, risks, and trends in national AI strategies (Lauterbach, 2019). Specifically concerning AI startups, a study examined what type of data is vital for the growth of AI, providing insights into the policy, and suggesting the use of data-centric entrepreneurship in developed economies (Bessen et al., 2022). In the context of AI in South Korea, prior research has explored the drivers of startup companies in the media industry (Yoo et al., 2012), and the role of government policies in the formation of AI startup businesses in Korea (Schüler et al., 2020). Although there have been attempts to examine AI in perspective from different levels, there has been scant research examining AI startups, and the actual stakeholders' understandings of the AI business ecosystem, which we seek to explore in this study.

2.4. Social representations theory

To explore AI startup businesses' understanding of their AI ecosystem, this study employs the social representations theory (SRT), which has been used to explore shared thoughts regarding social objects (Moscovici, 1984a). Social representation theory indicates the stock of common knowledge of a social object shared by community members and is socially and historically reconstructed in reality, rather than as reflections of reality. The theory posits that

because the individual is a social being rooted in a community, social representation theory shared by community members guides members' social practices (Moscovici, 1984a). Therefore, SRT provides the theoretical framework for our investigation of AI startups' shared understanding of the AI ecosystem. The unfamiliar social object or phenomenon is collectively anchored by community members and has become a concrete form.

AI startups play an important role in the growth of the AI industry; however, there has been less attention given to how the actual AI startup stakeholders perceive the current status quo of the AI ecosystem. Therefore, SRT, which explains shared thoughts of a novel or unfamiliar social object, can be an appropriate approach in investigating the AI startups' collective understandings of the overall AI ecosystem. To analyze the multidimensional aspect of social representations, researchers have employed diverse methods in an exploratory manner (Deaux & Philogène, 2001). As the AI startup industry is experiencing rapid growth, but in the infant stage, an exploratory approach is more relevant than a confirmatory method.

Accordingly, we employed the social representation theory, where the structure of social representation theory consists of central core and peripheral elements (Abric, 2001). A social object of social representation theory is composed of attributes, perceptions, feelings, and attitudes about the object, and those components are classified into cores or peripherals. While core elements have a generating function through which other elements acquire meaning and value, peripheral elements, which are organized around and interpreted with core elements, are a soft area of adaptation to changing environments (Abric, 2001). As a core-periphery perspective on social representation theory provides systematic explanations of conceptual components of representations, core-periphery analysis has been widely employed in social representation theory studies in various domains (Brondi et al., 2021; Jang et al., 2021; Rochira et al., 2015).

Given this background, it is vital to examine AI startups' views and understanding of the AI ecosystem in the Korean AI industry. In particular, the opportunities and challenges posed in the AI ecosystem will enable an understanding of the future direction of the local AI startups and the AI ecosystem. Thus, this study asks the following research question: How do AI startups perceive the AI business ecosystem in the Korean AI industry?

3. Methodology

To understand AI startups' understanding of the AI business ecosystem in South Korea, core-periphery analysis of social representation theory was employed. We interviewed CEOs and managers in different applications in the context of AI startups (Table 1). We ensured that our samples, mainly AI professionals, were suitable for exploratory research that provides an understanding of the AI ecosystem. Based on responses, this study employed the structure of social representations, a core-periphery analysis of the social representation of the AI ecosystem. Content analysis of semi-structured interviews was conducted, and the elements were analyzed in the representation structure based on core-periphery analysis (Borgatti & Everett, 2000). To establish the relationship between the codes (elements), the perceptual map of the core-periphery structure was drawn with a maximum tree (Flament, 1981).

Table 1. Participant information

Startups	Business domain	Business information
A	Medical AI image	AI in medical image, Data-driven image, Biomarker technology
B	AI solution for education	Commercialization of AI education
C	Secondhand e-commerce platform	Software development, E-commerce
D	AI platform consulting	AI contest hosting, AI model development
E	AI platform consulting	Smart factory, Disaster surveillance
F	AI platform consulting	Large-scale AI learning data preprocessing technology
G	AI platform consulting	AI transformation solution
H	AI platform consulting	AI Pub, Solution for AI development and operation
I	AI platform consulting	AI solution
J	AI services for the disabled	Autonomous wheelchair development, Navigator development for visual impairment
K	AI services for education	Operation of educational program, AI school
L	AI services based on blockchain	AI consulting, Blockchain consulting

M	AI culture technology	Video contents production, DRM research
N	Carsharing services	Mobility user management, Provision of vehicle service
O	AI software testing	Logistic automation, AI vision recognition
P	Conversational AI services	Application development

3.1. Semi-structured interviews

Through semi-structured interviews, the authors investigated the content of writing or speaking about the theme is regarded as the best measure to elicit social representations (Moscovici, 1984b). To identify social representations about the AI ecosystem, interviews were conducted in South Korea with Startup Alliance, a non-profit organization (intermediator) that promotes the development of the Korean startup ecosystem. We conducted semi-structured interviews via Zoom with 16 participants, CEOs, or managers in AI startups in South Korea from April to October 2021. The interview questions consisted of thoughts about the AI business, technology, and the ecosystem.

3.2. Content analysis

For content analysis, detailed coding of interviews was conducted. The first author coded the transcripts of the interview based on an open coding process, where the codes emerged from the data. 46 codes were identified during the primary coding. There were several discussions with the coding facilitator, and the codes were grouped into 18 topics (Table 2). The second coder re-coded using the set of codes. The inter-coder agreement, the value of Cohen's Kappa was 0.91, showing that the two raters agreed on high level (Fleiss et al., 1981).

3.3. Core-periphery analysis

The topics of AI startups' understanding of the AI business ecosystem were identified into core and peripheral elements. We employed the core-periphery algorithm (Borgatti & Everett, 2000), which identifies a core-periphery structure in the data. Coreness is measured by a function of closeness, reflecting on the extent of the strength of the relationship between two topics. We used the core and periphery algorithm in UCINET, a statistical software. Three topics

were classified as core elements, while the remaining 15 topics were classified as peripheral elements (Table 2).

Table 2. Core and periphery structure of AI startups

Topic #	Topic	Coreness	Membership
T16	Importance of securing and managing human resources	**0.547**	
T12	Need for sharing and securing data	**0.536**	**Core**
T11	Expansion of AI application field	**0.302**	
T6	Social consensus	0.228	
T1	Awareness of privacy issues	0.225	
T17	Minimum regulation for startups	0.202	
T18	Need for effective government support	0.199	
T9	Limitation of AI technology	0.199	
T15	Winner-takes-all (Technical side)	0.168	
T10	Immature AI business environment	0.140	
T2	Guideline for personal information	0.114	Periphery
T14	Difficulty in attracting aggressive investment	0.110	
T5	Need for AI ownership/copyright policy	0.107	
T8	Superiority of AI technology	0.105	
T7	Low social awareness of AI	0.049	
T3	Common ethical issues	0.025	
T4	Need for AI application guideline	0.017	
T13	Need for technology valuation index	0.005	

3.4. Mapping social representations

Finally, core and peripheral elements were arranged on the perceptual map to visualize the relationship among topics (elements). A Jaccard's similarity coefficient, indicating a degree of similarity based on co-occurrence (Hammond, 1993), was produced between two topics, and all coefficients were summarized into the inter-attribute similarity matrix. According to the

similarity between topics, the relationship among representations was visualized as a maximum tree (Flament, 1981). A maximum tree is constructed by the nearest neighbor algorithm, which is a procedure to link two elements. The first step is to include the topic (X) with the largest frequency value in the map; then, among the other topics, the one with the highest similarity to X is selected and connected to X. If there are multiple topics with the same similarity, the one with the highest frequency value is selected. The same procedure continues to be applied to the previously selected topic until all topics are connected. The results of the analysis are shown in Figure 1. The location of each node does not mean actual position but instead displays the arrangement of significant relationships among the topics (Pawlowski et al., 2007). The thicker the connecting line is, the stronger the similarity index is.

4. Results

Figure 1 visualizes the social representations map, with three core topics and 15 peripheral topics. Three core topics consisted of the Importance of securing and managing human resources (T16), the Need for sharing and securing data (T12), and the Expansion of the AI application field (T11). As the domain of AI applications has expanded, startups raised concerns about acquiring the right level of human capital, addressing difficulties in hiring human resources, such as developers and Chief Information Security Officers (CISOs). Also, securing quality data is fundamental for the operation and development of AI businesses, and startups mentioned the value of sharing quality data with others.

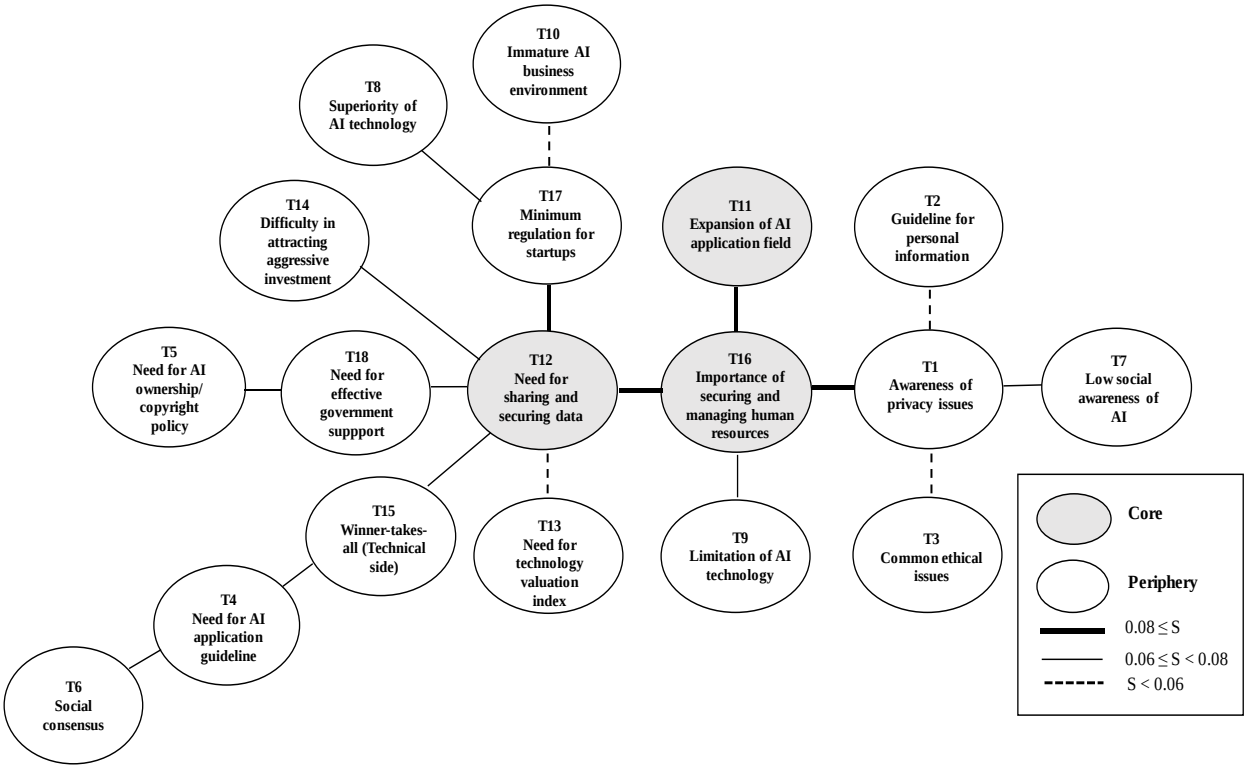

Figure 1. Social representation map of the AI business ecosystem

5. Discussion

The perceptual tree map reveals important relations related to the AI business ecosystem. The core topics included the Importance of securing and managing human resources (T16), the Need for sharing and securing data (T12), and the Expansion of the AI application field (T11). Securing and managing human resources (T16) was the most significant and core element among the 18 topics, implying the importance of acquiring human resources. Acquiring the appropriate level of human resources, especially AI developers and Chief Information Security Officers (CISO) is critical to the maintenance and growth of AI startups. The need for sharing and securing data (T12) is another core topic that is related to the Importance of securing and managing human resources (T16). Data is a fundamental resource for AI startups, especially when AI applications have expanded over different domains (T11). Following the advancement of AI technology and the application of AI in diverse domains (T11), efficient data management has been key to AI startups. The social representation map of the AI business ecosystem exhibits five significant relations, which consist of society, startups, business, technology, and

government. We interpreted the perceptual map by discussing the relationships among the important components that establish the AI business ecosystem (Yoo et al., 2012).

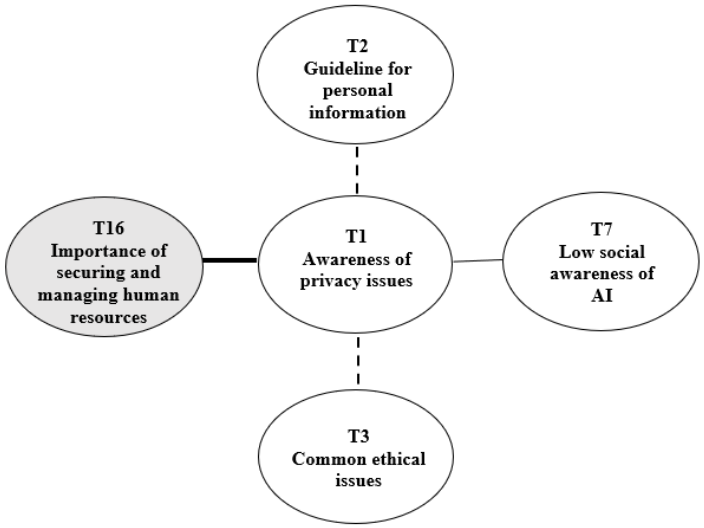

Figure 1. Society

The first relationship demonstrates the societal aspect concerning users' awareness of AI (Figure 2). The social challenge pertains to ethical issues (T3), users' low social awareness of AI (T7), and the need for guideline for personal information (T2). AI startups mentioned that although users are aware of privacy issues that are prevalent with AI-enabled services, there is still a lack of understanding of AI's social and ethical impacts on society and individuals (T1). There has been huge controversy about AI technology's impact on society, as AI raises many challenges, ranging from privacy to ethical, and social issues (Wirtz et al., 2019). Privacy issues are relevant to the misuse of users' data, including the collection and use of personally identifiable information (PII) data when using AI-enabled services, and the ethical issues relating to the challenge of AI ethics that contain AI discrimination. A case that AI startups mentioned was the case of Iruda, an AI chatbot that utilized hate speech and offensive language, and misused users' personal information throughout the conversations (McCurry, 2021). AI decision-making can lead to discriminatory outcomes if the system learns from biased training data, raising concerns about AI's potential discriminatory effects (Zuiderveen Borgesius, 2018). As the AI applications have expanded over core business domains, social challenges arise with these

changes, implying the need for the guideline for personal information (T2) that can protect users against adverse impacts from the usage of personal information in AI-enabled services. The guidelines should also involve instructions on what types of data AI startups can collect and process and how they can apply the data. Adequate personal information guidance must be followed by the use of AI-enabled services and mitigate ethical or social issues (Duan et al., 2019).

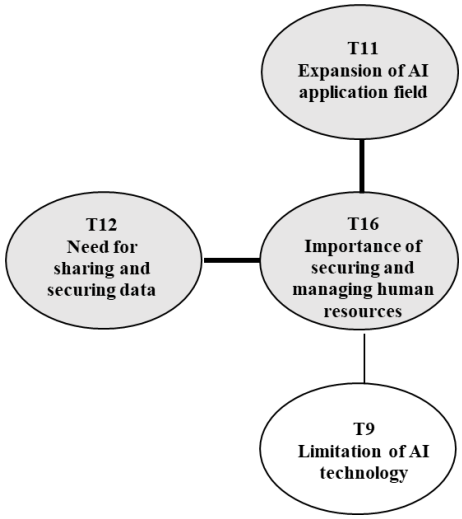

Figure 2. Startups

The second relationship focuses on the fundamental element of startups, especially regarding acquiring appropriate human capital. As the big tech companies, the leading conglomerates in South Korea have resources to secure professional developers, local AI startups have faced challenges from a lack of AI-related workforce. In the current AI business ecosystem, although there exists AI-concentrated industries that use applications of AI technology, there also exist infant industries that face challenges in adopting AI technology, implying a boundary condition. The boundary conditions imply that corresponding boundary conditions need to be solved to address the problem. Two contrary topics - expansion of the AI application field (T11) and limitation of AI technology (T9) are connected through the core topic, the importance of securing and managing human resources (T16). AI startups need to secure a competent level of human resources, which includes developers and AI-related professionals (T16) to overcome the

challenges that AI technology-applied sectors face (T9) and expand the application domains. However, AI startups raised concerns that in South Korea, there is a lack of AI developers, marking only 3.9% of that of developers compared to the United States. The number of AI professionals in the United States reached 28,536, whereas the number of AI experts in Korea remained at a low level of 2,664 professionals, ranking 15th globally (Statista, 2018).

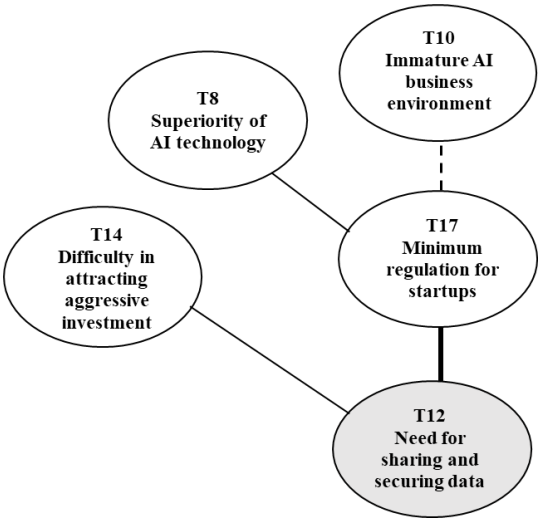

Figure 3. Business

AI startups emphasized the importance of applying minimum regulation upon AI startups' business. Although securing and sharing quality data are critical resources for AI startups, many regulations limit the growth of the AI business ecosystem. Furthermore, the current AI ecosystem is perceived to be immature (T10), which raises the need for appropriate guidelines and support for AI startups in the AI business ecosystem. Startups expressed concerns relating to the government's excessive regulations that hinder the growth of the AI business. Particularly, AI startups face challenges in securing aggressive investment and funding. Global big tech companies such as Google, IBM, and Apple have acquired AI startups, while local AI startups in South Korea lack in securing massive investments. Globally, AI funding and investment in South Korea are lower compared to that of leading AI leaders, the United States and China (FKI, 2021). Investment in Korean AI startups amounted to USD 1.1 billion, only 2% of USD 52.9 billion worth of investment in U.S. startups (HAI, 2022). Enabling regulatory environments for AI businesses will

enable AI growth and minimize potential risks (Ernst & Mishra, 2021). Thus, an appropriate level of regulation, especially minimal regulation may be necessary, considering each domain of AI business.

Figure 4. Government

While securing and sharing quality data is important for AI startups (T12), there also exist potential issues related to AI ownership (T5). AI startups mentioned that a certain level of government support is necessary for AI startups to secure AI (AI technology). AI startups emphasized the importance of the government's role as a supporter, implying that the government should consider promoting the safe and fair sharing of quality data among companies (T18). Within AI ownership, data ownership clarifies fundamental rights and responsibilities for data (Hart, 2002), referring to the data governance process that details an organization's legal ownership of data (Rouse, 2012). In South Korea, the main challenge to efficient data transactions concerns the infringement of data ownership and copyright issues (KISDI, 2018). AI copyright issues concern the allocation of authorship of potentially copyrightable works generated by AI-enabled services (Kiseleva, 2018). Although accessing and acquiring good data is critical for AI startups, a challenge mentioned by AI startups is the lack of guidelines for securing and owning AI technology. As AI ownership is related to the enactment of guidelines (Bessen et al., 2020), practical government support (T18) is needed to promote a flexible AI ownership guideline that supports AI securement and safe data-sharing practices.

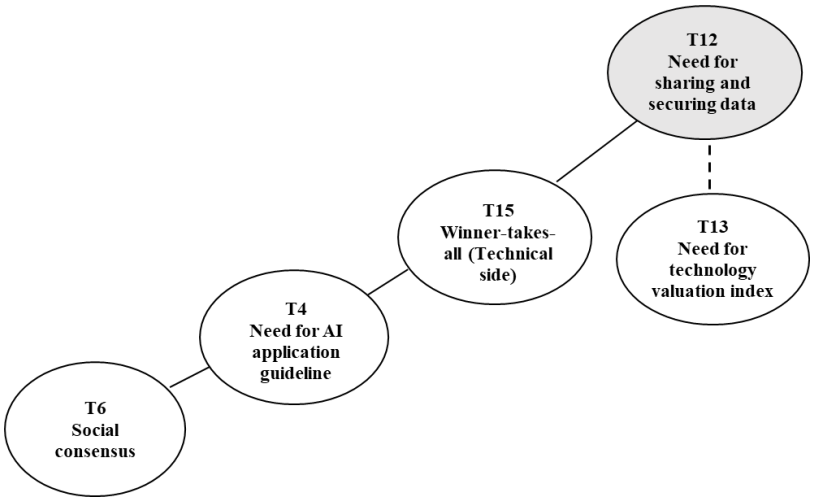

Figure 5. Technology

There exist various players in the AI business ecosystem, and how to deal with data governance has been recognized as a vital issue in AI governance (Hilb, 2020). A critical input for firms developing AI products is acquiring data, which is used to train the algorithms underlying a firm's AI (Bessen et al., 2022). As data is the most critical component in the AI business, startups expressed the necessity to secure and acquire quality data, which is the core of AI technology. However, investment in AI is currently dominated by a few big tech firms (Bessen et al., 2018). Startups expressed concerns that big tech companies have access to high-quality data, while AI startups have a lack of availability of datasets (Coadec, 2022) as they do not have user-based platforms that enable them to collect large amounts of data. This implies that the data gap is increasing between big tech companies and startups (T15). There exists a challenge for policymakers to make decisions about guidelines related to AI startups and their business (Hannigan et al., 2021). Appropriate AI application guidelines and incentives (T14) are necessary to minimize the data gap among the big tech companies and AI startups in the AI business ecosystem. This raises a call for establishing a data ecosystem that can safely guide stakeholders in the AI business ecosystem.

Along with the AI application guideline, another issue pertains to the insufficient understanding regarding correct valuations of the AI startups' technology. To alleviate the technical gap of AI technology (T15), establishing a technology valuation index that can

effectively evaluate AI technology and set standards for the appropriate investment into AI technology will be necessary. Furthermore, the use of AI has prompted intergovernmental, regional, and national organizations to establish strategies regarding AI governance, but there still exist societal and ethical concerns surrounding AI-enabled services that need to be addressed (HAI, 2023). When utilizing AI-enabled services, through social consensus (T6) between big tech companies and AI startups, a solid AI application guideline will be critical to minimize social and data ownership issues that arise from the process of using and sharing data.

6. Implications

The study explored the understanding of the AI business ecosystem, from the perspective of AI startups. This comprehensive study explores how the AI business ecosystem is collectively understood from AI startups' perspective in the South Korean AI industry. Prior research has focused on drivers of startups' growth, or the role of government regulations in the AI businesses; however, no study explored the actual understanding of the AI business ecosystem from AI startups' perspective. By employing the social representations theory, the study collectively explores AI startups' perceptions of the AI business ecosystem in South Korea. The study fills the gap and contributes to the research domain of the AI business ecosystem by examining the opportunities and challenges present in the current AI business industry.

As AI startups need important input for their operation and maintenance, consisting of human capital, data, software, and management practices, the AI business ecosystem is an intertwined system that requires attention from various stakeholders. This study provides implications for practitioners, government, and businesses. There are various business regulations, market policies, and institutional considerations that could influence the development and deployment of the AI business ecosystem (Ernst & Mishra, 2021). Data securement, management, and sharing practices are critical to AI startups. However, AI startups face difficulties securing quality amounts of data. There exists a huge gap concerning data acquisition between big tech companies and AI startups, as data is dominated by a few large firms. A solid AI application guideline that addresses data sharing practices as well as an appropriate incentive system for large technology companies and AI startups is necessary for fostering the AI startup ecosystem. The formation of the data ecosystem can guide various players in the AI business ecosystem.

AI startups need a competent level of human capital and the acquisition and securing of quality data. As the leading conglomerates in South Korea have resources to secure professional developers, the government needs to play a supporting role in nurturing and fostering AI-related professionals through expertise programs. Furthermore, effective government support and investments are necessary to acquire a competent level of human capital and secure quality data. There is also a need for the formation of a solid technology valuation index dedicated to the AI business environment in South Korea. AI startups reported strict regulations that inhibit the growth of the AI business ecosystem. Thus, the government needs to foster minimum guidance rather than excessive regulation directed toward AI startups.

Consistent social consensus and discussion are needed among the government, large technology companies, and startups for maintaining a sustainable AI business ecosystem. At an international level, international policy coordination will be an effective approach to address the social, cultural, and economic discord between startups, firms, governments, and societies to allow AI-enabled technology and regulation to work together (Feijóo & Kwon, 2020). The requirements for achieving trustworthy AI, including AI governance, human agency, and accountability are critical for the sustainability of the AI business ecosystem (Madiega, 2019).

7. Limitations and future research

This study is not without its limitations. As the study examined the AI business ecosystem from the perspective of AI startups in South Korea, future research is necessary to explore the understanding in different countries that have different policies and the deployment of AI infrastructure. Moreover, the study focused on AI startups' understandings of the AI business ecosystem by employing interviews with AI startup CEOs and managers through a core-periphery analysis. For a deeper understanding, more interviewees of AI startups in different domains are necessary for future research.

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