Entrepreneurial Ecosystem of Japan: Investigation from the Perspective of University Ventures

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Résumé :

Conscient de l'importance de l'entrepreneuriat universitaire dans la gestion stratégique de l'écosystème national d'innovation, le Japon a investi massivement dans le développement des startups académiques. L'une des dernières initiatives en date est un plan quinquennal de création de startups d'un montant de mille milliards de yens, annoncé par le cabinet Kishida en 2022. Pourtant, les études sur l'écosystème entrepreneurial japonais et la situation réelle des startups académiques restent rares. La présente étude a pour but d'examiner la situation des startups académiques au Japon et d'évaluer l'écosystème entrepreneurial à l'aide de quatre conditions systémiques : Financement, talents et connaissances ; services de soutien ; réseau et leadership. Nous avons utilisé une méthode d'enquête, recueillant 184 réponses de startups académiques, combinée à une collecte de données primaires et secondaires supplémentaires. Les données issues de l'analyse des documents officiels du gouvernement et de notre enquête révèlent que si le Japon reconnaît l'importance des entrepreneurs universitaires dans le transfert de technologie, ce qui se traduit par un soutien accru à la gestion stratégique de la recherche universitaire, l'accessibilité de ce soutien reste toutefois limitée, comme le montrent les données de l'enquête. Dans l'ensemble, les politiques du gouvernement japonais semblent prendre en considération l'importance de nourrir un écosystème entrepreneurial, mais l'efficacité des politiques mettant en œuvre ses conditions systémiques doit être évaluée. Nous proposons ensuite d'autres questions de recherche qui méritent d'être approfondies : 1) Quels sont les facteurs qui influencent l'accessibilité des programmes gouvernementaux de soutien aux entrepreneurs universitaires ? 2) Dans quelle mesure les startups académiques existantes sont-elles conscientes des ressources de soutien disponibles ? 3) Quelle est l'efficacité des politiques et des programmes existants en matière de soutien aux startups académiques ?

Mots-clés : Ecosystème entrepreneurial, Education à l'entrepreneuriat, Entreprenariat académiques, startups académiques, Japon

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Abstract:

Japan's academic entrepreneurship has been on the rise in the last 20 years. Recognising the importance of academic entrepreneurship in the strategic management of the national innovation ecosystem, Japan has invested massively in nurturing university ventures. One of the latest initiatives includes a trillion yen, five-year start-up plan announced by the Kishida Cabinet in 2022. Yet, studies on Japan's entrepreneurial ecosystem and the real-life situation of academic ventures remain scarce. This study aims to investigate how university ventures are faring in Japan and evaluate the entrepreneurial ecosystem using four systemic conditions: Finance, Talent and Knowledge; Support services; Network and Leadership. We used a survey method, collecting 184 responses from academic ventures, combined with additional primary and secondary data collection. Data from analysis of official government documents and our survey reveal that while Japan recognises the importance of academic entrepreneurs in technology transfer, leading to increased support for strategic management of university research, yet the accessibility of such support remains limited, as shown by survey data. Overall, the Japanese government policies appear to take into consideration the importance of nurturing an entrepreneurial ecosystem, yet the effectiveness of policies enforcing its systemic conditions requires evaluation. We then propose further research questions that need further investigation: 1) What factors influence the accessibility of government academic entrepreneurs support programs? 2) To what extent are existing university ventures aware of available supporting resources? 3) How effective are the existing policies and programs regarding academic venture support?

Keywords: Entrepreneurial ecosystem, Entrepreneurship education, Academic entrepreneurs, University ventures, Japan

1 INTRODUCTION

Recently, Japan's Kishida Cabinet (2022) announced a five-year startup creation plan, marking 2022 as the first year. The plan consists of three pillars strengthening 1) human resources and networks, 2) funding opportunities 3) open innovation for the creation of start-ups (Cabinet Office 2022). The government has also approved a 1 trillion yen[1] budget for venture development, the largest ever in history. In addition, the Japanese government recognises that the strategic management and commercialisation of research and technology from higher education institutions have been a source of innovation for many countries. Hence, the new five-year plan vows to make 100 billion yen available for university venture creation via Japan Science and Technology Agency (Cabinet Office 2022). This is in addition to billions of yen made available as funding resources for university ventures. Japan's *6th Science and Technology (STI) Basic Plan* (2021 - 2025)[2] states that the annual amount of venture capital (VC) investment is 289.1 billion yen as of 2019. Universities have also embraced their role in nurturing academic entrepreneurs and offer various means of support, such as university-industry collaboration offices and technology licensing offices.

Despite these vigorous initiatives by the government and follow-up action by universities, the Global Entrepreneurship Monitor (GEM) has produced statistics on "entrepreneurial intention" and "entrepreneurship as a good career" rates in Japan, which are drastically low[3] compared to the regional and global rates. Moreover, Tokyo placed only 12th in the Global Start-up Ecosystem Ranking in 2022, a decrease from 9th in 2021. This reveals a serious gap between the extensive and varied entrepreneurial support promoted by the

[1]As of 15th January, 2023, 1 USD = 127.89498307 JPY according to Forbes Advisor; retrieved from https://www.forbes.com/advisor/money-transfer/currency-converter/usd-jpy/?amount=1

[2] A five-year comprehensive plan for the promotion of science and technology: https://www8.cao.go.jp/cstp/english/sti_basic_plan.pdf

[3] According to Global Entrepreneurship Monitor (2021), entrepreneurial intentions rate of Japan is 3.15 (with global average of 23.41, regional average of 30.55) and percentage of population agreeing that entrepreneurship as a good career choice is 23.99 (with global average of 68.73, regional average of 70.39)

government and survey-based appreciation of the actual conditions of entrepreneurship in Japan. Our study aims to better understand the reality of university ventures in Japan as the first step towards addressing this gap by exploring the perspective of academic entrepreneurship in universities in Japan.

Firstly, we investigated existing literature to examine the concept of the entrepreneurial ecosystem and methods of evaluating its conditions. We also explored studies on entrepreneurship education and supporting structures for academic entrepreneurship in Japan, which we found to be very limited. To investigate the extent of support and resources from the government, we employed secondary research methods to analyse government documents and websites via keyword searches to answer the following questions:

1. What is the current policy landscape for academic entrepreneurship in Japan?
2. What types of university venture support are made available by the government and universities?
3. To what extent are academic ventures supported by the universities in reality?

The literature on academic entrepreneurship in Japan is still limited. Still, we gathered insightful information from analysing official government documents and policies and publicly available information from university websites. In addition, we conducted a survey with 184 respondents on existing university ventures to gain insights into the type and extent of support they have received for the company's inception and operations. Using a 5-point Likert Scale, we asked the academic ventures their opinions on the support they have received from their related university in terms of entrepreneurship education, finance, leadership and networks, supporting services and intermediaries. We aim to compare the resources made available by the government and the reality of the accessibility of such support for academic entrepreneurs.

The remaining paper is organised as follows. Section 2 discusses the theoretical framework of an entrepreneurial ecosystem and its systemic conditions in the context of Japanese universities, while Section 3 presents the research methodology. This is followed by an exploration of the academic entrepreneurship landscape in Japan together with the aforementioned systemic conditions from the perspective of university ventures in Section 4 and a discussion of the results in Section 5. Section 6 concludes the paper with the implications, limitations, and avenues for future research.

2. LITERATURE REVIEW

As we move away from the idea of a linear innovation model and acknowledge that the processes of strategic management of innovation are more complex (Kline 1985), many studies have been done on the nature of and the factors driving them (Etzkowitz and Leydesdorff 1995, Beaudry et al. 2021), including higher education institutions (Etzkowitz and Leydesdorff 1997). Universities have grown from only providing academic knowledge for economic growth in the long term to a more dynamic position of contributing to the creation of wealth in both the long term and the short term (Etzkowitz and Leydesdorff 1997). Universities then contribute to the growth of the innovation system directly through academic entrepreneurship when the students or faculty members commercialise their research or technology (Rothaermal et al. 2007). This has led to the rise of "entrepreneurial universities", which combine the traditional tasks of teaching and research with contributions to economic and social development (Etzkowitz 1998) as part of the region's entrepreneurial ecosystem. This section first discusses the concept of an "entrepreneurial ecosystem", stressing the importance of universities in the system. The review then focuses on evaluating entrepreneurship education and entrepreneurial support functions by universities while

analysing the role of Japanese universities in the entrepreneurial ecosystem based on the still limited literature.

2.1 Entrepreneurial Ecosystem Approach

While there is no shared definition of an entrepreneurial ecosystem yet, many scholars have attempted to do so by highlighting its different aspects. Scholars such as Kuckertz (2019) and Spigel (2017) define an entrepreneurial ecosystem as multiple complex actors supporting the growth of entrepreneurial activities in a region. Such definitions fail to acknowledge the interactions and relationships between the different actors in an entrepreneurial ecosystem which was addressed by Audretsch and Belitski (2017, 1045), whose definition is "a complex system of interactions between agents within various socioeconomic, institutional and informational contexts which generate more new businesses and growth." Hence, a general definition of an entrepreneurial ecosystem should acknowledge the different stakeholders and their intricate relations that lead to a self-sustaining life cycle of entrepreneurship.

Exploring the different types of support in an entrepreneurial ecosystem, the World Economic Forum (WEF) listed eight pillars of conditions as support for an entrepreneurial ecosystem to thrive, such as major universities as catalysts and human capital/workforce (World Economic Forum 2014; 17). While the eight pillars provide an overall view of the different factors in encouraging the growth of entrepreneurial activities, it is not systematic enough to fully understand the relations between the different actors and the effects each one can bring about. Such a shortcoming was noted by Stam (2015), who argued that this approach had listed superficial conditions for entrepreneurship, such as human resources and finance, which are reliant on fundamental financial and educational institutions (Acemoglu et al., 2004) and calls for the need to distinguish between essential and conditional elements of

an entrepreneurial ecosystem. Instead, he proposes a new model categorising elements of an entrepreneurial ecosystem into "framework conditions" and "systemic conditions".

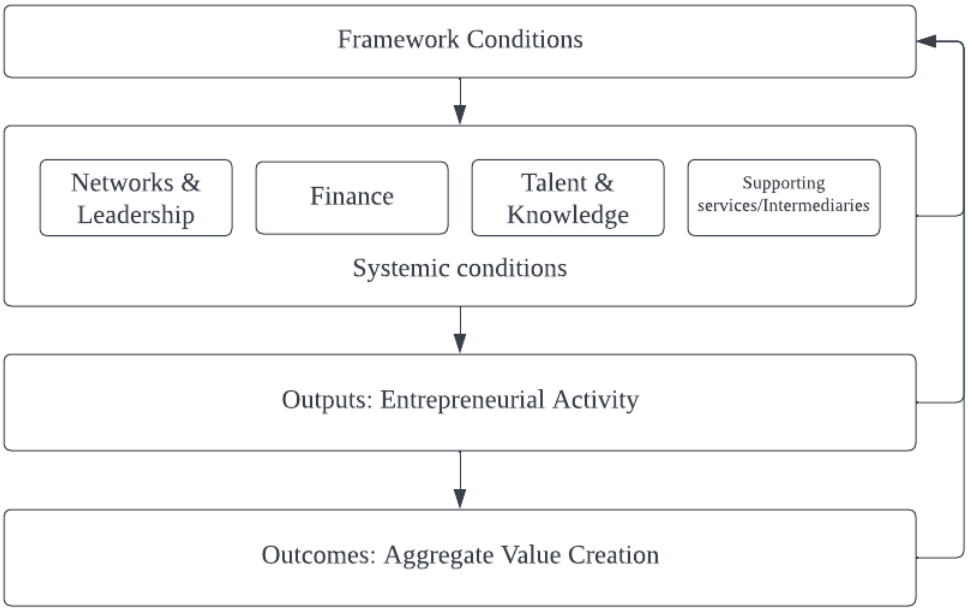

Figure 1: Systemic conditions of an entrepreneurial ecosystem (Source: Stam 2015)

The new model proposed by Stam (2015), as shown in Figure 1, provides the overall structure of an entrepreneurial ecosystem that leads to aggregate value creation via entrepreneurial activities, both of which contribute back to the systemic and framework conditions, highlighting the links between the different components and levels. This has led to the Global Entrepreneurship Monitor (GEM) adopting the model to develop the Entrepreneurial Ecosystem Quality Composite Index (ESI), a diagnostic tool that analyses subnational EEs (Global Entrepreneurship Monitor 2018). Our research utilises the systemic conditions adapted from Stam (2015) model, categorising them as networks and leadership, finance, talent and knowledge and supporting services/intermediaries to analyse the entrepreneurial ecosystem in Japan.

2.2 Entrepreneurial Ecosystem: the case of Japanese Universities

Universities nowadays disseminate knowledge and skilled human resources via university-based ventures, which has led to an increase in investment in the promotion of technology commercialisation and entrepreneurship education (Belitski and Heron 2017). However, Hemmert et al. (2022) denoted that intrapreneurship thrives more than entrepreneurship in commercialising research and technology in Japan's entrepreneurial ecosystem, implying low levels of academic entrepreneurship via universities. There has been government intervention to nurture university ventures which can be traced back to the *Hiranuma Plan* introduced in 2001, a policy that aimed to create a thousand start-up companies from universities (Ito et al. 2016). Even though the goal was met in 2004, entrepreneurial behaviour and attitudes in Japan, measured by Global Entrepreneurship Monitor, are still relatively low compared to the regional and global average in 2021. According to Global Entrepreneurship Monitor (2021), the entrepreneurial intentions rate of Japan is 3.15 (with a global average of 23.41 and a regional average of 30.55) and the percentage of the population agreeing that entrepreneurship is a good career choice is 23.99 (with a global average of 68.73, regional average of 70.39). There is an urgent need to assess the health of Japan's entrepreneurial ecosystem, and our study aims to do so via university-based ventures.

2.2.1 Networks & Leadership

Many scholars, such as Tsai and Ghoshal (1998), have analysed the critical role of social interaction and forming networks in driving innovation and creativity, which are essential components of entrepreneurship. Eesley and Wang (2017) have shown that having mentors who are entrepreneurs or self-employed parents increases the likelihood of forming

entrepreneurial intentions and entry of university students and graduates. In addition, it has been stressed that when there are more "entrepreneur peers", the chances of graduates starting unsuccessful ventures or the likelihood of entrepreneurial entry of graduates with no prior experience decreases (Lerner & Malmendier 2013). Hence, we can argue that the social networking opportunities and the presence of mentors as role models enabled by higher education institutions are essential to an entrepreneurial ecosystem's health. However, in the case of Japanese university-based ventures, there is minimal literature on this aspect. Some scholars conducted industry-specific studies, such as Lynskey (2004), on biotechnology and Information Technology (IT) firms in Japan and concluded that the former engage in more collaborative personnel networking with university researchers than industrial researchers. The opposite is true for the latter. Our study aims to contribute to the literature by examining the extent to which universities in Japan provide academic entrepreneurs with networking opportunities and leadership.

2.2.2 Finance

Generally, it is accepted that the higher the level of education, the more considerable the amount of capital that can be obtained in building a start-up (Majková et al. 2014). Such a phenomenon may be explained by the screening effect, also known as the signalling value. Spence (1974) and Riley (2002) have examined the ability of education level to act as a signal of ability or any other product attributes that cannot be easily observed by employers, stakeholders, and financial providers. In contrast, Wright et al. (2006) argue that venture capitalists may take a different approach to investing in university-based start-ups due to their differences from traditional start-ups. This may be explained by the poorly developed and designed procedures for intellectual property (IP) valuation and marketability (Leitch &

Harrison 2005). Hence, new university ventures may find it challenging to attract external funding. It may be even more difficult for Japanese university-based start-ups because of Japan's limited venture capital market (Lynskey 2004) and scarce business angels (Tashiro 1998). Our study aims to determine whether universities in Japan assist their ventures in acquiring venture capital or funding resources amidst these challenges.

2.2.3 Talent & Knowledge

Lee et al. (2004) noted that "talent" in the context of the economy refers to "a diverse and skilled group of workers" who may be equipped with the knowledge and skills necessary for venture creation by higher educational institutions, as explained above. As for knowledge, one of the findings of the analysis of existing literature by Henry et al. (2005) to investigate whether entrepreneurship can be taught was that entrepreneurship education can be categorised into three groups; education about entrepreneurship, education for entrepreneurship and education in entrepreneurship (Jamieson 1984).

In the context of Japan, MEXT (2020) recognised over 60 universities in Japan as actively offering entrepreneurial education. Some studies have been done on the availability of entrepreneurship courses in Japanese universities, but they are rather dispersed. For instance, Shinato et al. (2013) listed the number of entrepreneurship-related classes offered in major universities in Japan and concluded that Kyoto University (a public university) and Waseda University, Keio University, Ritsumeikan University, Nihon University (private universities) are leading the entrepreneurship education field. The effectiveness of such entrepreneurship education courses in Japanese universities in producing "talent" and assisting ventures has not yet been widely examined.

2.2.4 Support Services/Intermediaries

Any programs or centres that bolster the university-industry-government collaboration projects (the triple helix) would also support entrepreneurial activities because technology transfer or knowledge spillovers may take the form of venture creation. Etzkowitz (2003) listed such services as technology transfer offices and access to government grant programs for research. Huang-Saad et al. (2018) highlighted that universities also provide physical spaces for co-working, promotion support, formal mentorship programs engaging alumni or community partners and networking events.

In Japan, support services for academic entrepreneurship mainly involve university-industry collaboration activities and technology transfer services. Motohashi (2005) categorised UIC activities in Japan as formal (joint research or contracted research and technology licensing) and informal methods (communication and technology consultations). This was further complemented by Tanigawa et al. (2011), whose study added joint research, sponsored research, technology transfer and the creation of university start-ups as UIC activities.

Technology transfer support services in Japan mainly take two forms; IP management offices and Technology Licensing Offices (TLOs). Takahashi and Carraz (2011, 94) listed the goals of these offices as the creation of IP, the protection of IP, and the exploitation of IP achieved via "commissioned and joint research; examination of new inventions; patent application and management; technology transfer through licensing and marketing; support to start-up companies; managing consulting activities of faculty members, and dealing with conflicts of interest". To our knowledge, no study has been done on other supporting services,

such as entrepreneurship-specific centres, networking events and mentorship programs in Japanese universities. Our study aims to investigate the availability of such services.

This literature review explored the concept of an entrepreneurial ecosystem and analysed the role of universities in Japan in an EE based on the systematic conditions proposed by Stam (2015), the same model used by GEM. Some significant observations which warrant the need for further research include the accessibility of funding resources for university-based ventures, the prevalence of entrepreneurship education and the availability of different types of support services offered in Japanese universities. Our study aims to explore further by analysing the availability of networks and leadership, finance, talent, knowledge and support services enabled by Japanese universities from the perspective of university-based ventures.

3. METHODOLOGY

To test the four dimensions identified by the entrepreneurial ecosystem approach in the literature review, we selected a quantitative research design in which two rounds of online survey data collection was conducted. Firstly, we used a database of 778 university ventures in Japan based on the survey done on 3,306 companies by METI in 2021[4]. The database contains the contact information of most of the companies and their partner universities. We used the Likert Scale for survey questions to investigate "the specific dimension of attitude" (Joshi et al. 2015, 397) of academic entrepreneurs towards various venture support structures made available by the government via their partner university. Our questions were categorised based on our interpretation of the systemic conditions of an entrepreneurial ecosystem (Stam

[4] University originated venture database (2021): https://www.meti.go.jp/policy/innovation_corp/univ-startupsdb.html

2015), using a descending-ordered scale to reduce response-order effects (Chyung et al. 2018). We used publicly available documents from Government agencies and universities to complement and contextualise our results. As for the second round, we obtained the list of venture companies from the official web pages of universities and listed their publicly available contact information.

We used a cloud-based survey tool to send out the survey for both rounds. We sent the survey via mass mail to companies that had listed their electronic mail addresses on the METI database and on official university websites. For the rest of the ventures, we sent the survey via the contact form on their official websites. We sent out the survey for the first time by both methods on 1st November 2022. We sent two reminders to the companies that had not responded one week apart, with the first reminder delivered on 14th November 2022 and the second reminder on 21st November 2022. The second round of survey started on 25th January 2023 which consisted of both electronic mail and contact forms of official websites. Similarly to the first round, we sent two reminders to the companies that had not responded one week apart, the first reminder on 3rd January 2023 and the second reminder on 11th January 2023. Table 1 shows the breakdown; out of the 778 companies with public information available, we managed to contact 1324. Overall we had a response rate of 14.52%.

Table 1: Breakdown of numbers of companies in sample population

Variable		**Observation**
Total number of companies from the MEITI database		3,306
Round 1	Total number of companies who answered the MEITI survey (publicly available data)	778
	Number of companies with valid email	546
	Invalid email	59
	Number of companies contacted via website[5]	152

[5] We reached out to companies with bounced mails via website and hence, there is an overlap between the two categories, "Bounced mails" and "Number of companies sent via website"

	Number of companies impossible to reach[6]	21
	Total number of companies contacted	698
Round 2	Total number of companies retrieved from Universities website	793
	Number of companies with valid email	180
	Invalid email	15
	Number of companies contacted via website[7]	446
	Number of companies impossible to reach[8]	152
	Total number of companies contacted	626
Total	Total number of companies contacted (round 1 & 2)	1324
	Percentage of all companies	47.5%
	Percentage of companies contacted	40.0%

Table 2: Response rates for the survey

Survey delivery method		**Response rate (%)**				**Observations**
		First time	***First reminder***	***Second reminder***	***Total***	
Round 1	Email	4.76%	5.67%	0.92%	11.35%	62
	Direct via website	37.50%	No reminder	No reminder	37.50%	57
	Total Respondents	-	-	-	17.05%	119
Round 2	Email	6.67%	0.00%	5.00%	11.67%	21
	Direct via website	9.64%	No reminder	No reminder	9.64%	43
	Total Respondents	-	-	-	10.22%	64
Total	**Total Respondents**	**-**	**-**	**-**	**13.37%**	**183**

[6] Number of companies that opted out of survey (7) and those without an email address or a contact form/website (14)
[7] We reached out to companies with bounced mails via website and hence, there is an overlap between the two categories, "Bounced mails" and "Number of companies sent via website"
[8] Number of companies that opted out of survey (7) and those without an email address or a contact form/website (14)

3.1 Descriptive Statistics: Database and Survey

Table 3: Comparison of percentage of companies in venture database and respondents

Variable		**Database Percentage (population)**	**Respondents Percentage (sample)**
Region	Kanto	34.50%	36.80%
	Kansai	21.20%	18.30%
	Kyushu	12.50%	9.20%
	Chubu	14.20%	11.60%
	Chugoku	5.40%	3.60%
	Shikoku	4.50%	1.10%
	Tohoku	8.10%	0.90%
Field	Software & Apps	10.20%	9.20%
	Aerospace	2.20%	1.80%
	Raw materials	5.10%	6.40%
	Robotics	2.90%	1.80%
	Electronics	5.80%	4.60%
	Environment & Energy	8.00%	10.10%
	Bio-Healthcare	32.10%	35.80%
	AI & IoT	9.50%	8.30%
	Others	19.00%	14.70%

In terms of region, our sample is close to the population for most of the areas with the exception of Tohoku, where the sample is drastically lower than that of the database, 0.9% as opposed to 8.10% (Table 3). As for the "field" of research as listed in the METI database, we observed that the sample percentage is the same magnitude as for the general population. Table 4 provides summary statistics of the answers of the four main categories of questions. The "Talent and Knowledge" category has the highest mean of 2.67 and the lowest mean of 1.28 for the "Finance" category; as we used a descending-ordered scale, the higher the number, the higher the level of agreement with how the category has impacted the academic ventures.

Table 4: Summary Statistics

Variable	Observations	Mean	Standard deviation	Min	Max
Finance	164	1.28	0.84	1	5
Talent and Knowledge	159	2.67	0.41	1	5
Support services	157	2.48	0.39	1	5
Network and Leadership	152	1.98	0.58	1	5

4. RESULTS

In this section, we first explore the current policy landscape regarding academic entrepreneurship in Japan to examine the resources available for the creation of university ventures. Secondly, we analysed the existing support programs and policies which were complemented by our survey results. The analysis was done based on the systemic conditions of the entrepreneurial ecosystem model proposed by Stam (2015).

4.1 Academic Entrepreneurship Landscape in Japan

As we have established in the literature review, the government of Japan has long since realised the importance of academic entrepreneurship in driving innovation and economic growth, as consistently highlighted in their Basic Plans for Science, Technology and Innovation (STI). The latest 6th STI Basic Plan aims for an expenditure of 57 billion yen for start-ups based on Small Business Innovation Research (SBIR) and strives to reach a number of 1,200 participants in practical entrepreneurial education programs by 2025. In addition, government bodies such as the Ministry of Economy, Trade and Industry (METI) and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) have been

monitoring the level of entrepreneurial activities by universities. According to a survey by METI (2021), 3,306 university-based ventures have been established in Japan since 1989. METI include ventures recognised as research result venture, joint research venture, technology transfer venture, student venture and related venture.

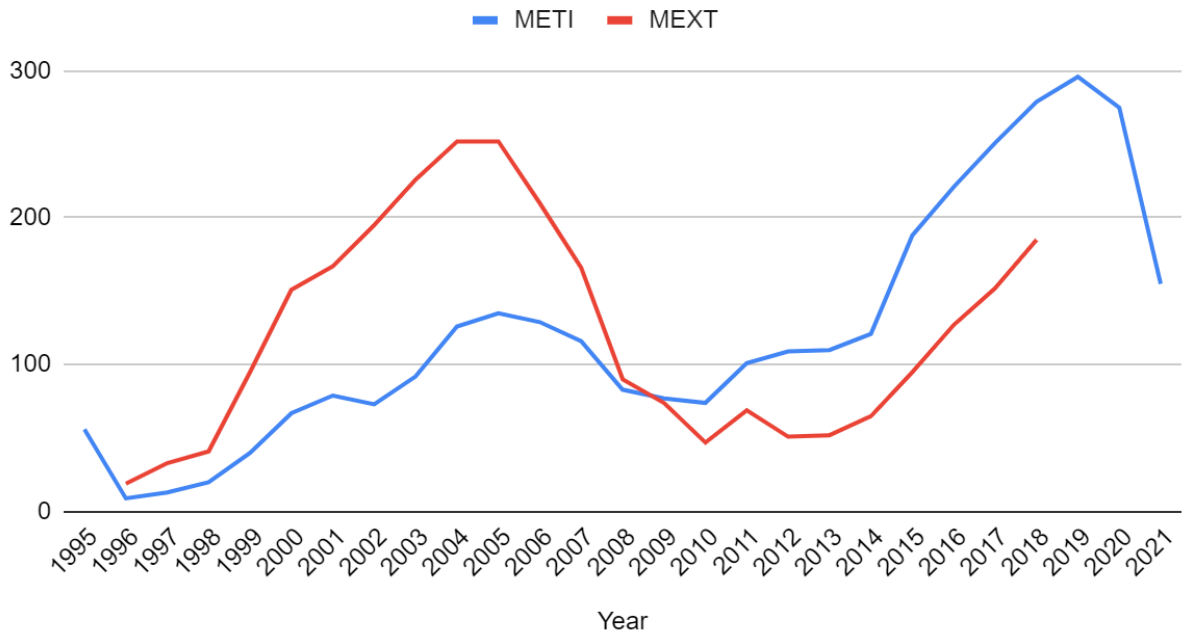

Figure 2: Number of university ventures established per year (Source: MEXT 2018 and METI 2021)

Figure 2 shows that the number of university ventures established per year peaked in 2019, with 296 ventures created in the year, and the number has been falling ever since. The steady increase from 1998 onwards was contributed by the Hiranuma Plan introduced by the government, aiming to reach 1,000 university ventures (Ito et al. 2016). According to MEXT (2021), the drastic decrease in the number of university ventures from 2008 onwards can be attributed to the Lehman Shock, which affected the overall availability of financial resources. On the other hand, MEXT has surveyed the number of university spin-offs per year from

1996 to 2018 using a different methodology. MEXT recognises ventures as university-based when they are related to universities via (1) technology transfer through patents, (2) technology transfer through means other than patents, (3) transfer of human resources from universities, and (4) other related cases.

In addition to monitoring the number of university ventures, both MEXT and METI design and send out surveys to these companies yearly to assess the conditions they are in. For example, METI published a publicly available "University Venture Database" of 778 companies out of 3,306 based on the information they received from the yearly "Survey on the State of University Ventures". This is the database from which we obtained the contact information of university ventures for our survey.

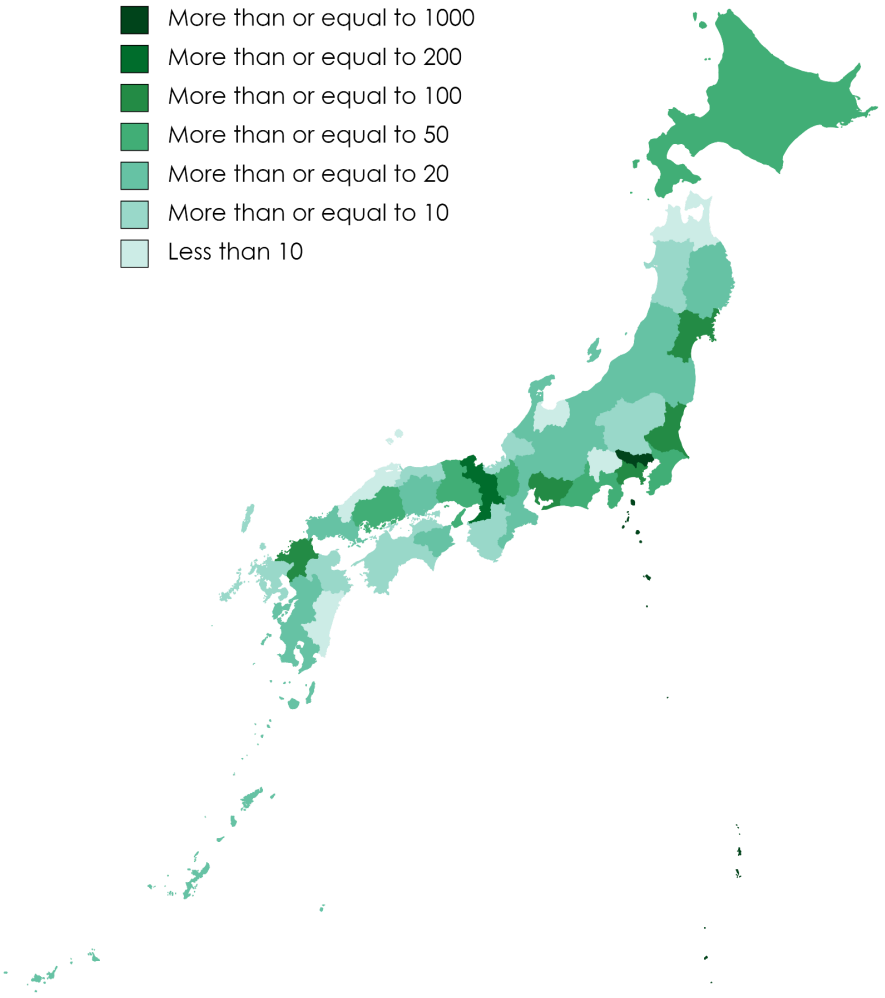

Figure 3: Distribution of university ventures in Japan by prefecture (Source: METI 2021)

According to the METI database, with 3,306 university ventures, most of them are concentrated in Tokyo (1118), as shown in Figure 3. Osaka prefecture ranks second in terms of the number of academic ventures, but it houses 218 companies which indicate a considerable gap between the top two prefectures, Kanto and Kansai.

4.2 Finance

According to Japan External Trade Organization (JETRO) (2022), funding sources for start-up companies in Japan include accelerators, university venture capital funds, venture capital firms, government-related venture capital firms and corporate venture capital firms. According to MEXT (2021), 289.1 billion yen of venture capital and 655 billion yen of public and private sector funds were available for ventures as of 2019.

Table 5: Survey results on support for university ventures in finance

To what extent do you agree or disagree with the following statements about the support the company received from partner university?						
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Number of respondents
The company received internal university venture funds for its inception	81.98%	3.68%	7.98%	2.45%	4.91%	163
The company has received support from the university to obtain funding from a government venture capital firm	90.80%	4.91%	0.00%	3.07%	1.23%	163
The company has received support from the university to obtain funding from a corporate venture capital firm	86.96%	6.21%	3.68%	1.29%	1.86%	161
The company has received support from the university to obtain funding from an accelerator	89.02%	6.10%	1.83%	1.83%	1.22%	164

Our survey asked the academic start-ups on the role of the university in assisting them in obtaining university venture fund, government venture fund, corporate venture fund and

funding from the accelerator as listed by JETRO (2022). It is notable that our survey did not differentiate between companies that asked for support and those that did not ask for financial support. This means some companies may not be aware of the different types of resources available. Among the different kinds of funding opportunities, the university venture fund is the most accessible as it has the highest percentage of 7.36% of respondents agreeing or strongly agreeing, while the funding from an accelerator is the least common (3.05%), according to Table 5.

4.3 Entrepreneurship Education: Talent, Knowledge

As for entrepreneurship education, our survey asked the respondents whether they received education about entrepreneurship, for entrepreneurship and in entrepreneurship as listed in the literature review. More than half of the respondents disagreed or strongly disagreed that they received education about entrepreneurship, for entrepreneurship and in entrepreneurship, according to Table 6. On the other hand, 37.58% of respondents agreed that they received support for contracted/cooperative research or operations. As established in the literature review, one of the strengths of Japanese universities is their UIC activities which include contracted and collaborative research.

Table 6: Survey results on support for university ventures in talent and knowledge

To what extent do you agree or disagree with the following statements about the support the company received from partner university?						
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Number of respondents
The company has received human resources necessary for the contracted/cooperative research or operations from the	26.11%	17.83%	18.47%	28.03%	9.55%	157

university						
The university has provided learning opportunities on the topic of entrepreneurship (Education about entrepreneurship)	32.05%	36.54%	23.08%	16.67%	4.49%	156
The university has provided learning opportunities on how to commercially operate the company at inception (Education for entrepreneurship)	35.26%	21.79%	19.87%	17.31%	5.77%	156
The company still receives learning opportunities on entrepreneurship or/and how to upgrade the company's commercial operations (Education in entrepreneurship)	29.49%	28.85%	19.87%	17.95%	3.85%	156

In addition to the entrepreneurship-related classes within universities, MEXT also offers a supporting program named Exploration and Development of Global Entrepreneurship for NEXT generation (EDGE-NEXT). MEXT (2020) stated that there are five universities in Japan supported by the EDGE-NEXT, a government project funded by MEXT that aims to promote entrepreneurship by building networks and systems conducive to entrepreneurial activities in universities in Japan. It is a practical program for fostering academic entrepreneurs via lectures, seminars, symposiums, pitches and business contests. Since implementation in 2017 until 2019, there have been 26,700 participants, and the program has assisted 102 start-ups. Moreover, the program has raised 540 million yen of external funds for university ventures.

4.4 Leadership, Networks and Support Programs

Technology licensing offices for public university ventures operate under the Technology Licensing Organization (TLO), University-Industry Collaboration Office of METI. Under the Act on the Promotion of Technology Transfer from Universities to the Private Business Operation (TLO Act), university students or staff with a technology transfer plan may submit it to MEXT and METI to receive approval to be accredited. When accredited, the venture can access various services such as business management consulting, technical guidance, licensing support and financial support. Moreover, according to Industrial Competitive Enhancement Act, venture capital firms and businesses that intend to support university ventures financially, with human resources or technical support, need to gain authorisation and approval from METI and MEXT. Overall, we mapped out the roles of the two ministries in nurturing academic entrepreneurs in Figure 8.

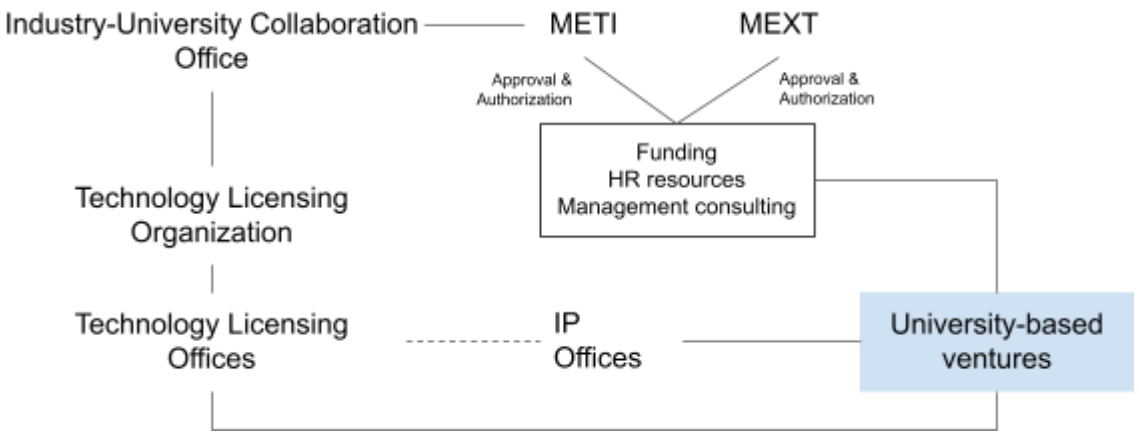

Figure 4: Roles of MEXT and METI (Source: Authors)

Figure 4 shows the different roles METI and MEXT play in Japan's academic entrepreneurship field. METI also manages the Industry-University Collaboration Office, which is in charge of TLO. TLO, in turn, oversees the technology licensing offices which support the university spin-off companies with matters related to IP rights and licenses of technology together with IP offices. Theoretically, university-based ventures can obtain access

to human resources, technical support, and consulting support from the government via MEXT and METI. This is in line with our survey results which include that the category of support with the highest agreement rate is regarding the patent application. 21.71% of respondents agreed or strongly agreed that they received technical support for intellectual property protection. On the other hand, only 5.96% of respondents agreed that they receive business management consulting for their companies, the common type of supporting service.

Table 7: Survey results on support for university ventures in support services/intermediaries

To what extent do you agree or disagree with the following statements about the support the company received from partner university?						
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Number of respondents
The company has received technical support for intellectual property protection for from the university: patent application	45.39%	19.79%	13.16%	13.82%	7.89%	152
The company has received technical support for intellectual property protection from the university: technology license application	52.98%	17.88%	10.60%	13.25%	5.30%	151
The university has helped with contractual agreements with industrial partner with whom you did joint research/commissioned research with	44.08%	23.03%	13.16%	13.82%	5.92%	152
The company has received business management consulting services from the partner university	65.56%	20.53%	7.95%	5.30%	0.66%	151

Recently, the Japanese government introduced various initiatives to enhance the supporting services for academic entrepreneurship. The recent initiatives include START, SCORE programs by Japan Science and Technology Agency (JST) and "Beyond Limits, Unlock our Potential" by the Cabinet, which will be described below.

4.4.1 Program for Creating STart-ups from Advanced Science and Technology (START)

START program by JST was created to develop a talent pool called "Project promoters" who possess commercialisation and business development expertise who will assist ventures based in universities from the pre-startup phase until market viability (JST 2018). The program aims to maximise the contribution of research results to society by helping university spin-offs thrive. In general, START aims to kick-start the ventures within 3 years of implementation. START may provide funding in the form of direct R&D expenses and assist the ventures in attracting private funds after being established. As of 2018, there are 103 projects have been completed or are ongoing. A total of 9 billion yen has been raised for 43 university ventures under START (JST 2018).

4.4.2 Program of Start-up incubation from COre REsearch (SCORE)

SCORE program is also organised by the Japan Science and Technology Agency. It is a yearly program that connects academic staff from universities with entrepreneur leads (ELs) to undergo training and mentoring to optimise their commercialisation and business development skills (JST 2018). In the program, EL is the person who focuses on planning and honing the business plan, closely works with the researcher, and operates both inside and outside the campus. Throughout the different stages, teams of ELs and inventors from

universities experience practical training by proficient mentors and develop prototypes and data for their ventures which are presented to START project promoters and venture capitalists on Demo Day.

4.4.3 "Beyond Limits, Unlock our Potential"

Beyond Limits, Unlock our Potential is a series of start-up strategies adopted by the Cabinet in 2019 to create a start-up ecosystem in Japan that would compete with world-leading ecosystems. In general, the series aims to double the number of start-ups in Japan and the number of foreign talent entrepreneurs by 2024.

Table 8: Survey results on support for university ventures in networks and leadership

To what extent do you agree or disagree with the following statements about the support the company received from partner university?						
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Number of respondents
The company has received networking opportunities with other university-based ventures	28.30%	26.42%	22.64%	18.87%	3.77%	159
The company gets to connect with alumni entrepreneurs from the university	32.91%	20.25%	13.82%	21.52%	9.49%	158
The university has helped expand the company's network of business connections significantly	19.50%	23.90%	23.90%	25.18%	7.55%	159
The company has attended networking event(s) organized by the university	20.13%	22.64%	15.72%	30.82%	10.69%	159

Despite the government initiatives to enrich the talent pool for academic entrepreneurship, 43.94% of respondents disagreed that they received any support regarding human resources. In comparison, 37.58% agreed, according to Table 6. In terms of support for networks and leadership, networking events appear to be the most common form of assistance by universities as 41.51% agreed that they had attended such events in the past, among others such as connection with alumni entrepreneurs (31.01%), with other university-based ventures (22.64%) and business connections (32.73%) as shown in Table 8.

5. DISCUSSION

In earlier sections, we explored the concept of the entrepreneurial ecosystem and the existing conditions for entrepreneurial activities in Japan, specifically from the perspective of university ventures. In this chapter, we discuss three salient aspects of data collected from our survey data and secondary documents on Japan's university ventures.

5.1 Japan acknowledges academic ventures as a critical player in technology transfer, leading to increased planning and support to manage university research strategically.

According to the analysis of Japan's past policies on R&D, Carraz and Harayama (2018) detailed how the Japanese government introduced a series of Science and Technology Basic Plans to actively promote "a new R&D system for the country". Initiatives by the First STI Basic Plan (1996-2000) included "the strengthening of university-industry linkages" (Carraz and Harayama 2018, 37). The 4th STI Basic Plan (2011 - 2015) outlines the establishment of University Research Administrators (URA) system, a talent pool of administrators who are in charge of "technical work", "management and maintenance of

knowledge base" of R&D activities in universities (SciREX 2018, 2) to increase the research capabilities and dissemination of results to the public.

Moreover, the 5th STI Basic Plan adopted by the Japanese Cabinet in 2016 aims to achieve Society 5.0, "a human-centric society in which both economic development and the resolution of societal challenges are achieved, and people can enjoy a high quality of life that is fully active and comfortable" (Fukuyama 2018, 48). This is in line with the inclusion of society in the quadruple helix model (Schütz et al. 2019), which shows that the Japanese government is actively improving the national innovation system. It may imply that relations between universities and the industry (UIC) are well-developed. Motohashi (2005) categorised UIC activities in Japan as formal (joint research or contracted research and technology licensing) and informal methods (communication and technology consultations). This was further complemented by Tanigawa et al. (2011), whose study added joint research, sponsored research, technology transfer and the creation of university start-ups as UIC activities that promote technology transfer to create social value.

5.2 Government policies have quantitative targets to reach, but the efficiency and effectiveness of programs under these policies are to be questioned

The data shows that the Japanese government has actively promoted and nurtured entrepreneurial activities in higher education institutions. Its focus on academic entrepreneurship may be traced back to the *Hiranuma plan* in 2001, which aimed to establish 1000 university start-ups. The consistent emphasis on promoting university-based ventures as part of nurturing the innovation ecosystem in the STI *Basic Plans*, the central science and technology policies in Japan, also shows the government's strengthening interest in academic entrepreneurship in higher education institutions. For example, the 6th STI *Basic Plan*

acknowledges that start-ups in Japan face various problems, such as a lack of funding, limited human resources, and few connections with other businesses. The plan seeks to alleviate such challenges by "forming an ecosystem in which universities, national research and development agencies, business companies, local governments, etc. are closely connected, and start-ups that create innovation are created…" (Cabinet Office 2021, 36) and setting up numerical targets, including the amount of expenditure for SBIR start-ups, the number of participants in the entrepreneurial education program, as well as the amount of joint research between universities and private companies. The variety of entrepreneurial support offered by long-term programs (START, EDGE-NEXT) and short-term programs (SCORE) also signals the existence of government policies dedicated to nurturing conditions conducive to university spinoffs. In addition, the creation of university ventures has been listed as one of the activities of university-industry collaboration on the official website of METI, which further solidifies the role of universities in encouraging academic entrepreneurship.

Although it is clear that the Japanese government has been actively promoting academic entrepreneurship, we can also argue that its policies mainly focus on increasing the number of university start-ups and there is room for improvement in evaluating the efficiency of these measures. Little has been done to assess the current conditions of university ventures and how to provide continued support to help them thrive. In recent years, the regular conduct of annual surveys on the actual conditions of university ventures by METI and MEXT displays the government's efforts to monitor the conditions of existing companies. However, whether follow-up actions are taken after analysis of the results of such surveys remains unclear.

5.3 Japan recognises the importance of academic entrepreneurship, but support is still limited compared to international standards.

At present, despite the prevalence of entrepreneurship-related classes and lectures in universities, entrepreneurship education seems to be limited, with more respondents disagreeing that they obtained education in all three categories of entrepreneurship, for entrepreneurship and in entrepreneurship. According to Table 6, the agreement rate for all three types of entrepreneurship is around 20%. We deduce that either the effectiveness or accessibility of university courses and government initiatives which aim to provide academic entrepreneurs with training and knowledge to kick-start and operate a venture company should be further investigated.

MEXT (2020) estimated that about 200 billion yen of venture capital and 340 billion yen of private funds were available for start-ups in Japan up to 2017 (MEXT 2020). However, according to our survey, access to such funding sources is limited as very few respondents agreed that they received support to acquire a government venture fund (4.30%), corporate venture fund (3.15%) or funding from an accelerator (3.05%), according to Table 5. This may partially be explained by the relatively lower financial resources available compared to other countries such as the UK. Tokyo, ranking 12th in Global Start-up Ecosystem Ranking[9], has an ecosystem value of $62 billion. In contrast, London, ranking 2nd, has a five times more value of $314 billion. According to Ito et al. (2015), collaborative research and contracted research to facilitate technology commercialisation is lower in Japan than in the UK. The direct comparison of Japan and the UK was justified by Ito et al. (2015) as the number of undergraduates, graduate students, and academic and non-academic staff are relatively similar in scale in the two nations.

[9] Global ranking developed by Startup Genome, "the world-leading policy advisory and research organization for public and private organizations committed to accelerating the success of their startup ecosystem": https://startupgenome.com/article/global-startup-ecosystem-ranking-2022-top-30-plus-runners-up

6. CONCLUSION

Firstly, this paper has investigated existing government policies and programs that promote the creation of university start-ups which build on research results and technology and evaluated them from the perspective of university ventures. We established that the Japanese government directs most of its academic entrepreneurship support to increase the number of university ventures. The recent "Beyond limits, Unlock our potential" acknowledges the concept of an entrepreneurial ecosystem with its official aim to "compete with the world's top (start-up) ecosystems" (Cabinet Office 2019), but its effectiveness remains to be evaluated. Despite the abovementioned entrepreneurship support initiatives, our study revealed that, in reality, access to entrepreneurship education and the support structures mentioned above do not seem to meet the expectations of university ventures, according to our 183 respondents. Follow-up studies such as interviews are needed to obtain an in-depth understanding of the perspective of university ventures.

Secondly, the investigation findings contribute to new understandings of the systemic conditions of the entrepreneurial ecosystem in Japan for academic start-ups. In contrast to what the current literature has established, various venture fund sources are available for academic entrepreneurs in addition to the availability of networks, leadership and other supporting services in theory. From our survey results, we deduced that the listed support remains inaccessible to a large extent and limited in effectiveness, with respondents mostly disagreeing that they received the different types of venture support. However, our study has barely scratched the surface of understanding the gap between the significant investment of funds and efforts into nurturing entrepreneurial activities in universities and the resulting low entrepreneurial attitudes and mindset in Japan, as reported by the GEM assessment. We are

currently working on conducting interviews with university ventures to understand better the actual conditions of the different types of support available:

- Evaluate the access to government programs and venture funds for universities
- Assess the effectiveness of policies and programs introduced by the government to support academic entrepreneurs
- Measure the extent of awareness of universities and academic entrepreneurs on the support available
- Evaluate the effectiveness of the university-industry collaboration offices or entrepreneurship support centres within universities in supporting academic ventures

Finally, despite some limitations, the findings of our study will be of interest to academics and practitioners who aim to understand the availability of university venture support systems in Japan. They will also be helpful for policymakers to evaluate the existing landscape of academic entrepreneurship and identify areas of weakness to create more effective and efficient policies for not only the creation of start-ups but also the maintenance and improvement of existing ventures. For current measures, especially the highly invested five-year startup creation plan, to be effective and to be able to implement better strategies in the future, we urge that Japan address the lack of understanding of the gap between a low entrepreneurial mindset of the public and the abundance of resources invested in the entrepreneurial ecosystem in the near future.

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