Which Factors do Affect Success of Business Incubators

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***Abstract*—Entrepreneurial process, from the recognition or creation of business opportunities to the exploitation of opportunities through new firm creation, requires nascent entrepreneurs to be "jacks of all trades" even though they need not to be a master of all. Focusing on the role of business incubators as knowledge transfer organizations, this study examines how the scope and focus of skills that incubation managers can transfer to nascent entrepreneurs affect new firm creation, and how the impacts vary according to technological categories. Estimated Tobit models show that technological skills of incubation managers are particularly beneficial for incubatees in science-based sectors. Furthermore, formal alliances with and the geographical contiguity to universities do not help business incubators spawn science-based startups. Policy implications of the results are discussed.**

***Index Terms*—business incubators, entrepreneurship, knowledge transfer, incubation managers, networks, Japan.**

I. Introduction

Since 1980s Japan experienced two major upheavals in economy: the emergence and collapse of the bubble economy after the Plaza Agreement in 1985 that approved strong Yen; and the long-term recession since 1991. Regarding the latter, the living standards measured as real GDP per capita have been stagnated in Japan since 1990s, which made decades since the bubble economy called as "lost decades". In terms of growth accounting, the improvement of real GDP per capita can be decomposed into labor productivity growth and changes in the proportion of workers to population. Labor productivity growth is a sum of capital deepening and total factor productivity (TFP) growth, that is, real output growth that cannot be accounted for by real input growth weighted by cost share. Recent empirical studies show that the fundamental cause of the long-term stagnation of the living standards in Japan is low TFP growth since 1990s [1]. Although there are many factors affecting TFP growth such as resource reallocation, it is widely accepted that the creation and diffusion of new knowledge (i.e., innovation) and the exploitation of new or undiscovered opportunities through new firm creation and new entry (i.e., entrepreneurship) are the main engines for TFP growth.

Under economic circumstances since 1990s described above, innovation and entrepreneurship have been received increasing attention, not only from researchers but from policymakers. This made the establishment of business incubators one of the important regional and entrepreneurship policies in Japan. Since 1990s, a number of business incubators were established mainly by local authorities to assist entrepreneurial activities. Business incubators have two main goals. One is to provide nascent entrepreneurs with physical resources such as offices, internet connection, and shared facilities like reception, meeting rooms, and copy machines. Another, and more important, goal is to help nascent entrepreneurs access to intangible resources such as knowledge. That is, business incubators help nascent entrepreneurs improve their general human capital so that they can recognize or create business opportunities and to pursue the opportunities through new firm creation. Incubation managers who have various professional experiences and skills play a key role in the acquisition of general human capital by nascent entrepreneurs through the incubation period. Incubation managers are supposed to transfer their knowledge to nascent entrepreneurs so that they will have their entrepreneurial process effective and leave the incubator successfully. Using the micro dataset of business incubators, this study examines how the scope and focus of skills that business incubators can transfer to nascent entrepreneurs affect new firm creation from business incubators, and how the impacts vary according to technological categories. By so doing, the present study attempts to provide guidelines for effective design of regional and entrepreneurship policies.

II. Method

Entrepreneurship refers to the recognition or creation of business opportunities and the exploitation of the opportunities through new firm creation. Entrepreneurial process requires various types of skills, such as to search and evaluate information about opportunities, to translate the information into new markets, techniques, and goods, to marshal the financial resources necessary for the enterprise, to make time-binding arrangements, to take ultimate responsibility for management, to be the ultimate uncertainty and/or risk bearer, to provide and be responsible for the motivational system within the firm, and to provide leadership for the work group. Leibenstein emphasizes the role of entrepreneurs as a gap filler or an input completer in the economy where the pursuit of opportunities requires complementary entrepreneurial capabilities shown above, some of which are inherently

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unmarketable and some of which are difficult to market, which encourages entrepreneurs to create a new firm rather than leasing them in the market. Therefore, successful entrepreneurs are likely to be "jacks of all trades" even though they need not to be a master of all [2]. Some of these diversified skills and some portion of each skill pertain to general human capital (e.g., intelligence) that can be formed thorough formal education and the acquisition of more specific skills builds on professional experiences which vary according to characteristics of technology or industry to which entrepreneurs enter.

The acquisition of diversified types of skills is particularly important for novice entrepreneurs whose current business is their first business. This is because some types of entrepreneurial abilities can be learned only through having engaged in entrepreneurship, which novice entrepreneurs do no retain by definition. Recent survey in Japan shows that over eighty percent of entrepreneurs have previous professional experience as regular employees mainly in small- and medium-sized enterprises [3]. Thus, it is likely that entrepreneurs retain a certain level of general and specific skills from professional experiences, such as in finance, marketing, and R&D, and some entrepreneurial ideas from previous work experiences. Assuming that nascent entrepreneurs who enter to business incubators are novice entrepreneurs, it is possible to hypothesize that successful incubators would provide nascent entrepreneurs with appropriate types of skills according to characteristics of technology or industry to which they are going to enter. Considering the organizational nature of business incubators, it is likely that incubation managers play a core role in skill acquisition by nascent entrepreneurs through the incubation period. Focusing on the role of business incubators as knowledge transfer organizations, this study examines how the scope and focus of skills that incubation managers can transfer to nascent entrepreneurs affect new firm creation, and how the impacts vary according to technological categories.

Selecting appropriate performance measure(s) of business incubators is a controversial issue [4]. This study employs the cumulative number of incubatees that graduated business incubators as a performance measure of business incubators. The graduation of incubatees is defined in this study as the situation where incubatees leave business incubators because they grow sufficiently through the incubation period and need more physical space for their future operation. This study assumes that the more graduates business incubators spawn, the more successful they are. Using this performance measure excludes the possibility that business incubators with low selection criteria also have more incubatees that left the business incubator because incubatees reneged on a contract (e.g., the absence of rent payment) or failed. The strength of using this performance measure for business incubator study is twofold. First, as stated earlier, the ultimate goal of business incubators is to help nascent entrepreneurs improve their capabilities in the recognition or creation of business opportunities and the exploitation of opportunities through new firm creation. These activities require nascent entrepreneurs to be "jacks of all trades", unlike employees who are specialists. Thus, the goal of business incubators pertains to the formation of skills in various fields. With this regard, it is difficult to precisely measure the contributions of business incubators in the improvement of human capital of nascent entrepreneurs. Instead, this study assumes that nascent entrepreneurs who graduated business incubators would have accumulated such human capital. Second, related to the first, the accumulation of general human capital by nascent entrepreneurs is considered to have long term effects on regional or macroeconomic development. General human capital obtained through the incubation period will persist. As a habitual entrepreneur, she may be able to exert such skills under another circumstance. Furthermore, business incubators' having a greater number of graduates can yield externalities by showing potential entrepreneurs in the region a higher rate of entrepreneurial activities, which would encourage them to enter entrepreneurship. This type of externalities can exert even though the startup she established at the business incubator was not successful because potential entrepreneurs can learn from failure of others [5].

Information of business incubators in Japan was collected from the Basic Survey of Business Incubators conducted in 2006 by the Ministry of Economy, Trade, and Industry. In the survey, business incubators are defined as organizations that nurture nascent entrepreneurs to be full-fledged business owners within a specific period of time and help them graduate the incubator. Thus, business incubators have to set a specific period of time for incubatees to leave the incubator. They must not to be like a hotel where wealthy but inefficient incubatees can stay as long as they want simply to enjoy reputation effects by being located in business incubators. In addition, business incubators must not to be a rent collector that pays little attention to the quality of incubatees. Thus, they must have a rigorous selection process to choose appropriate incubatees. This questionnaire survey obtained responses from 194 business incubators. Only six percent of them were established in 1980s while fifty eight percent of them were established in 2000s. Nearly half of the business incubators are geographically concentrated in metropolitan areas such as Tokyo (13%), Osaka (7%), and Kanagawa, Aichi, Fukuoka (6%). Nearly half of the business incubators were established by the local authorities (i.e., prefectural and municipal governments) and seven percent or the incubators were established by universities. Thirty one percent of business incubators are administrated by juridical foundations while sixteen percent of them are administrated by local authorities.

This study employs the cumulative number of incubatees that graduated business incubators as a performance measure of business incubators. Forty five percent of business incubators reported no graduates. Tobit model is used to analyze count data with truncation. Since a dependent variable is a cumulative number, it is reasonable that older and larger (in physical size) business incubators tend to have more graduates.

Therefore, the years since establishment and the number of rooms of a business incubator are included in the regression model as control variables. Other control variables are an ordinal variable for the phase of incubation on which business incubators chiefly focus (pre-incubation=1, main=2, and post-incubation=3), a binary dummy for the acceptance of foreign firms, contract period (in years), and a binary dummy for the renewal of rental agreement.

Independent variables are a binary dummy for the adjacent location to university, a binary dummy for organizational alliance with universities, sixteen binary dummies for business assistance available at incubators (preparation for starting business, business proposal, general assistance in starting business, legal issues, finance, raising fund, human resource management, marketing, distribution, alliances, cooperative R&D, technological assistance, intellectual property, access to public assistance, advertising, and networking events), the number of incubation managers which represents the scope of skills that business incubators can transfer to nascent entrepreneurs, and thirteen binary dummies for professional skills of incubation managers (legal issues, management, finance, distribution, marketing, R&D, product technology, process technology, information technology, human resource management, science-business collaboration, access to subsidies, and advertising). If a business incubator has more than one incubation manager, all the professional skills held by incubation managers are considered. To get the focus of skills that business incubators can transfer to nascent entrepreneurs operational, the following procedure is undertaken.

Since there are a number of variables pertinent to professional skills of incubation managers, factor analysis was used to reduce the data. Based on a scree plot, two factors, F1 and F2, were generated which represented latent capabilities of incubation managers. F1 represents management skills that are highly correlated to professional skills in management, finance, distribution, and marketing. F2 represents technological skills that are highly correlated to product technology, process technology, and R&D. Similarly, information on business support available at incubators was also reduced through factor analysis and four factors were extracted. S1 represents assistance in basic managerial tasks such as in finance, raising fund, and human resource management. S2 represents assistance in identifying and exploiting demand such as in marketing and distribution. S3 represents technological assistance such as support for organizing cooperative R&D and the management of intellectual property rights. S4 represents general assistance in starting business such as the preparation for business proposal.

III. RESULTS

TABLE I. TOBIT ESTIATIMON (N=163)

	All(164)			Electronics(150)			ICT(154)			Biotechnology(149)			Environment(152)			Distribution(151)		
	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Years since establishment	4.15	0.69	**	2.36	0.33	**	2.25	0.54	**	0.92	0.28	**	1.02	0.22	**	1.9	0.73	*
Number of rooms	0.08	0.2		-0.09	0.09		0.16	0.15		-0.09	0.09		0	0.06		0.13	0.19	
Foreign tenants	19.35	6.24	**	9.52	2.97	**	15.65	4.6	**	2.94	2.63		1.42	1.94		9.46	6.65	
Contract period	-7.51	1.95	**	-0.76	0.91		-5.34	1.49	**	-0.09	0.8		-1.19	0.64		-9.32	2.21	**
Renewal	-26.57	6.97	**	-3.97	3.52		-18.03	5.35	**	1.98	3.33		-0.91	2.45		-18.5	7.19	*
Incubation stage	-8.14	6.15		4.88	3.19		-1.94	4.9		-1.61	2.86		1.15	2.04		-2.49	6.65	
Number of IMs	2.03	1.73		1.14	0.87		0.3	1.39		-0.7	0.91		0.28	0.58		1.78	1.76	
F1	-1.28	3.74		1.25	1.86		0.51	2.96		1.11	1.66		1.58	1.25		1.13	3.95	
F2	-1.8	3.38		3.37	1.62	*	-3.77	2.67		3.51	1.53	*	-1.39	1.12		-8.15	3.73	*
S1	3.24	3.34		-0.69	1.66		1.03	2.58		1.52	1.47		-0.12	1.05		3.54	3.43	
S2	2.36	3.59		0.97	1.97		3	3.03		2.22	1.72		1	1.35		6.4	4.15	
S3	-7.7	3.51	*	-0.17	1.68		-1.97	2.71		-1.03	1.53		1.68	1.16		-3.71	3.51	
S4	2.91	3.63		0.44	1.75		1.99	2.73		-2.29	1.48		1.24	1.2		9.56	4.08	*
Alliance with univ.	0.76	6		-8.49	3.03	**	-5.51	4.59		-5.02	2.79		-4.34	2	*	5.01	6.26	
Geo. proximity to univ.	-4.65	8.96		-2.42	5.65		-2.87	8.17		-3.12	5.27		1.74	3.44		-9.71	12.78	
Constant	34.37	12.91	**	-20.94	6.63	**	13.45	10.12		-8.36	5.74		-8.6	4.21	*	8.98	13.59	

Note: The level of significance: ** p<.01; * p<.05.

Table I. shows the results of Tobit estimation by technological category in which incubatees are engaged (electronics, information communication technology, biotechnology, environment, and services). As for estimation results on all types of graduates, most of the control variables show predicted signs. The cumulative number of graduates gets larger when the business incubator is older, has a shorter contract period, is less likely to allow contract renewal, and more open to foreign new ventures. Although it is difficult to know the actual number of foreign new ventures that entered to and graduated from business incubators, it is possible that business incubators' being prepared for assisting foreign startups contributed to creating better environment for domestic entrepreneurs as well in terms of rapid globalization, networking, and innovation. The size of business incubators in terms of the number of rooms and the incubation stage do not affect performance measure. Technological assistance by business incubators, S3, has a negative impact on the cumulative number of graduates. The number of incubation managers and any type of professional skills of incubation managers do not have significant impacts. Formal alliances with and the geographical contiguity to universities do not have significant impacts on performance.

As for estimation results by technological category in which incubatees are engaged, technological skills of incubation managers, F2, are associated with success of business incubators when incubatees are engaged in technological development in biotechnology and

electronics. F2, however, has a negative impact on the number of graduates in the service industry. Managerial skills of incubation managers, F1, do not have significant impacts. In contrast to predictions, incubators' establishing alliances with universities has a negative impact in science-based sectors such as the electronics industry. The geographical proximity to universities does not have significant impacts in any model. S4, general assistance in starting business, has a positive impact on the number of graduates in the service industry.

IV. Discussion

Estimation results by technological category show that the number of incubation managers does not have significant impacts on performance in any regression model while technological skills of incubation managers, represented as F2, are associated with more graduates in science-based sectors, such as electronics and biotechnology. In relation to knowledge transfer from incubation managers, formal alliances with and the geographical contiguity to universities do not seem to be effective channels of technological knowledge for science-based startups (alliance with universities has a negative impact in the electronics industry.). One interpretation of the results is that nascent entrepreneurs in science-based sectors need technological knowledge, instead of diversified types of skills represented as the number of incubation managers, to be transferred from incubation managers, which made coefficients of F2 significantly positive. Policy implications of this interpretation are that providing incubatees with opportunities to learn appropriate types of skills that vary according to technological category matters more than expanding business incubators in terms of size. This is of great significance, considering that approximately sixty percent of business incubators accept all types of startups as an incubatee as of 2006. Since resources of business incubators are limited (average business incubators in Japan have one or two incubation managers.), accepting various types of startups as an incubatee may make it difficult for business incubators to arrange appropriate assistance. Although it is possible that accepting diversified incubatees would exert synergy effects (i.e., learning from others with different backgrounds), if the aim of a business incubator is to nurture high-tech startups, the business incubator needs to select incubatees rigorously to exploit its limited resources effectively.

Another interpretation of the results is that incubation managers may have acted as a gatekeeper that connects incubatees with external organizations (even though their technological skills do not mater for the creation and growth of startups in science-based sectors). Networks or social capital are valuable resources for startups that face with the liability of newness and need to establish social legitimacy. Not only augmenting human or financial capital, social capital is also important for startups in science-based sectors in that it is more necessary for their innovative activities to establish access to and tap into the quality sources of scientific knowledge, such as universities and public research institutes. It is reasonable that incubation managers with technological skills would also retain social capital that help nascent entrepreneurs develop knowledge networks, such as collaborations with universities and public research institutes, to set a goal of and carry out R&D efficiently. It should be noted that it is empirically difficult to clearly distinguish the impacts of social capital and technological assistance resulting from the incubator's focus on technological skills of incubation managers. With that caveat in mind, this effect might contribute to the positive impact of F2 in science-based sectors such as electronics and biotechnology (and the absence of positive impacts of formal or geographical university linkages on knowledge transfer even in science-based sectors). Policy implications of this interpretation are that university-based technology incubators are not the only way to promote high-tech venturing. With deploying incubation managers with appropriate skills, business incubators could contribute to the creation of high-tech startups.

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References

[1] K. Fukao and H. Kwon, "Why did Japan's TFP growth slow down in the lost decade? An empirical analysis based on firm-level data of manufacturing firms," *Japanese Economic Review*, vol. 57, no. 2, pp. 195-227, 2006.

[2] E. Lazear, "Entrepreneurship," *Journal of Labor Economics*, vol. 23, no. 4, pp. 649-680, 2005.

[3] Japan Finance Corporation, "Entrepreneurship survey," Tokyo: Japan Finance Corporation, 2010.

[4] J. Vanderstraeten, P. Matthyssens, and A. van Witteloostuijn, "Measuring the performance of business incubators," University of Antwerp, Faculty of Applied Economics, 2012.

[5] A. King and H. Robson, "A dynamic model of investment and endogenous growth," *Scandinavian Journal of Economics*, vol. 95, no. 4, pp. 445-466, 1993.

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