1.1.3 University-launched startups

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First Published August 28, 2018 Final Updated April 26, 2019

Abstract

In the process of science, technology and innovation, the “university startup” is one of the mechanisms by which research output is returned to society. In the United States, several studies have demonstrated that university-launched startup companies perform better than other startup companies, and are recognized as commercializing technologies that could not otherwise be put into practical use. Therefore, investigating the mechanism of their success is of great significance to Japanese society. This paper reviews existing research on university-launched startup companies and summarizes the mechanisms for the success of university-launched startups, which are important in policy formation.

Keywords

University-launched startups, technology characteristics, founding team, fundraising

1 Introduction

In the process of science, technology and innovation, one of the mechanisms returning research output to society is the “university startup.” Figure 1 shows the number of academic papers published on university-launched startups (Rothaermel et al., 2007). As Figure 1 clearly shows, research on university-

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launched startups is increasing year on year, indicating the high degree of attention the topic is receiving as an academic field. Research on university-launched startups is drawing attention in academia because it is familiar to university faculty members who are researchers, making it easy to obtain data, and due to the importance of university-launched startups themselves.

According to Shane and Stuart (2002), university-launched startups perform better than other independent startups. However, Ensley and Hmieleski (2005) found that their rate of return tends to be lower than that of independent startups. Although their performance is evaluated separately, they play an important role in commercializing a piece of technology that could not otherwise have been put into practical use. As such, there is social significance in exploring the mechanisms of their success.

For policymakers, fostering university-launched startups is an effective way to promote economic development. Innovative technologies generate new economic value, create jobs, and promote regional economic development. For university management, university-launched startups are an effective means of commercializing highly uncertain technologies and, in terms of bringing funds to the university, can further the university's original mission of research and educational activities. At the very least, the creation of university-launched startups is highly profitable for universities. Indeed, a survey of Canadian researchers found a 57 percent increase in research funding within three years of establishment (Doutriaux and Barker, 1995).

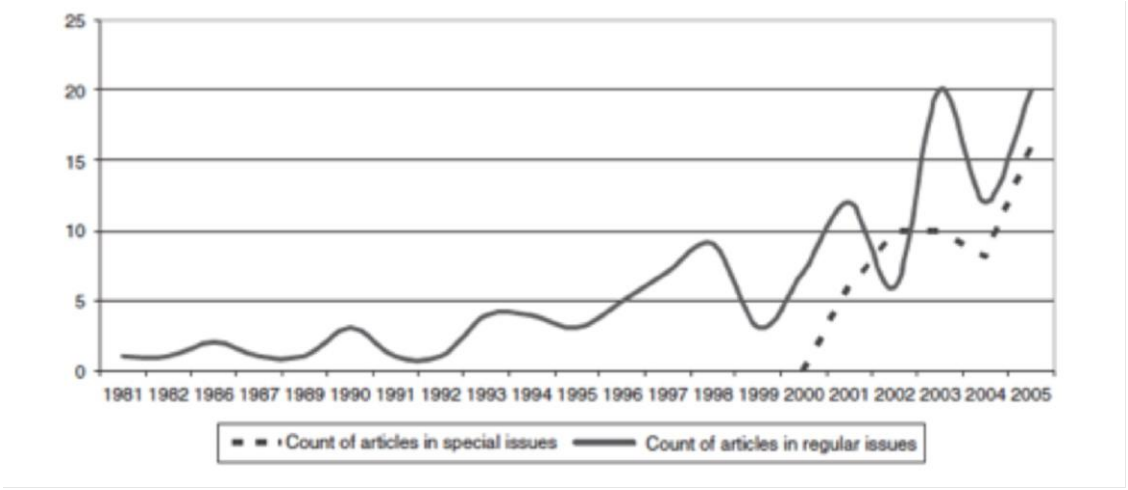

Figure 1. Number of papers related to "university startups."
Source: Rothaermel et al. (2007)

The development of university-launched startups in Japan has come to be positioned as one of the pillars of science, technology and innovation policy. This began with the Act for the Promotion of University Technology Transfer (TLO Law) in 1998, and the launch of the Plan for 1,000 University-Launched Startups by the Ministry of Economy, Trade, and Industry in 2001. By the end of 2015, a total of 1,773 university-launched startup companies had been established, indicating the degree of success of these

initiatives. However, sufficient verification of the efficacy of such university-launched startups has yet to be conducted, and needs to be continued.

Evaluating the efficacy of university-launched startups is an issue faced by countries around the world. A lack of appropriate data sets underlies this lack of adequate evaluation (Rothaermel et al.2007, Shane 2004). Datasets of university-launched startups face the following issues: (1) small sample size, (2) lack of exhaustive data (few variables), and (3) survivorship bias (data can only be collected from companies that continue to exist). The majority of studies thus relied on case studies (qualitative research), resulting in a need to continue to accumulate such research as "objective evidence."

Figure 2 shows the classification of university-launched startup research papers by Rothaermel et al. (2007). Research on university-launched startups has been divided into four major categories: university organizational factors; productivity of technology licensing organizations; establishment of startup companies; and external environment, including networks. This indicates that, when considering what factors give birth to university-launched startups and help them grow, these four factors have a large impact.

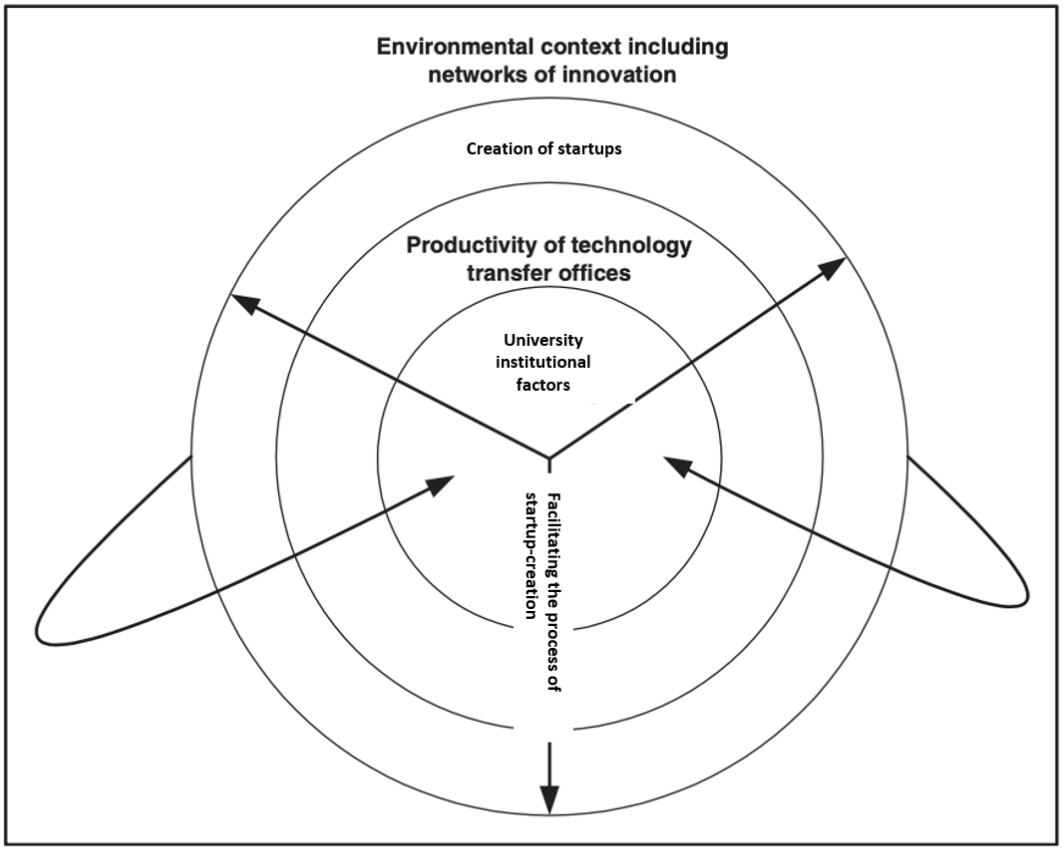

Figure 4 Conceptual framework of university entrepreneurship.

Figure 2. Classification of "university-launched startup" related research.
Source: Rothaermel et al. (2007), translated into Japanese by the author.

2 Factors that create and nurture university-launched startup companies

2.1 University organizational factors

University-launched startups are not created in the same way at every university. Indeed, we know from the actual situations in Europe and the US that there are large biases depending on the university (Pressman, 2002; Charles, 2001). This is because the institutions and culture specific to each university have a significant impact on the creation of seed startups and entrepreneurial decision-making (see Shane [2004] for a complete picture). D'Este and Patel (2007) offer an empirical analysis using a questionnaire survey. A large number of studies have utilized individual factors, as shown in Figure 3. It has been confirmed that it is important that the institutional culture is entrepreneurial-oriented, that the institution's systems are conducive to university-launched startups, and that the institution has human, financial, and knowledge resources that are beneficial to the establishment of university-launched startups. To touch on a few important individual factors, among the systematic factors within institutions, it is clear that attributing intellectual property rights to inventors produces companies with a strong commitment to commercializing the results. Even when a company belongs to a university, receiving royalties in the form of equity can alleviate the initial lack of funds for university-launched startups, which not only encourages entrepreneurship but increases the success rate of university-launched startups. Among the resource factors within an institution, the presence of knowledge concentration and human networks in technology licensing organizations and industry-academia collaboration departments has been found to be effective. This indicates that it is necessary to devise an organization that can continue to employ human resources with knowledge and human networks in the industry-academia collaboration field, primarily national universities and public universities.

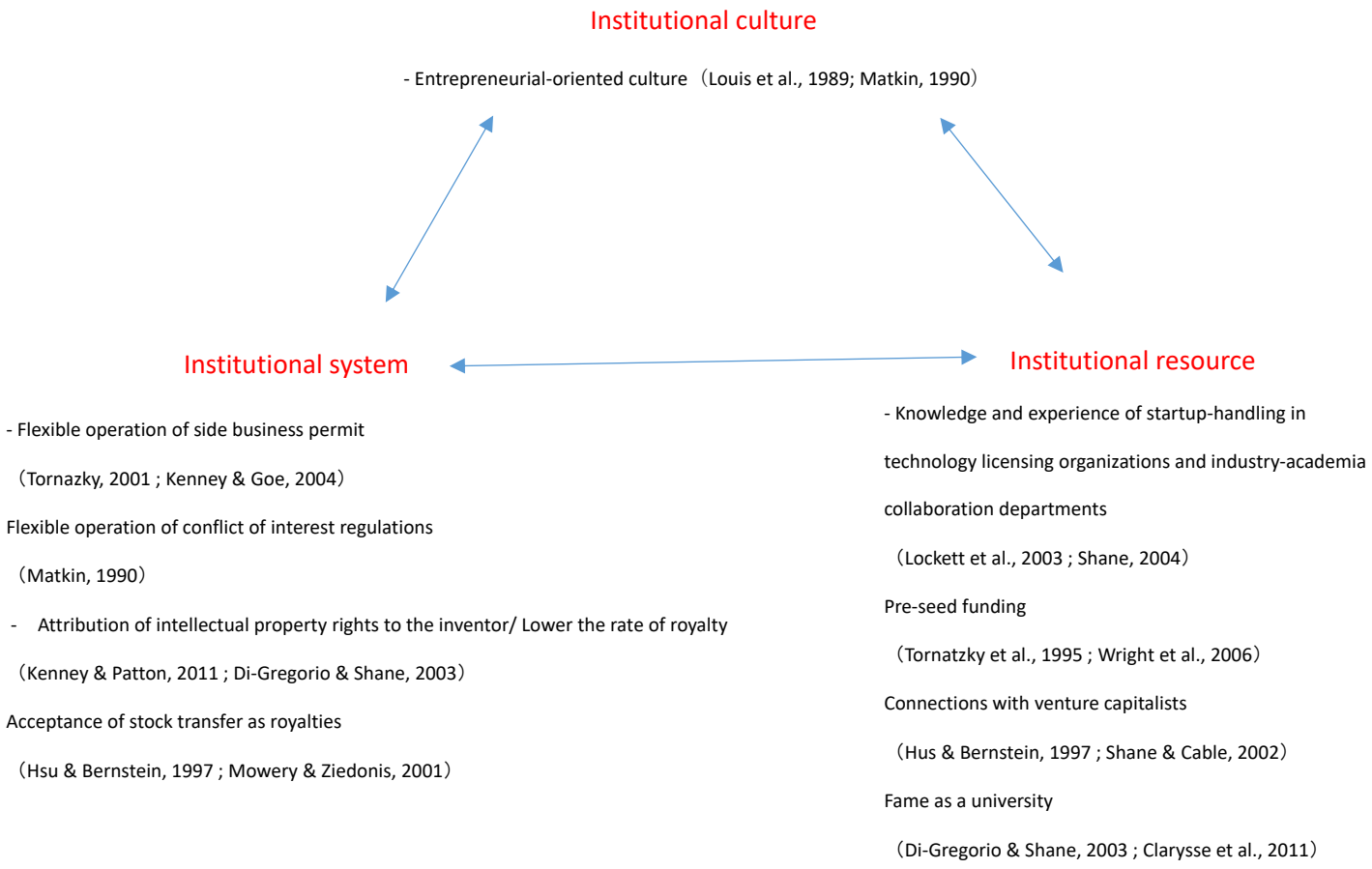

Figure 3. University organizational factors that affect the creation of university-launched startups.
Source: Created by the author.

In Japan, resources for the creation of university-launched startups have been in place since 1997, primarily through the promotion of policy development for industry-university cooperation departments and technology licensing organizations (TLOs). While the system is left to the discretion of the institution in the case of private universities, there used to be restrictions for national universities; this changed with the incorporation of national universities in 2004. For example, the institutional environment rapidly improved as permission to engage in concurrent business became a matter of corporate judgment. In respect to culture, several institutions have appeared in recent years in which an entrepreneurial culture is being formed. For instance, the University of Tokyo was once relatively inactive in entrepreneurship compared to other universities, but underwent a transformation, with the emergence of faculty-launched startups that have gone public and been acquired by global companies. However, the university was not reformed in a way that exclusively encouraged the establishment of university-launched startups; rather, the university successfully changed its culture by introducing systems that were beneficial to university-launched startups

and cultivating human and knowledge resources in a way that coexisted with the traditional university culture (Yoshioka-Kobayashi, 2018).

2.2 The productivity of technology licensing organizations

The creation of university-launched startups is greatly influenced by technology licensing organizations, such as industry-university cooperation departments and technology licensing organizations.

First, these organizations have a significant impact on the decision to establish a startup. Technology licensing organizations are also in a better position to advise on entrepreneurship; for instance, they can judge the market opportunity in determining whether to patent a researcher's invention. An example of the success of this is PeptiDream Inc., which was founded in 2006 based on technology invented by Professor Suga Hiroaki of the University of Tokyo. When Professor Suga consulted with the University of Tokyo's TLO, Todai TLO, about applying for a patent for his invention, he was advised to start a business, resulting in the company's founding. The company went public in 2013 and has a market capitalization of JPY 40 billion.

Second, they are in a position to easily build networks with business managers, venture capitalists, lawyers, accountants, tax accountants, and other professionals, thus supplementing the management resources that the university lacks. In PeptiDream's case, the University of Tokyo Edge Capital Corporation, which heard about the company from Todai TLO, introduced human resources who would serve as managers, and the company was able to start business.

2.3 Founding a startup company

The type of resources a startup has will naturally affect the probability of its subsequent success. Being supplied with risk money such as venture capital alone has a significant impact on subsequent success (Shane and Stuart, 2002). It is clear observed in Japan that a typical loan would require sufficient collateral assets or personal guarantees. If the business failed, it would further result in the destruction of social relationships. This is too risky, and it is difficult to launch a venture with an innovative business at its core.

So how does one obtain venture capital investment? Existing research points to the need for a set of patents preventing imitation (Shane and Stuart, 2002) and team members experienced in marketing and management among the founders (Roberts and Malonet, 1996). The impact of direct social ties to venture capitalists has also been noted (Shane and Stuart, 2002; Shane, 2004).

Various factors affecting the performance of university-launched startups are becoming apparent, including the relevance of strategy (Shane, 2004), the involvement of university researchers in technology development (Maki, 2015), and the diversity of management expertise (Doutriaux and Barker, 1995). In particular, a study of Japanese university-launched startups noted that having a highly diverse management team and one with a high proportion of people from universities other than the parent university are factors that enhance performance (Yuri Hirai et al., 2013).

2.4 The external environment, including networks

The external environment is also important to the creation of university-launched startups. For example, the presence of an entrepreneurial ecosystem within the region makes a significant contribution. An entrepreneurial ecosystem is one in which people with entrepreneurial experience become venture capitalists and encourage new entrepreneurial startups, and those who have succeeded in such startups become new venture capitalists and encourage further entrepreneurial startups. Silicon Valley is known for having formed such an environment. A recent study has set out the formation of a startup creation ecosystem out of the University of Texas in Austin, starting from the OB/OG of a major company (Fukushima Michi, 2013). As Tables 1 and 2 show, ecosystems are being formed in Boston, where the Massachusetts Institute of Technology and Harvard University are located; in London, where the University of London and other institutions are located; in Cambridge, where the University of Cambridge is located; in Berlin, where the University of Berlin is located; in the Zhongguancun area of Beijing, where Peking University and Tsinghua University are located; and, more recently, around the University of Tokyo Hongo Campus and in Shenzhen, China. However, Silicon Valley continues to have a global impact (Economist, 2015). One of the reasons for this is that it has particular strength in the software industry, which has high growth potential and serves as the foundation for other industries (Gupta and Wang, 2016). In fact, the majority of venture capital investment is also unevenly distributed in Silicon Valley (Table 3).

Table 1. Regions highlighted as forming ecosystems for university-launched startups (1)

Region	Main industry	Main University	Source
San Francisco, California, USA （Silicon Valley）	Technology industry, Information technology industry, Bio industry, Semiconductor industry	Stanford University, University of California	
Boston, Massachusetts, USA	Bio industry	Massachusetts Institute of Technology, Harvard University	Economist (2016)
Manhattan, New York City, New York, USA （Silicon Alley）	Media industry, Information technology industry, Bio industry	Columbia University in the City of New York, Cornell University, Technion - Israel Institute of Technology	Economist (2016)
Austin, Texas, USA （Silicon Hills）	Information technology industry	Texas State University	Fukushima (2015)
San Diego, California, USA	Bio industry, Information technology industry	University of California, San Diego	
East London, Greater London, UK （Silicon Roundabout / East London Tech City）	Technology industry, Information technology industry	University of London, Imperial College London	Economist (2016)
Cambridge city, East England, UK （Silicon Fen / Cambridge Cluster）	Information technology industry, Bio industry	University of Cambridge	Economist (2016)

Note. Major clusters and related universities were also drawn from Wikipedia.
Source: Created by the author.

Table 2. Regions highlighted as forming ecosystems for university-launched startups (2)

Region	Main industry	Main University	Source
Berlin, Germany	Technology industry	Non-information	Economist (2015)
München, Germany	Information technology industry	Technical University of Munich	The New York Times (2015)
Zhongguancun silicon valley, Beijing, China	Information technology industry	Peking University and Tsinghua University	Economist (2011)
Shenzhen, Guangdong province, China （Silicon Valley)	Telecom-equipment industry, Technology industry	Tsinghua University	Mao and Motohashi(2016) Economist (2017)
Bunkyo City, Tokyo	Software industry, technology industry	University of Tokyo	Shukan Toyo Keizai (2017)

Note. Major clusters and related universities were also drawn from Wikipedia.
Source: Created by the author.

Table 3. Venture capital investment by region (2012)

Rank	Metro	Venture Capital Investment*	Share of Global Venture Capital Investment
1	San Francisco	$6,471	15.4%
2	San Jose	$4,175	9.9%
3	Boston	$3,144	7.5%
4	New York	$2,106	5.0%
5	Los Angeles	$1,450	3.4%
6	San Diego	$1,410	3.3%
7	London	$842	2.0%
8	Washington, D.C.	$835	2.0%
9	Beijing	$758	1.8%
10	Seattle	$727	1.7%
11	Chicago	$688	1.6%
12	Toronto	$628	1.5%
13	Austin	$626	1.5%
14	Shanghai	$510	1.2%
15	Mumbai	$497	1.2%
16	Paris	$449	1.1%
17	Bangalore	$419	1.0%
18	Philadelphia	$413	1.0%
19	Phoenix	$325	0.8%
20	Moscow	$318	0.8%
	Top 20 Metros	$26,790	63.6%
	Total	$42,121	100.0%

*U.S. million dollars

Exhibit 2: Top 20 Global Metros by Venture Capital Investment

Note. Based on the Thomson Reuters venture investment database.
Columns with colored backgrounds are the regions listed in Tables 1 and 2.
Percentage figures represent the share of global venture capital investment.
Source: Martin Prosperity Institute (2016)

The existence of systems to support startups is also important. Supplying risk money is one such system. Small Business Innovation Research (SBIR), a system in the US that aims to provide R&D subsidies according to the growth phase, is known to have contributed greatly to the development of startups (Maki, 2015; Yamaguchi Eiichi, 2015).

3 Implications for policymakers

University-launched startups are a means of generating innovation. As evidenced by the factors affecting their creation and success, university-launched startups are created and grow through the interrelationship of many factors. As Figure 4 illustrates, should be an awareness in policies concerning university-launched

startups that there are ecosystems that create university-launched startups with the power to change society and which continue to aid their growth.

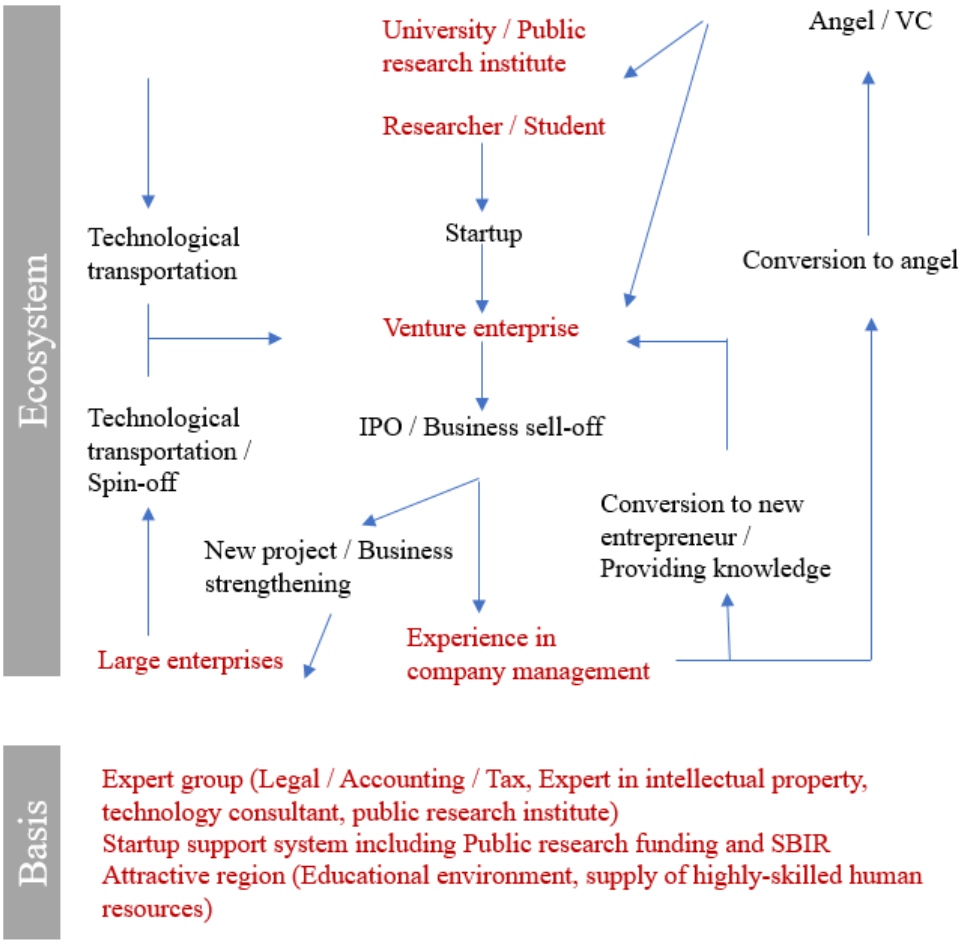

Figure 4. Ecosystems surrounding university-launched startups.
Source: Created by the author with reference to Fukushima Michi (2013).

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