Regionalisation of Innovation Policies: The Case of Japan

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Abstract

This article contributes to discussions concerning the geographical dimension of innovation systems by shedding light on recent 'regionalisation' efforts being made in the Japanese context. The current government's cluster initiatives, with national industrial and science & technology policies centred on strengthening university-business links, are critically examined in light of the development of Industry-Science Relationships (ISRs) and Regional Innovation Systems (RIS) set within multi-level governance structures of knowledge production. The recent development of regional policies for innovation, set against the development of the globalising knowledge-based economy, draws attention to issues concerning the limited scope of multi-level governance structure in Japan today. Regionalisation of innovation policy needs to be situated within a wider geographical paradigm, which links knowledge value chains encompassing local, regional, national and trans-national levels.

1. Introduction

In the age of globalisation and the knowledge economy, production of knowledge, particularly localised tacit knowledge, is viewed as a valuable regional asset (OECD, 2001a). As strategic sites of policy implementation and knowledge creation, regional, rather than national economies, are increasingly recognised as the salient foci of wealth creation and world trade (Ohmae, 1995). Within economic geography and regional studies, these perspectives view regional development as being dependent on innovation and institutional learning processes, and are notably found in literature on 'Regional Innovation Systems'(RIS) (e.g. Braczyk et al., 1998; Cooke et al., 2000; Cooke et al., 2004).[1] This article investigates whether or not recent Japanese national industrial and science & technology policies to encourage local innovative capability (e.g. local cluster strategies) foster the development of regional innovation with new regional governance system of knowledge production. In so doing, it considers the current Japanese political context surrounding the regionalisation of innovation policies in an international comparative framework and in view of the growing significance of

'trans-national regional economies' and the international relations of sub-national governments such as regions and municipalities (see Bellini, 2004).

Although the nation-state provides the overall organising framework, individual and often local institutional actors, operating in conjunction with nationally determined initiatives and strategies, comprise the framework of innovation systems operating at sub-national levels. Some authors (e.g. Cooke et al., 2000) situate regions within the 'multi-level governance' (MLG) (i.e., local, regional, national and trans-national) structures of innovation policies that are emerging within Europe. The concept of regional innovation systems has been empirically described and widely tested (e.g. Cooke et al. 2004; de la Mothe and Paquer, 1998) and has developed a typology of systems (Cooke, 1998; Heidenreich, 2004) assisting to understand structural differences in the 'systemness' of the regions.[2] Nevertheless, precisely what 'region' means varies politically and depends on national and trans-national contexts. In Japan, where there is no formal political administrative bodies at regional level, the 'regional' and 'local' levels are sometimes loosely used synonymous whilst sub-regional cluster development is increasingly recognised as a strategic site of policy implementation. It is important to examine the historical development of distinct national Industry-Science Relationships (ISRs) set against the governance structures of innovation, encompassing multiple levels of geographical spaces (Kitagawa, 2005a).

Japan, among other countries, is aiming to increase national competitiveness in the global knowledge economy by tapping into local innovative capability and establishing new ISRs (OECD, 2002a), which are in turn hoped to foster further knowledge creation and innovation. For example, through the implementation of local cluster strategies, complex patterns of inter-firm and inter-organisational relationships are promoted at the local and regional levels.[3] The recent development of regional policies for innovation, set against the development of the globalising knowledge-based economy, draws attention to issues concerning the limited scope of multi-level governance structure in Japan today. This line of thinking poses two interesting analytical questions: 1) Does the RIS concept (as predominantly developed in the Western contexts) hold in Japan where traditionally established sectoral networks among firms are arguably more outstanding than the 'Regional Innovation Systems'?; 2) With growing pressures from globalisation of the economy and growing trans-national linkages, can policies which ensure RIS be embedded in Japan, or will it be the case of developing linkages to pan-Asian value chains even if that means diluting

the impact of ‘regionally focused’ policies? The ways in which theoretical concepts such as ‘cluster development’ (Porter, 1990; 1998) and RIS have informed policy, and been adapted to geo-political structures particular to Japan warrants clarification.

This article is organised into four parts. Following this introduction, in the second part, a historical background of the development of national/regional innovation systems in Japan is provided, giving a brief overview of literature in this field and depicting recent policy development. These national-regional initiatives are situated in the wider international and global political economy unfolding in East Asia, in relation to recent trends of foreign direct investment (FDI) and the so-called ‘hollowing out’ of the Japanese economy. The third part examines recent Japanese cluster policies, policies promoting university-industry links, and the new development of ISRs, raising questions as to the impact of these political instruments. Finally, in the fourth part, policy implications are discussed and opportunities and constraints that may present themselves from the current structural change of innovation policies are identified.

2. Japan: innovation systems and regional governance

2.1. Historical and comparative background

Japan is known to have developed broad national technology strategies with long-term scientific and technology goals. In European literature, however, regional and local innovation systems rather than national or corporate systems stand out (Malecki, 2000). This is particularly notable in years, given a recent policy emphasis on ‘regions’ in the EU contexts. The important role that regions can play in mobilising research and innovation efforts in making Europe ‘the most competitive and dynamic knowledge based-economy’ has been emphasised in policy documents published by the European Commission (e.g. CEC, 2000; 2001). In Japan, however, there are very few literature on ‘regional innovation systems’ but for a few notable exceptions (e.g. Abe, 2004). Literature on innovation systems seems to have centred on national (e.g. Odagiri and Goto, 1993) or corporate (e.g. Nonaka and Takeuchi, 1995), rather than regional and local levels until very recently. This is reflected in the characterisation of Japanese innovation systems as resulting from “technonationalist policies” (Fransman, 1999, p.169). Nevertheless, recent years have witnessed an apparent devolution of planning

functions from the national to local governments accompanied by the emergence of research parks as a key implementation strategy (Bass, 1998).

In terms of the roles of industrial policy, science and technology policies in the context of regional development, the development of ISRs in Japan have had three separate phases: 1) 'Catch up' after the Second World War to 1980, 2) 'Technopolis' from the 1980s to the mid-1990s; and 3) 'Science-based local innovation' from 1995 to the present, including local cluster initiatives. Regional industrial policy of the central government, mainly led by the Ministry of Economy, Trade and Industry (METI), from the 1960s until the early 1990s, had been to promote regional development through the relocation of factories to non-urban regions from larger metropolitan areas. Since the late 1990s, the emphasis shifted to revitalising the industry in order to overcome the 'hollowing out' of the manufacturing base caused by the shift of production from domestic sites to overseas nations, primarily located in China and other Asian countries. Policies inducing regional industrial agglomeration to raise industrial competitiveness (e.g. cluster strategies) have emerged in such a political-economy.

An overview of these developments follows. As a general background, the political dimension of Japan's post-war regional development is to be noted, albeit briefly. The ruling Liberal Democratic Party (LDP) has for decades used massive amounts of state funding to pursue its political goals of economic development and to maintain predominance in (often remote) key regional constituencies. This political background has influenced regional structural policies and is characterised by great public investment in physical infrastructure. Whilst there has been a shift under Koizumi cabinet, this remains a key feature of Japan's political and economic policies.[4]

2.2. From Catch up to Technopolis

Japan's post-war recovery period was centred on the development of 'Pacific belt zone' including big four industrial areas (Tokyo, Nagoya, Osaka and Fukuoka). Throughout the 1960s, chemical engineering industries were heavily concentrated in coastal zones leading to excessive industrial concentration in the four aforementioned industrial areas. As a result, the 1970s witnessed growing regional disparities in terms of income and employment rates, whilst serious environmental pollution emerged as the consequence of the preceding decades' national industrial development policy. In the

1970s, Tsukuba Science City, involving a construction of a new town sixty kilometres north of Tokyo since 1963, with a strong research and development dimension, was established in an effort to decentralise government science and engineering research institutes. In order to tackle regional disparities, several policy instruments, such as industrial relocation promotion and factory location laws were enacted.

In 1980, a Ministry of International Trade and Industry (MITI) report highlighted the need to move beyond the 'catch-up' strategy to the development of 'fundamental science'. Around the same time, the legal basis for the new Technopolis programme, the 'Law for accelerating the regional development based on high technology industrial complexes' was enacted. Technopolis was started in 1983 as part of the national government's intention to support both national industrial growth and economic development in peripheral regions. The government designated 26 sites as eligible areas under Technopolois programme.

A large body of literature examines the effects and constraints of Japan's regional high-technology initiatives since the Technopolis Programme was introduced in 1983 (e.g. Bass, 1998; Imai 1986; Masser, 1990; Patrick, 1986). Technopolis is recognised internationally as an example of the use of technology-led development policies as a means of promoting the expansion of peripheral regions led by MITI during the 1980s. In practice, however, the evaluation of these initiatives in terms of their impact on local economic competitiveness vary, and some observers have pointed out many constraints and limitations in terms of the development of local ISRs (industry-science relationships).

Local universities have made a significant contribution in terms of R&D and the development of research infrastructure in these sites in conjunction with the Technopolis Foundation, one of several co-ordination and support organisations (Masser, 1990). Linkages were developed between university and industry, and public research institute were combined with improved social infrastructure. Incubator facilities were developed in most of the sites, and most of the national universities opened 'local collaborative research centres', which supported the combined efforts of local businesses and universities. Some new Technical Universities were developed in relation to the Technopolis programme, some of which have made a notable contribution to local innovation (e.g. Nagaoka University of Technology; see Masser, 1990).

Despite these promising developments and policy aspirations, the policy thinking behind the Technopolis Programme generally did not function well in practice. The conceptual 'triple-helix' (Etzkowitz and Leydesdorff, 1997) model, linking university-industry-government, seems to have underlined the Technopolis Programme and other early initiatives, whilst in many cases collaboration was limited with partial impact on local innovation capability and competitiveness. Local linkages within the Technopolis areas were not strong, partly due to the fact that most branch subsidiaries retain strong vertical links with their headquarters rather than opening up new production spaces for local firms (Abe, 2004).

There are a number of complex factors which hindered the full implementation of these initiatives. First, in the 1980s, whilst local small and medium sized enterprises (SMEs) were encouraged to interact with university research, cooperative efforts were ultimately lacking. Second, most large firms tended to conduct R&D in-house, or work with universities overseas rather than with Japanese ones. Third, regional and local technology transfer had been promoted by *Kohsetsushi* centres (public research institutes funded by local authorities) in each prefectures (Shapira, 1996; see also Suzuki, 2001), which were under-resourced and not deeply involved with the new initiatives. Fourth, spin-off effects of new technology on the local economy were limited (Masser, 1990). Therefore, the implementation of local development policy based on the framework of Technopolis Programme suffered under efforts to revitalise Japan's industrial structure as a whole, with the result that the initiative did not adapt well enough to the changing needs of society throughout its 15 years' existence.

There were three fundamental, inter-linked reasons which hindered the full development of Technopolis Programme to regional innovation systems in Japan during the 1980s. One of these was the excessive concentration of economic activities in the metropolitan Tokyo area. In terms of regional development policies, the extent to which R&D related activities had been heavily concentrated in this area resulted in the view that technology transfer to peripheral regions were limited to activities such as simple parts production and assembly instead of basic research. Moreover, some reservations were expressed about the role played by universities in peripheral areas given the high concentration of existing R&D efforts in core academic institutions such as the University Tokyo and other former 'imperial' universities. Wider structural problems were also foreseen with regards to meeting skill shortages in peripheral regions given the greater job opportunities in the national industrial heartland.

A second problem hindering the development of regional innovation systems was a closed higher education system, which did not encourage technology transfer from universities to their localities. Many of the problems were found in the ways in which national universities operated. During the 1980s many science and technology parks were created, but links with university research were weak and support mechanisms for knowledge transfer to local economies or the creation of venture firms from university research were insufficient. It has been argued that this insufficiency of university-industry collaboration was due to the lack of co-ordination mechanisms among universities, industry and the policy makers (Kubo and Harada, 2001).

Furthermore, there were structural constraints for university researchers, who were prevented by their legal status from engaging in any formal co-operation with private firms. That the university system was not open to society at large and that human resources of support organisations were insufficient represented critical factors explaining the limited development of ISRs based on the Technopolis Programme. This resulted in a lack of intraregional networking between the newly attracted firms and suppliers, universities and public research institutions in regions (Hassink, 2000).

The third structural constraint which hindered the development of the Technopolis Programme during the 1980s was the globalisation of the economy, which accelerated growth in foreign direct investment (FDI) leading to the ‘hollowing out’ of the Japanese economy. In recent years, a number of East Asian countries, and China, in particular, have emerged as the ‘world’s factory’ seizing top world production shares for many products. Competition to establish and maintain information and knowledge activities is becoming fierce in cities and regions in South Korea, China, Taiwan and Japan. Singapore, referred to as a business hub, is facing intense competition with other nations. Chinese development to date has centred on those industries located in local Japanese cities, imposing challenges to the development of Japanese local and regional innovation systems.

Whilst competition is intensifying among East Asia’s economic agglomerations, inter-linkages between these regions are also growing. One factor encouraging inter-agglomerative linkages within East Asian regions has been the movement of multinational corporations into East Asia, including those of Japan. These activities have created horizontal links among economic agglomerations in East Asian countries, which are becoming increasingly specialised (METI, 2002). As far as Japanese firms are

concerned, manufacturing and sales clearly comprise the bulk of offshore operations whilst in the R&D sector, companies have just started to shift their operations abroad (METI, 2002; see also Odagiri and Yasuda, 1997). This landscape may change even further as the Chinese strategy for translocation of global Information and Communication Technology (ICT) production *and* R&D into the Beijing, Huamgdong (Shanghai) and Guangzhou (Shenzen-Guangdond) regions has borne fruit, significantly on the back of an investment in engineering talent (Cooke, 2004). Therefore, in developing local/regional innovation systems and designing national R&D policies in Japan, policy makers at various levels need to consider the potential for such transformation within wider trans-national regions, and construct robust ISRs which can respond to these changes.

2.3. Going beyond Technopolis

Although limited in terms of enhancing the diversity of regional and local economies, the Technopolis Programme was "not an invention of a central agency but rather its effort to provide an organizational national framework for, and to reinforce different components of trends already ongoing at regional level" (Stohr, 1985, p.10 as cited in Masser, 1990, p.51). Despite not having been implemented to its full extent, local endeavours throughout the 1980s provided some areas with potential innovation capabilities with global links which came to be realised as bases of regional innovation systems in later years.

There are notable successful cases arising from the Technopolis Programme. For example, the Kitakyushu Techno Centre in Fukuoka Prefecture has become known for its entrepreneurial activities combining universities, private sector and local authorities as well as for making networks with Korean companies and science parks (Kubo and Harada, 2001). In more recent years, Fukuoka Prefecture has been developing partnership schemes for R&D collaboration and human resource development with universities, research institutes and those intermediary organisations not only in Japan but also in other regions in East Asia (e.g. Korea, Taiwan, Hong Kong, Shanghai, Singapore). This is known as *Silicon Seabelt Fukuoka Project*, [5] and the future development warrants close investigation in light of the development of trans-regional technological collaboration in East Asia (see Kitagawa, 2005b).

Another example of successful locality is Hamamatsu, in Shizuoka Prefecture. Hamamatsu, which is often referred to as an exemplar of a successful local innovative system, has adapted its economic structure and been able to construct support mechanisms for local innovation utilising different government programmes such as Technopolis and more recent funding for developing university-business links. These support mechanisms are embedded as part of the historical and social networks of the locality (Nishiguchi et al., 2003). Whilst Yamaha, Honda and SUZUKI are well known international firms based in this area, new high-tech firms in the field of photonics constitute noteworthy additions to the area (see Hatakenaka, 2004). The economic growth of Hamamatsu area is characterised by its 'endogenous' development, rather than through attracting large, outside firms.

2.4. National, Regional and Sub-Regional Governance of Knowledge

In regard to science and technology policies, the responsibilities of national and local governments are as follows: the national government is responsible for formulating and implementing comprehensive policies for promoting science and technology; local governments are responsible for formulating and implementing policies for promoting science and technology corresponding to national policies and in accordance with the local characteristics. Local governments operate at sub-regional level, including prefecture and municipal levels. The fifth National Institute of Science and Technology Policy (NISTEP) review of regional science and technology promotion policies shows that over 90 % of prefecture governments adopted at least one key action programme for science and technology, two examples being the 'regional council boards for the promotion of science and technology' and 'basic plans for the promotion of science technology' (OECD, 2003).

There is no institutional mechanism operating at 'regional' level as such in research policy and funding terms. The only exception to this structure is the existence of nine METI regional economic bureaus which oversee economic and industrial policies at the 'regional' level across prefectures. These nine bureaus are expected to develop plans, become nodes to co-ordinate local networking and alliances. In light of the growing economic activities which encompass narrow 'local' areas, this can be regarded as 'regionalisation' of innovation policies in Japan. Significant initiatives are currently being undertaken jointly by some prefectural governments, and the central

government's policy of developing regional research strength encompasses this level of government (OECD, 2003).

In 2000, the Local Devolution Law was enacted whereby responsibilities given to local authorities were substantially strengthened. However, there is a range of science and technology policies at the local level, depending on each local authority. The introduction of the local 'platform' (see below) was a significant turn in Japan's regional policy from the 'exogenous model' assisting lagging regions by attracting firms and creating jobs to the 'endogenous growth model' aimed at inducing competition between localities and promoting innovation. However, authors such as Bass (1998) have cautioned against overstating the role of local governments in Japanese regional high technology planning. Policy instruments may be needed with consideration of appropriate level of partnerships and alliances among government, universities and private sector.

3. Japanese Cluster Policies, University-Business Links in the 21st century

3.1. Current National Policy Changes in Science &Technology Policy

To succinctly illustrate the Japanese policy contexts, Box 1 presents principle legal frameworks underlining new industry-science relationships in Japan since the mid 1990s. In 1995, with passing of the Science and Technology Basic Law by the Japanese parliament, the first Science and Technology Basic Plan (1996-2000) was formed. In December 1998, the legal framework which underlined the Technopolis Programme was abolished and in 1999 was replaced by a new law for promoting the creation of new enterprise, providing local municipal and prefectural governments with far more autonomy and responsibilities. A new model, called the 'local platform' was created in order to respond to new societal demands stemming from the globalisation of the economy and a perceived need to implement new regional development policies which were more oriented towards entrepreneurship and indigenous models of economic development. Recently, the new Japanese research system has articulated goals, identified in its Science and Technology Basic Plan through the Council for Science and Technology Policy (CSTP). [6] Between FY 2001-5, 24 trillion yen are to be spent on science and technology, assuming 1 per cent of GDP and 3.5 per cent of nominal GDP rate.

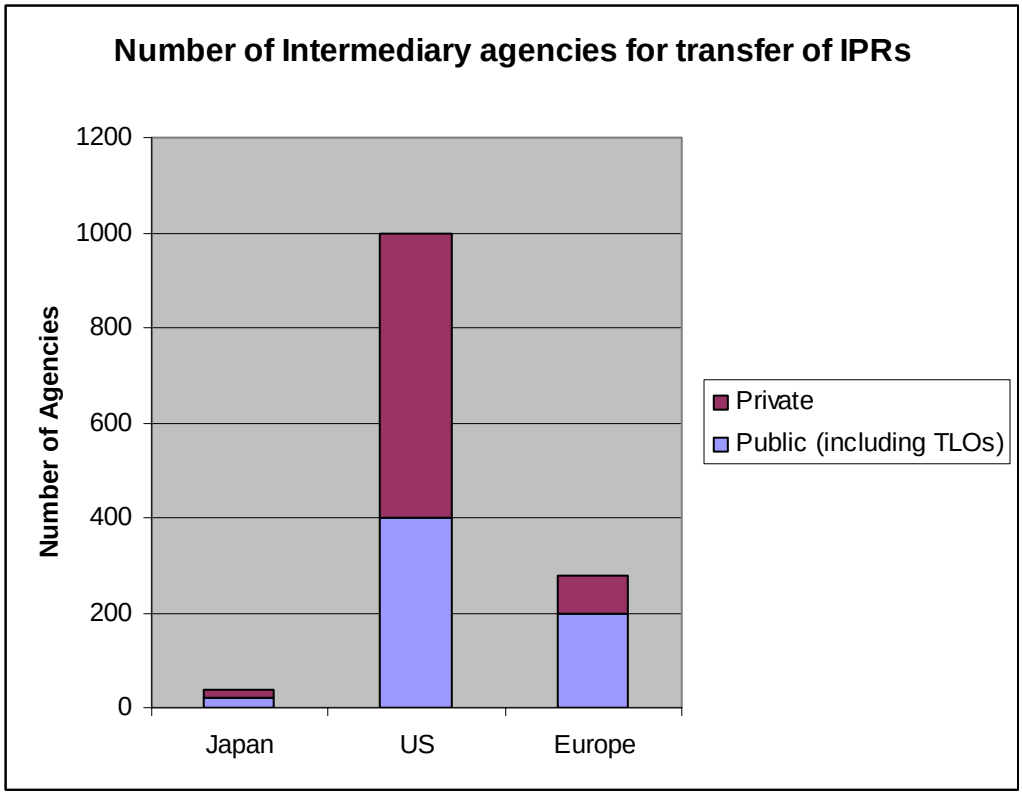
Box.1 Japanese legal-institutional frameworks promoting industry- science relationships

1995 The Science and Technology Basic Law
1996 The First Science and Technology Basic Plan (1996-2000)
1998 The Law on Promoting Technology Transfer from Universities to Industry (TLO Law)
1998 Abolition of Technopolis Law
1999 The Law on Facilitating the Creation of New Business
2001 The Second Science and Technology Basic Plan (2001-2005)
2001 Council for Science and Technology Policy: CSTP attached to the Cabinet Office

With the Science and Technology Basic Plan, the geographical limitation which was applied to the Technopolis Programme was no longer valid, meaning that every local government has an opportunity to develop a 'local platform' whereby local resources and characteristics can be utilised. This new law for promoting enterprise creation, combined with the model of local platform prepared the context to develop new cluster policies to revitalise the long suffering Japanese economy in the 21st century. One aim of the current second Science and Technology Basic Plan (2001-5) is to promote science and technology in each geographic region.[7] Furthermore, to encourage the development of university-linked incubators, METI (reorganised in 2001 from MITI) provides support through the Japan Regional Development Corporation (JRDC), and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) provides supplementary budgetary support. In 2001, *Hiranuma Plan*, aimed at increasing 'venture businesses born in universities' was launched, targeting to 'create 1000 within 3 years'. As of 2003, the total number of spin-off firms from universities in Japan reached 614.

These new trends in industrial and science & technology policies have been accompanied by new sets of policy instruments aiming to promote innovation and forge new links between universities and industry. It is generally accepted that an effective dissemination of knowledge between public knowledge institutions and the private sector depends on certain regulatory factors (e.g. intellectual property rights policy in the public sector) and on the existence and efficacy of mediating institutions (for comparison, see Figure 1 below).

Figure 1 Intermediary agencies for the transfer of intellectual property rights (IPRs) (Source: MITI as cited in OECD 2001b) [8]



For Japan, the share of business funding of higher education research is less than half of the OECD average. The figure was 1.5 per cent in 1985, and has stayed as 2.3 per cent since 1990. Table 1 below shows the percentage of business funding of the research performed by the government and university sector in the UK, Japan, US against the OECD average as of 1999.

Table 1. Comparing UK, Japan, US and OECD average percentage of businesses in the funding of research in 1999 (Source: OECD, 2001c)

	UK	Japan	US	OECD average
Government	21.1	1.8	0.0	4.1
HE	7.2	2.3	6.3	6.1

After the 1995 Basic Law, recent university reforms were accelerated to encourage further development of university-industry links which was hitherto legally and structurally constrained in Japan. A legal framework to promote university-industry technology transfer was enacted in 1998, and 27 Technology Licensing Organisations (TLOs) have been established as of April 2002. The number of filed patent application, patent grants, and licensing and option contracts all grew as a result of these

government efforts. [9] MEXT has created a budgeting scheme whereby national universities promoting university-industry co-operation and patenting can be allocated additional funds (OECD, 2003).[10] To further open the university system to society, a law prohibiting the exchange of personnel between universities and industry was amended, which facilitated national university faculty members to conduct research or work as consultants with private companies.

3.2. Two Cluster Programmes

National government's initiatives since 2001, such as the 'Industrial Cluster Project' led by METI and the 'Knowledge Cluster Initiative' led by MEXT rest on the conceptual cluster models developed by Michael Porter (1990;1998). They also reflect a consideration of models of successful local economic development in other countries, mostly those of the United States (Silicon Valley in particular), and Europe. Both of these two cluster initiatives emphasise strengthening university-business linkages in local contexts, which will arguably lead to the creation of high-technology venture business spin-off from universities' research. This section reviews recent cluster policies in Japan including 19 Industrial Cluster Project, 13 Knowledge Cluster Initiative and the more recent, integrated 'Regional Cluster model'. Furthermore, it examines whether or not national industrial policies are encouraging the emergence of 'regional innovation systems'.

It is important to understand the specific context of cluster policy implementation in Japan. Current policy initiatives focus on linkages through exchanging technology and knowledge between firms, whilst Porter's cluster notion involves broader inter-firm linkages including commodity transactions and links through supply chains. Kodama (2004) points out that the two cluster initiatives in Japan since 2001 have selectively applied Porter's model, focusing on technological aspects of industrial agglomeration. He argues that more commercially-oriented aspects of inter-firm linkages are increasingly recognised as significant features in developing clusters (Kodama, 2004).

The Industrial Cluster Project implemented by METI aims at revitalising regional economies and promoting industrial accumulation through promoting networks between industry, university and public research institutes (e.g., Regional R&D Consortium), and through supporting the creation of new businesses and new industries.

The ultimate goal is to promote new business creation combined with existing local industrial strengths. Whilst the financial scale of Industrial Cluster Project is rather limited, it is expected that in implementing these activities, a variety of governmental subsidiaries and grants will be utilised (Mitsui, 2003). Until the mid-1990s, policies focussed primarily on maintaining networks of SMEs in the manufacturing sector. However, given the ongoing 'hollowing out' of manufacturing sector, such an approach was insufficient. The new policy focus targeted the creating linkages between different groups of actors including, SMEs, large enterprises, universities and other research institutions, promoting innovative capability of local production.

As previously mentioned, nine regional economic departments of METI oversee the development of clusters in each region with the support of the central bureau. The role played by the METI regional economic bureau in fostering the collaboration and networks is acknowledged in the successful development of locally based cluster. [11] Targeted industry includes biotechnology, Information and Communication Technology (ICT), electronics, neo-manufacturing, new energy, ecology and recycling. Each cluster project promotes technology licensing, university spin-outs, incubation activities, and venture investments. [12]

The Knowledge Cluster Initiative supported by MEXT, and developed from the existing policies for the promotion of science and technology in regions, aims to construct 'regional system of technological innovations', based on triple helix industry-university-government collaboration by forming networks of Centre of Excellences (COEs) in regions. [13] The plan assumes a bottom up approach, with action plans proposed by local governments rather than being imposed from above by the central government.

Questions may arise as to the relationship between these two cluster policies which are planned, implemented and evaluated by separate ministries. In order to co-ordinate science and technology agenda from a wider inter-ministrial point of view, Council for Science and Technology Policy (CSTP) was established in 2001 and directly attached to the Cabinet Office to function as a co-ordinator among ministries. The Council drew up a 'Regional Cluster Plan' combining the two cluster policies, with the expectation that a greater collaboration between the Industrial Cluster Project and The Knowledge Cluster Initiative would lead to further innovation. For example, each region has established a Regional Cluster Promotion Association, consisting of representatives of both initiatives. METI regional bureaus also serve as focal points to

link various actors in their regions. However, the evaluation of each cluster program is conducted separately under the two ministries, potentially causing an 'accountability burden' on the local authorities, universities and agencies which are already under severe financial and time constraints.

3.3. Beyond Narrow University-Industry Links

Now in the second decade of an economic downturn, a central focus of the Japanese national institutional reform efforts concern university-industry links directed at both local and national innovative capacity. The government has been supporting new spin-off company creation from universities by de-regulation and by providing subsidies to R&D activities. However, issues remain in terms of the sustainability of these spin-off firms, and the long-term impact of these activities to the local economy. Only a limited number of studies have rigorously examined the relationships between government policies and university-industry linkages in relation to the strategies and policies of universities; there is a particular dearth of research into the geographical dimension of their institutional activities

Japan has taken the 'US model', with its emphasis on licensing and start-ups from universities, for economic growth whilst tending, especially in local contexts, to underestimate the role of existing informal links between universities and business. Only a small fraction of the flow of knowledge from universities to industry is mediated by formal licensing agreements involving university-generated patents. It is important to recognise that spin-offs and science parks are only one aspect of academic entrepreneurial activities. Intellectual property (IP) commercialisation is only one aspect of the wider institutional picture; sometimes fundamental differences in institutional arrangements are underestimated. The widely observed, recent enthusiasm for promoting these links by setting up TLOs and other formal mechanisms in Japan may need to be tempered with more realistic expectations (Branstertter, 2004).

Future state policy directions, and in particular, its evaluation mechanisms are in need of closer investigation. Universities formulate new strategies and design new organisational structures in order to meet national reform agendas and strengthen university-industry linkages. Evaluation criteria of cluster development and other initiatives affect strategies and resource distribution mechanisms of universities. Nevertheless, there seems to be methodological contention concerning the evaluation of

the outcome of new policy initiatives, and there seems to be little rigorous methodological effort to seek consensus as to policy and institutional changes taking place. Pechter (2001) suggests that for Japanese policy makers, rather than making mostly bilateral comparison with the US, multilateral national comparison may be equally important and perhaps even more relevant to Japan's policy formulation.

One of the most important functions played by universities in the innovation system is to provide graduates. The movement of workers and students is a central pathway for the transfer of knowledge and experience (Angel, 2000). In general, the broader significance of labour-market processes for the technological and organisational dynamism including universities has yet to be examined, and further works are required in light of the significance of local labour-market processes conditioning the supply of local skilled labour. Sub-national governments may develop programmes of individual learning tailored specifically to the needs of the localised economy (see OECD, 2001 d).

From regional development point of view, it is important to draw attention to the roles played by public research institutes. At local level, each prefecture has several industrial technology research institutes and centres, all of which aim at conducting applied industrial research. These industrial research centres as well as the National Institute of Advanced Industrial Science and Technology (AIST) perform a supplementary function to university research function, and they are much closer to the needs of local businesses. Collaboration between universities and these public research institutes, with more human mobility between the sectors, would serve to encourage linkages among basic research, education and industrial needs, particularly those of SMEs which have been hitherto neglected.

3.4. Towards Constructing Regional Innovation Systems

In regards to constructing regional innovation systems, many problems of Japanese cluster strategies have been revealed throughout the above investigation. Firstly, issues of decentralisation need to be investigated carefully. Whilst devolution of power to local authorities has been encouraged in terms of legal arrangements, in practice, there are varying levels of financial, organisational and human resource constraints at the local level. Japan benefited from highly centralised model of national innovation system for the decades of its economic development after the Second World

War, but it is unlikely that this mechanism will remain intact in the 21st century. In general, many local authorities will face severe problems, as the lack of professionals to be engaged in regional strategic policy formulation and implementation may hinder the organic development of regional networks. [14] There is already a widening gap between innovative local authorities and others with respect to long- term human resource strategies in the areas of industrial policies, and university-business links.

Secondly, a multi-level governance structure has not been well developed in Japan under the current form of governance structure. There exists no distinctive pattern of governance of regional policies at the regional level. METI economic bureaus are significant in terms of policy co-ordination, but they do not represent any elected bodies, and the extent of their systematic engagement varies between regions. The clear division of labour and responsibility as well as the existence of collaborative relationships between local authorities and the METI regional economic bureaus are other issues in constructing regional architectures of the knowledge economy which deserve attention.

Thirdly, another vital issue concerns perennial regional disparities. Local economic development policy centring on cluster development has to be seen within a wider process of regional development, combined with provisions aimed at fostering skills appropriate to the future as well as existing local labour market and industrial structures. Policy makers, especially those at the local and regional levels, need to identify the real needs and strengths of each locality, rather than just following the 'cluster brand' (Martin and Sunley, 2003).

In the current Japanese policy environment, more attention needs to be drawn to broadened scope of 'cluster policy' objectives, involving wider range of activities such as supply-chain development and transaction linkages. These activities have been implemented under national and local SME policies and local regeneration policies for decades. Socio-cultural aspects of production systems, inter-linkages of suppliers and industrial agglomeration (e.g. *keiretsu* relationships, networks of suppliers, division of labour between large and small firms) need clarification (see, for example, Fruin, 1998). In order to incorporate these aspects into the current 'cluster initiatives', there need to be more joined-up thinking within ministries and local authoritative bodies; and between S&T policies, SME policies, labour market strategies, and educational policies.

Fourthly, the regional innovation systems need to be constructed strategically whereby local nodes of excellence link in inter-cluster networks animated by large firms,

university research, smaller specialist firms and government support across space to recover and enhance global competitiveness in specific advanced technologies. Among the key actors in this respect are technology-based, R&D focused SMEs which can tap into external R&D alliances such as university-industry collaboration (Motohashi, 2004) thus linking knowledge 'exploration' and 'exploitation' systems (Cooke, 2004). Innovation support and technology transfer organisations will need to be designed so as to strategically link science and industry; as well as foster knowledge exploration and exploitation systems.

Fifthly, there is an issue of policy evaluation, concerning the impact and sustainability of any given policy. The central government has been promoting 'endogenous model' of local economic development through cluster initiatives with various financial support mechanisms, but the impacts of this policy direction warrants close investigation. The current allotment of public funds to encourage local cluster development will be exhausted after three to five years' time, and the local authorities will need to have accomplished sustainable development.

Finally, the transformation of Japan's innovation systems needs to be investigated in relation to emerging trans-national innovation systems in East Asia, with growing inter-cluster competition and partnerships. The Japanese national innovation system has been highly centred upon the Tokyo metropolitan region. In order for regions to compete with growing economic powers in Asia such as Taiwan and Korea, public support for human resource and skill development and financial provisions underlying regional innovation are needed. The national government may take a more strategic and integrated approach to enhance regional innovation capacities of regions to make them meet international standards.

4. Conclusion

Regionalisation of innovation policies entails over-arching national industrial, science and technology policies within the globalising economy. This article has discussed Japan's policy environments from historical and comparative perspectives. Japan's regional industrial policy shifted in emphasis from the relocation of firms to peripheral regions to a more 'endogenous' approach aiming to link S&T policies and industrial and regional development. More theoretical works as well as empirical

research (both qualitative and quantitative) are needed in this light so that characteristics of developing the RIS in the Japanese context can be illuminated.

The Japanese government has embarked on constructing regional innovation systems in the knowledge economy which centre on the 'cluster' model based on Porter (1990; 1998) and the creation of university spin-off firms and licensing activities based on US models. However, the 'cluster' model was applied selectively, and the current approaches are only part of the total of mechanisms to promote innovation systems. There are also inherent constraints at both local governments and agencies and knowledge institutions such as universities.

Constraints in constructing the RIS are found at the local level in terms of human resource strategies and formulating intra-regional strategic institutional linkages. The structure of multi-level governance (MLG) structure does not exist explicitly in the current Japanese political environment. This matter is up to individual local governments' initiatives, but some of them are disempowered under the highly centralised innovation systems. In order to develop university-business collaboration into a robust system of innovation, a longer-term perspective should be taken, following the stages of development of firms, university research and organisational capacity of other intermediary organisations. Human resource development is another significant issue to be tackled. Universities are seen as potentially useful actors in building up the knowledge economies of the regions, but their institutional mechanisms and human resources to achieve this goal are still limited. More links may be forged between universities and public research institutes at the local level with more frequent human exchanges and flows of information.

Issues remain, furthermore, in terms of adopting policy models from predominantly Western literature. It has been pointed out that cluster initiatives in Japan focus on creating technological linkages between actors, whilst Porter's cluster model encompasses enhancing linkages through wider commercial channels. Existing policy channels and other informal links need to be recognised and strategically linked to the current scope of 'cluster development' in Japan. More research is required in the socio-economic aspects of relationships between actors in industrial agglomerations in order to clarify the complex web of market and non-market interactions. A coherent approach is needed lo link existing social structures and new cluster initiatives, and attention should be given to the fact that production systems and supply chains are now generally changing in Japan with the forces of economic globalisation.

For policy makers and those agencies concerned with policy evaluation, there is a huge task lying ahead given the complexity of the whole process of creating regional innovation systems. The first step is to identify the strength of each region and locality with various institutional players. Entrepreneurial and innovative institutional strategies, combined with public initiatives enabling global and local knowledge flows are essential. The process of economic restructuring in Japan needs to be investigated in relation to the growing links among trans-national regions in East Asia. Innovation support and technology transfer organisations must be designed so as to strategically link science and industry; as well as foster knowledge exploration and exploitation systems which create spaces for innovation extending beyond the national framework. It may be a strategic option for some regions, if not for all, to take more pan-Asian and/or global approaches in constructing RIS, rather than taking specifically 'regionally-focussed' approach.

Regionalisation of innovation policies needs to be strategically linked to the international/global geo-politics of the particular areas in which the nations and regions are situated. Regionalisation of national science & technology systems including research, development and technology transfer, and implementation of spatial economic policies such as cluster development must be more strategically coordinated through which interactions occur between different types of innovation actors, at different geographical levels, for a variety of purposes. This would entail restructuring the concept of RIS through bridging the institutional gap between R&D and innovation, between global and local knowledge, between historical industrial strengths and new technological trajectories, between successful global firms and locally embedded SMEs.

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[1] Systems approaches to innovation vary in emphasis and level, but they share a common core idea that: "the overall innovation performance of an economy depends not so much on how specific formal institutions (firms, research institutions, universities, etc.) perform, but on *their interplay with social institutions such as values, norms, legal frameworks, and so on*" (Smith, 1995, p.72, my emphasis). It contrasts with the linear model of innovation which is a simple deterministic model that simply represents the sequence from basic and applied research to product and process development.

[2] Regional innovation systems are "places where close inter-firm communication, socio-cultural structures and institutional environment may stimulate socially and territorially embedded collective learning and continuous innovation" (Asheim and Isaksen, 2002, p. 83). Comparative analysis of the regional innovation systems provided some guidance for policy makers as "policy-oriented innovation stimulation models" (Hassink, 2001, p.224). The "institutional thickness" (Amin and Thrift, 1994, p.15) found in local systems such as Baden-Württemberg in Germany and northern Italy has provided models of regional innovation systems for other regions.

[3] Evidence in Japan shows that industries and firms that are highly dependent on access to local tacit knowledge have a propensity to agglomerate in certain regions (Gonda and Kakizaki, 2001 as cited in OECD 2002b).

[4] I owe this point to the comment from one of the anonymous referees.

[5] See, http://www.silicon-seabelt.org/en/index.html 27/12/04

[6] See, http://www8.cao.go.jp/cstp/english/leaflet.pdf 31/01/05

[7] See, http://www8.cao.go.jp/cstp/english/basicplan01-05.pdf 31/01/05

[8] Japanese data are for September 2000; US data are for March 1997 (approximate number); data for Europe are for March 1998 (approximate number).

[9] Some TLOs form private companies limited and some form incorporated foundations. The TLOs are separate organisations from the national universities in the legal sense. Although there has been public funding for TLO activities, this is in decline. University staff have voluntarily made financial investment in TLOs , but after April 2004, universities are allowed to invest in TLOs directly as organisations.

[10] Organisations such as the Japan Science and Technology Corporation (JST) have started sponsoring programmes aimed at national universities and national laboratories to encourage the development of research into marketable products, with university administrators acting as liaison between the faculty members and JST.

[11] In terms of local economic development, there is a division of labour between prefectural government and METI regional economic bureau. The prefectural government oversees 'local platform' schemes whereas METI regional bureau administers wider cross-prefectural 'cluster' development. The METI industrial 'clusters' were chosen in light of this geographical administrative criteria, which do not necessarily represent the most successful local industrial agglomerations in Japan.

[12] The budget for the Industrial Cluster Project amounts to 680 million yen in FY 2004, and the nine METI bureaus have forged relationships with 5,800 SMEs, having links with 220 universities across the country (Kodama, 2004).

[13] There are 13 Cooperative Link of Unique Science and Technology for Economy Revitalization (CLUSTER) programs encompassing 15 regions in Japan. The budget for CLUSTER program is 500million yen per region per year, lasting for 5 years. Apart from CLUSTER, there are 19 areas designated as CITY AREA program (Cooperation of Innovative Technology and Advanced Research in Evolutional Area) covering smaller areas. See
http://www.rieti.go.jp/users/cluster-seminar/pdf/003_p_en.pdf access date 25/02/05

[14] This is partly due to conventional Japanese employment practice within the public sector, which has encouraged the career path as 'generalists' with wider but unspecialised experiences, rather than acknowledging specialists with focussed expertise.