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Title

MULTILEVEL POLICY GOVERNANCE AND TERRITORIAL ADAPTABILITY:
Evidence from Japanese SME Innovation Programmes

Abstract

Science, Technology and Innovation policies increasingly operate in a multilevel policy governance structure. This paper analyses the variety of local authorities' innovation support mechanisms for small and medium enterprises (SMEs) in Japan, drawing on a unique dataset of 241 local SME R&D subsidy programmes at the prefecture and city/municipality levels. The variation of SME R&D subsidy programmes in terms of institutional forms and coordination practices of multilevel innovation support mechanisms is analysed as manifestations of the complex territorial adaptability. The institutional co-evolutionary processes between different levels of governments help both vertical and horizontal coordination in a highly centralized system.

JEL codes

O38 - Government Policy < O3 - Innovation; Research and Development; Technological Change; Intellectual Property Rights < O - Economic Development, Technological Change, and Growth , H7 - State and Local Government Intergovernmental Relations < H - Public Economics, R58 - Regional Development Policy < R5 - Regional Government Analysis < R - Urban, Rural, Regional, Real Estate, and Transportation Economics

Key words

multilevel governance, SME R&D support, local authorities, Japan, local innovation policy, decentralization

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INTRODUCTION

National policy areas such as Science, Technology and Innovation (STI) policies have undergone profound changes in orientation, shifting away from top-down and centralized approaches towards policies that favour cooperative, multi-actor and often more ‘place-based’ approaches. Regions, and local authorities, are thus increasingly seen as arenas and actors for Research and Development (R&D) and STI policies along with other levels of government (see Clark, 2010; Lanahan and Feldman, 2015; Perry and May, 2007 and other contributions in *Regional Studies* special issue ‘Governance, Science Policy and Regions’). However, we still know little about how local R&D and innovation programmes interact between different governance levels, and whether local and regional institutions have responded to specific needs of the place in order to complement the national governance system. This paper aims to better understand the interaction between different levels of governments in terms of innovation support, and to make a theoretical contribution to the multilevel governance (MLG) literature by revealing ongoing multilevel institutional processes, drawing on the ‘territorial adaptability’ concept at the very local level.

Studies on multilevel STI policies have identified national governance forms consisting of horizontal collaborations and vertical territorial hierarchies with distinctive ‘regional dimensions’ (Perry and May, 2007; Clark, 2010). Two stereotypical national models of MLG policy structures can be identified. *Centralized countries* such as England, France, Finland and Japan, where traditionally STI policies are managed at a national level, have witnessed the emergence of sub-national actors in the design and implementations of STI policies within the nationally-defined policy frameworks (Crespy, Heraud and Perry, 2007; Kitagawa, 2007; Perry, 2007; Sotarauta and Kautonen, 2007). In *federal contexts*, such as US, Canada, Spain and Germany, where sub-national authorities may possess stronger

autonomy to develop and control their own policy areas, increasing and varied interactions between federal and regional actors are observed (Lanahan and Feldman, 2015; Koschatzky and Kroll 2007; Salzar and Hobrook, 2007; Sanz-Menendez and Cruz-Castro, 2005).

Based on a comparative overview of the MLG literature, we highlight several gaps in our knowledge. First, our understanding of the diversity of innovation policy spaces at the very local level, such as city and municipality, is particularly limited, and such contextual understanding of local institutions and multi-spatial interactions has not been well captured in the existing literature. Secondly, there is a need to analyze more deeply the ‘motivation of the adoption of innovation policies between different government levels’ (Lanahan and Feldman, 2015, p.1388), behind the variations across policy instruments (Uyarra et al., 2017). Thirdly, while multi-spatiality of STI policies, institutional changes and governance has been subject to extensive study in the industrialized economies in North America and Europe, Asian MLG experiences have been less documented.

Empirically we examine the local small and medium enterprises (SMEs) innovation support mechanisms within a centralized national science and innovation system in East Asia, that of Japan. Different levels of government in Japan support private sector innovations in a complex national and subnational STI policy space. However, there has been relatively little conceptualization of innovation in Japan in subnational and multilevel settings. While firms and local production networks are considered to be important, the central government’s ‘top-down’ planning and ‘techno-nationalism’ has been seen as the key drivers of outcomes at the local level (Edgington, 1999). We ask the following broad research questions: *How do local authorities implementing STI policies and R&D programmes develop their territorial adaptability in the context of multilevel STI governance? What are the roles of local institutions in implementing and coordinating multilevel STI policies?*

The rest of the paper is structured as follows. Section 2 reviews the MLG typology and literature, drawing on the concepts from recent innovation studies literature and evolutionary economic geography. Section 3 presents historical and contextual backgrounds of the Japanese MLG policy structures and SME R&D support mechanisms, highlighting recent policy changes and challenges. In Section 4, following the presentation of research design and methodology, we discuss the variety of institutional forms and coordination practices of SME R&D subsidy programmes at the local level, drawing on both quantitative data-sets and qualitative interviews. Section 5 discusses the nature of territorial adaptability in the Japanese multilevel context. The paper concludes by identifying the contribution of this study and further research agendas.

THE VARIETY OF THE MULTILEVEL STI POLICY GOVERNANCE STRUCTURES AND TERRITORIAL ADAPTABILITY

In relation to economic development involving actors across different spatial levels, some of the most important questions concern the definition, arrangements and coordination of institutions in order to be effective in mobilizing organizations in different geographical contexts (Gertler, 2010; Rodriguez-Pose, 2013). According to Bache and Flinders (2004, p.3), 'multilevel' refers to the increased interdependence of governments operating at different territorial levels, and 'governance' signals the growing interdependence between governments and non-governmental actors at various territorial levels. We should also note that the varied coordination of MLG policy structures are defined by powers and resources between the centre and local levels (Pike et al., 2015). The dynamics of MLG relationships, through a spatially distributed system of governance between vertical administrative levels, warrants comparative investigation across a variety of geographical and political systems.

Across the centralized and federal systems, a variety of institutional forms of governance is noted. Hooghe and Marks (2003) propose a set of conceptual MLG models related governance and policy structures: one type of MLG may be labelled as ‘general-purpose jurisdictions’ (Type I), and another as ‘task-specific jurisdictions’ (Type II). While *Type I* jurisdictions are formally defined and durable, *Type II* jurisdictions may be flexible with an intersecting membership, and may vary across sectoral areas. In practice, *Type I* and *Type II* MLG models co-exist both in the centralized and federal systems where local actors are balancing their horizontal interrelationships and vertical coordination issues on the ground. For instance, the ‘governance by networks’ is observed in the cases of STI policies in Canada and England (Perry and May, 2007; Salazar and Holbrook, 2007), driven by the dynamic interactions between geography, science and economic development (Clark, 2010) on one hand, and the recent ‘reconfiguration’ of centre-regional/local relations’ (Pike et al., 2017) on the other.

Empirically, the *Type I* model in action is analyzed within the decentralized federal system in the US between the ‘federal’ level support for small businesses and the ‘state’ level policy responses where complementary relationships exist between multilevel public innovation support for SMEs (Lanahan and Feldman, 2015; Lanahan, 2016). Within a highly centralized national system, Japan has a set of durable vertical levels of governments (*Type I MLG*) at the ‘central’, ‘prefectural’ and ‘municipality’ levels. Highly centralized countries such as France and Japan have witnessed the *Type II* institutional creation (e.g. cluster strategies), often coordinated by the central government (Crespy, Heraud and Perry, 2007; Kitagawa, 2007). In centralized countries where pre-existing administrative structures are more adequate to manage new science policy demands (e.g. Finland), an institutional creation has not been marked but a ‘complex process of negotiation between relevant parties’

including local government, businesses, academia and regional authorities is witnessed (Sotarauta and Kautonen, 2007, p. 1095).

Local and regional authorities can enhance R&D potentials through networking and mobilizing knowledge and know-how that is inaccessible to national policymakers (e.g. Koschatzky and Kroll 2007; Salzar and Hobrook, 2007; Koltveit and Askim, 2017). Subnational governments are in touch with diverse local conditions, and sometimes, it is the role of local authorities that coordinate policy initiatives, creating critical mass to promote collaboration with private R&D, and integrating national innovation support programmes. However, subnational levels of government often lack the resources to adequately govern or fund a coordinated multilevel STI policy (Lanahan and Feldman, 2015). They also absorb the intended and unintended impacts of policies made at the national government level (Clark, 2010). We may argue that in the centralized STI system where the autonomy of subnational governments is limited, in particular, local authorities need to create and mobilize new institutional forms (e.g. networks, inter-organizational linkages and intermediaries) to complement their limited resources to coordinate the multilevel STI policy.

In order to develop our analytical framework to understand the institutional variety and evolution of the MLG processes, we draw our insights from the wider literature in evolutionary economic geography. The concept of ‘complex adaptive system’ is relevant here, which emphasizes openness between hierarchical levels such as economic sub-systems formed at different spatial scales (see Martin and Sunley, 2007). The self-organizing nature of connections between the sub-systems means that the ‘co-evolutionary adaptive process is largely spontaneous rather than designed’ (Vallance, 2016, p.364). From a co-evolutionary perspective, it is argued that local and regional innovation policies and the local institutional environment condition ‘regional adaptability’ (Hassink, 2010). Adaptability is defined as a ‘dynamic capacity to effect and unfold multiple evolutionary trajectories, through loose and

weak couplings between social agents in place, that enhance the overall responsiveness of the system to unforeseen changes' (Pike et al., 2010, p. 62).

The complex adaptive system across multi-spatial levels could be further conceptualized as the balancing between the 'coordination' across different spatial scales (*Type I MLG* model) and local 'flexibility' where new local institutional forms develop in the context of the multilevel STI policies (*Type II MLG* model). It is pointed out that there is limited knowledge on how institutional diversity within the economic system contributes to 'regional adaptability', and that such diversity, not just among firms but also between organizations of different types, is crucial to the evolutionary process (Pike et al., 2010; Vallance, 2016). Theoretically, better conceptualization is required regarding the institutional trajectories of local authorities and their relationships embedded in different geographical contexts, reflecting their organizational structures, resources, and varied coordination and flexibility across the MLG policy structures.

Focusing the analysis on the local scale provides a useful lens to 'elaborate how institutions seek to structure and shape the agency and relationships of economic actors', and the role of extra-local relations and processes (Pike et al., 2015, p.185). In addition, an analysis with a focus on local authorities as both economic and policy actors would help us understand their heterogeneous and varied nature in terms of institutional forms, capacity, and resources, as well as decision-making powers (Pike et al, 2015; Koltveit and Askim, 2017). We investigate the variety of institutional forms at the local level, including the R&D subsidy programmes run by the local authorities, their networks and collaborative relationships, and forms of intermediaries. Here the role of intermediaries includes not only the diffusion and technology transfer process, but also the relationships between organizations and what type of activities they are involved in (see Howells 2006).

CHANGING JAPANESE STI POLICIES AND EVOLUTION OF MLG POLICY

STRUCTURE

Japan is traditionally known as a centralized country that favours the development of industry–science relationships at the national level, as a ‘national innovation system’ (Goto and Odagiri, 1997; OECD, 2005). The Japanese national R&D and innovation systems are characterized as follows compared to Germany and France (Okamuro and Nishimura, 2015). Firstly, the government plays a smaller role in terms of its share in total R&D expenditures and the share of public subsidies for business R&D as Japanese firms self-finance most of their R&D activities. Secondly, the ratio of SMEs that collaborate in innovation activities with other SME and with universities are both lower in Japan. Thirdly, innovation activities measured by patent share are skewed in the major city-regions in Japan with higher concentration in central areas. Fourthly, the venture capital share is much lower in Japan.

Japan has been facing a set of recent national challenges including the rapidly aging society and the stagnation of the economic activities since the 1990s. Japanese policy reform from the mid-1990s witnessed a strong push to promote regional innovation. After the enactment of the S&T Basic Law in 1995, local and regional STI policy instruments including local industrial clusters have been introduced to tackle economic and social development issues. This has led to new challenges of multilevel STI policy dimensions that interact with the national and international policy arenas. In 2014, the second Abe Cabinet announced the *Chiho Sosei* (*regional creation*) strategies. This is seen as part of the core of *Abenomics* strategies with a significant decentralization turn in national economic policies, in order to tackle fast declining population in periphery regions and growing economic disparities between urban and rural areas.

The local government system in Japan consists of two tiers: prefectures and the municipalities that make up the prefectures (see OECD, 2017). Prefectures and municipalities

are both local public entities of equal status and cooperate in local administration according to their share of duties. As of 2015, there are 47 prefectures, and under the categories of municipalities, there are 790 cities (including Designated Cities), 745 towns, and 183 villages in Japan. It is noted that since the 1990s, with the decentralization reforms, the autonomy of local authorities has been strengthened (Ikawa, 2008). There have been no formal institutional ‘regional’ administrative bodies in the Japanese MLG structure in STI policy and funding terms. The only exception to this structure is the existence of nine METI’s (the Ministry of Economy, Trade and Industry reorganised in 2001 from the Ministry of International Trade and Industry, MITI) regional economic bureau, which oversee economic and industrial policies at the regional level across prefectures.

In Japan, the layers of national and local administrative units have coexisted in a centralized R&D system with a recent development of ‘regional innovation’ policy instruments (Kitagawa, 2007; Nishimura and Okamuro, 2011). Until recently, relatively little has been known about how Japan’s industrial ‘regions’ have responded to economic pressures and technological change in the past (Edgington, 1999). The recent regionalization reform drive in Japan has come largely from the centre, which is characterized as a form of ‘top-down decentralisation’ (OECD, 2005). Given the absence of formal ‘regional’ structures, the institutional creation at the subnational levels has been observed as part of the emerging multilevel arrangements in recent years.

The nature and functions of multilevel governance of local innovation support for SMEs have changed over time in order to adapt to the external environment, both at national, prefecture and city/municipality levels. During the 1960s and 1970s, the industrial policy led by the central government, in particular, the MITI, was the key driver of economic development. During the 1980s, the local nature of Japanese technological development attracted an international attention, often through ‘show-case’ high-tech projects such as the

technopolis programme, or new *science cities* in rural settings (Edgington, 1999). Local authorities, mostly prefectures, became increasingly involved in supporting basic science and advanced technologies in addition to the traditional role of supporting standard technologies for SMEs via *Kosetsushi* (Fujita, 1988; Glasmeier 1988).¹ In some cases, the new high-tech local development projects led to a separation of the local innovation support between the science and research on one hand, and the production on the other, while some prefecture governments combined these initiatives to enhance their local industrial linkages and networks (Edgington, 1999).

Since the mid-1990s, the central government has enacted a series of acts in support of SMEs in the local economic development (Shapira, 2008). The central government has also initiated and implemented regional innovation support programmes such as ‘Industrial Cluster Policy’ under the METI; and ‘Knowledge Cluster Policy’ under the Ministry of Education, Culture, Sports, Science and Technology (MEXT). These initiatives aimed to create R&D consortia which promote triple helix interactions between university-industry and government at the sub-national level (Nishimura and Okamuro, 2011; 2016). The Small and Medium Enterprise Agency under the METI provides R&D subsidies to SMEs, part of which is provided and implemented by the prefectural governments. All 47 prefectures have developed their own science and technology plans with growing resource asymmetries (see Kitagawa, 2007).

There are contested views about the effectiveness of multilevel governance in Japan and the role of local governments supporting SMEs. One view is that local authorities (prefectures and municipalities) have arguably played a limited formal role in innovation or science policy, other than implementing and supplementing the national R&D policy. In particular, recent years have witnessed decline in the S&T budget of local governments while the S&T budget of the central government increased. A contrasting view is that local

authorities are building their own institutional capacity to create their own multilevel policy spaces in a bottom-up way. Some local authorities may be taking a more proactive and ‘regional’ approach than others by combining strategies and resources under the two cluster development schemes promoted by the central government.

EMPIRICAL FINDINGS

Methodology and research design

We now examine empirically how local authorities design and implement SME R&D subsidy programmes in practice in the MLG policy and institutional structures in Japan. This study employs mixed methods, based on quantitative and qualitative primary data collection, supplemented by a secondary web-based study. According to the web-based information as of 2015, 90% (42 among 47) of prefectures and 19% (158 among 813) of cities conduct their own R&D subsidy programmes, independently from the national innovation policy instruments such as the aforementioned cluster initiatives. Building on the initial secondary web-based study, an original online questionnaire survey was designed to investigate the contents and strategy of these programmes, targeting local government officers responsible for local R&D subsidy programmes at prefecture and municipality/city administrations across Japan.

The quantitative study consists of survey data of 241 R&D support programmes provided by the 169 local authorities, including 90 programmes implemented by 38 prefectures, and 151 programmes by 131 municipalities. The survey data was analyzed to compare the characteristics of subsidy programmes between prefectures and cities. The data was then checked for significant differences regarding their scale, content, conditions, and procedures (Table1). More statistical analysis of the survey data is presented elsewhere (see Okamuro and Nishimura, 2018).

Following the quantitative data analysis, qualitative semi-structured interviews were conducted in 2015 and 2016. The main objectives of the qualitative part of the study were to understand the institutional contexts and perceived variety of local R&D subsidy programmes, as well as the challenges in managing resources and decision-making processes at the municipality and prefecture levels. Selective numbers of local authorities from different areas in Japan were approached for the interviews. Seven local authorities (including prefectures and cities) in two regions (*Kyushu* and *Chubu*) responded to the interview requests. Interviews were conducted with the key officers at the seven local authorities responsible for the local R&D subsidy programmes including two prefecture governments, three capital cities and other two city governments. In addition, available survey data obtained from the neighbouring local authorities is collated, covering four prefectures and 14 municipalities in the two regions (Table 2). The names of the local authorities are anonymized. The qualitative interview findings include the micro level data on local institutional practices and perceptions of officers involved in design and implementation of R&D instruments, which help explain the coordination practices and institutional differences at the local level. Thematic findings are discussed drawing on the descriptive analysis of the survey data, and qualitative interpretative analysis of the interviews.

Key findings from the survey

A considerable variation in R&D support programmes among prefectures and cities is identified in the survey data. Table 1 shows the survey results comparing city and prefecture levels (average figures). Prefecture R&D programmes have a longer subsidy term, and the subsidy ratio (average 69% compared to 58% of city programmes) and ceiling are higher on average for the prefecture ones than those administered at the city level. The average of the total amount of the R&D subsidy programme budget administered by the prefectures is 73 million Japanese yen while the average figure for the cities is 18 million Japanese yen.

Differences are noted at the project level, in terms of the number of applications, selection and evaluation procedures. The survey data shows that subsidy recipients in prefectures are more competitively selected than the city programmes. The prefectures tend to execute more rigorous evaluation processes with a higher number of (external) judges, and additional procedures for midterm and ex-post evaluation. Differences are found also in programme design processes. Prefectures seem to be more likely to consider the conditions of national programmes (38%) when they design their projects. In contrast, cities are more likely to consider the conditions of local firms (27%), almost twice the figure of the prefectures, or benchmark similar programmes in neighbouring local authorities (21%).

Table 1 around here

In terms of the MLG structure of SME support programmes, there is a differentiation between the national and local governments. On average 75% of the subnational R&D programmes (91% of prefectures and 66% of municipalities) do not support projects, which are subsidized by the national programmes in the same year. Thus, the city level programmes are considered to complement the national programmes while the prefectural level tends to substitute national ones.

With regards to policy coordination, 80 % (both prefectures and municipalities) of the local authorities answered that they *‘do not make any policy coordination with other local authorities when they promote new product and technology development of their own local SMEs’*. 22 % of prefecture governments and 19% of city governments make some forms of policy coordination, including, *‘complementing grants’* (e.g. a city programme adding to the prefectural subsidy); *‘university-industry-government collaboration covering broad local authority areas’*; *‘organizing joint seminars across local authorities’*.

Table 2 below summarizes the multi-level structures and characteristics of SME R&D programmes within the two regions of *Kyushu* and *Chubu*, including those local authorities that participated in the interviews, as well as their neighbouring municipalities in the four prefectures that participated in the survey.

Table 2 around here

Across the set of four prefectures in the two regions, there are variations in terms of multi-level resource structures and coordination mechanisms. Two of the city governments that responded to the survey in *Prefecture F1* have set higher R&D subsidy rates with longer duration than the prefecture programme. In contrast, in *Prefecture N1*, the prefecture has more resources than the cities. In *Chubu* region, both *Prefectures F2* and *I2* provide higher R&D support budgets for SMEs compared to those available at the municipality level. In terms of the scope of the R&D projects, the prefectures tend to have specific project types to support, whereas the city governments tend to cover wider variety of collaborative R&D projects, sometimes with partners outside the local area. For example, *Prefecture F1* only supports firms' collaborative R&D project within the prefecture, while the cities support more diverse types of collaborative projects.

Findings from the interviews with local authority officers

Following the survey findings, the interviews with the local authority officers further highlight the perceived variation in SME R&D programmes across cities and prefectures, and different ways in which multilevel government initiatives are managed and coordinated in practice, both formally and informally. The following three key themes are identified through the interview findings.

- Limited formal MLG coordination with territorial adaptive evolution

All local authority officers, both at prefectural and city levels, say there is no formal institutional coordination mechanisms between the central, prefectural and city levels in terms of designing the R&D subsidy programmes. In many cases, communication and interactions between the local governments i.e. between prefecture and city levels, and between municipalities, seem to be rather limited in nature. For example, in one prefecture, the prefecture and city officers only have one annual joint information sharing event. One officer puts:

‘Due to our perceived territorial boundaries in each local authority, it is difficult to coordinate with others’.

While there is no official institutional differentiation and coordination mechanisms between the R&D support programmes between the central government and the prefectural level, there is a differentiation in practice. According to the interview with the prefecture officers, the central government supports large-scale R&D projects in the local area while the prefecture defines their role as supporting local SMEs in product development and new market creation (*Prefecture F2*). While the national cluster initiatives mainly target ‘high-tech’ SMEs, the key role of the R&D programme at the prefectural level is differentiated by targeting their support to ‘non-high-tech’ areas of local industry (*Prefecture F1*).

The local R&D programmes, especially at the city government level, have been evolving and differentiating themselves rather spontaneously over years. One city officer explains that they “*do not deliberately coordinate R&D programmes with the central and prefectural governments*”. Rather, they research and collect information on the subsidy programmes of the central and prefectural governments themselves and ‘*voluntarily differentiate the programmes*’.

- Responding to local needs on the ground

Each local authority has developed local institutional linkages with SMEs through their subsidy programmes. All city officers interviewed say that they aim to respond to the needs of local firms by making their programmes more flexible and attractive to local SMEs than those provided by central and prefecture governments (*City S1, N1, O1, F2, Kn2*). *City S1* started the subsidy programme ‘Creative Technology Development Support’ in 1997 to fill the gap when the national scheme supporting local SMEs in the area ended. One of the city officers says that they aim to provide ‘SME friendly support’ particularly at the city level, which is ‘positioned closer to the local SMEs’ needs than prefecture and national governments levels’ (*City S1*).

City N1 and *City F2* both say the city programmes complement the central and prefectural levels by making the eligibility criteria more flexible and covering broader range of SMEs. *City F2* mentions the central government’s *Chiho Sosei* strategy under the Abe cabinet has provided additional state subsidies to develop the city level programme. The city subsidy duration is longer than that of the prefecture programme, reflecting the recommendation of the city level selection panel. These city programmes show more flexibility in terms of allowing the subsidy to be spent on companies’ staff time, which is not the case with the prefecture programmes.

City governments vary in terms of the complementarity of their R&D subsidy programmes in relation to those available at the central and prefectural levels. Some cities differentiate their programmes by not allowing the R&D projects under the same themes as those of the central and prefectural governments. Others allow applications from SMEs under the same R&D themes as the national and prefectural supports. One city justifies this based on the lack of capacity to evaluate and select projects at the city level (*City O1*). Some city officers admit that they have struggled to attract enough applicants for their subsidy

programmes (*City OI, NI, F2*). Local firms tend to be attracted by larger subsidy programmes provided by the prefecture, and in some cities, those firms that were not successful at the prefecture level are allowed to apply for R&D subsidy provided at the city level (e.g. *City SI*).

- Governance by networks – Territorial adaptability and the Type II MLG model

The vertical coordination between the prefecture and city governments is limited, and the city officer says almost no horizontal coordination mechanisms of local R&D subsidies exist between the municipalities within the prefecture. While formal MLG coordination mechanisms are limited, we identify a number of adaptive evolution processes at the local level and the institutional creation by local actors. This may indicate that an informal ‘co-evolutionary adaptive process’ is at work, with limited formal *Type I* MLG coordination mechanisms. For example, *City SI* in *Prefecture NI* works closely with a local *techno-consortium* based at a technology college in the city. The consortium aims to connect surrounding cities, the prefectural foundation for industrial promotion, *Kosetsushi* centres in the prefecture, industry, universities and technical colleges in the area. The techno-consortium connects the local SMEs under the R&D subsidy programme with specialist technical colleges and other intermediary bodies for innovation support.

New institutional creation is observed at the prefectural level, both in informal and formal forms. In *Prefecture F1*, the prefecture staff oversees the subsidy programme and visits the SMEs every two months. They liaise closely with *Kosetsushi* and other units in the prefectural government to support the SMEs under the scheme to develop new products. *Prefecture F2* established a new organization in 2016 specifically to promote an open innovation, aiming to facilitate the university-industry-government-finance R&D collaboration programme, and better coordinate the collaboration between the prefecture

government, industry and intermediary organizations (e.g. *Kosetsushi*; the Prefectural Industry Support Centre).

There seem to be local networks and support mechanisms developed between the local governments and local SMEs, at both prefectural and city levels, respectively. The local authorities have developed networks with *Kosetsushi* centres and SMEs, through which learning occurs throughout the design, implementation and reviews of the R&D projects. For example, external members of the selection panels for the SME R&D subsidy programmes are likely to be comprised of those from *Kosetsushi*, local chambers of commerce, universities and local financial institutions. The individual local government officers play key roles with their accumulated local networks over time. The interviews with the officers at the local authorities reveal that regular job mobility of these officers, which is a common human resource practice among local authorities in Japan, helps inter-organizational learning, including the local governments, *Kosetsushi*, and other local public-private intermediary organizations supporting SMEs, especially at the prefectural level.

DISCUSSION – VARIATION OF SME INNOVATION SUPPORT AS REGIONAL ADAPTABILITY

The variation of SME R&D support mechanisms at the local level is demonstrated by the survey data. This is interesting in view of the centralized nature of the Japanese STI policy tradition. Local authorities – both prefectures and municipalities - design their R&D subsidy programmes for their local SMEs set in the MLG policy structures by referring to a variety of factors such as national policies, programmes conducted by neighbouring local authorities and the conditions of their own local economies. The data shows that more adaptability seems to be at work at the local municipality level. The interview findings demonstrate that formal MLG coordination mechanisms (*Type I* MLG model) between different levels of local governments are somewhat limited. Instead, local authorities at the

municipality level have been building adaptability and flexibility by spontaneously differentiating their programmes from those of the central and prefectural governments. In particular, city governments position themselves ‘closer’ to the needs of local SMEs, adapting to the local innovation conditions, compared to the prefecture and central governments with more financial and human resources. Some city governments see their subsidy programmes as a substitute, in other cases as complementary to other government levels.

These findings resonate well with the recent works in the innovation studies and evolutionary economic geography that link the ‘micro-economic behavior of agents’ such as firms and individuals with ‘spatial evolution of industries and networks’ (Uyarra et al., 2017). The local authorities – both prefectures and municipalities – have been playing key roles not only in implementation processes but also making choices ‘on the ground,’ creating significant variations across the policy instruments.

This further opens discussions on the dynamic relationship between the agency and institutions (Sotarauta, 2017). The individual actors working across the local authorities and intermediary organizations can modify old institutions and create new ones through adaptive evolution. Further qualitative studies would be needed from a co-evolutionary perspective to understand the ways in which both organizations and individuals can change institutions with individuals’ strategic intentions. However, strategic intentions and adaptation of individual actors and organizations are constrained by the structures of the power and resource allocations as they have to comply with the institutional environment over different territorial levels. More evidence needs to be collected with individuals not only from local authorities but also at the national government level in order to highlight the role of power and individuals as embedded agencies through both top-down and bottom-up institutional evolution. We should also bear in mind that timescales for multilevel territorial adaptive

actions can be very long and the impact maybe indirect, unintended, and sometimes negative.

The findings of the study shed a light on the adaptive evolution processes at the local level. The variety of local authorities' innovation support mechanisms– both organizational forms and practices - can be seen as manifestations of multilevel complex adaptive systems embedded in different geographical contexts. Consequently, the territorial adaptability varies between the levels in local design and implementation of the local SME support programmes. The nature and diversity of local authorities' R&D strategies are arguably conditioned by their own R&D capacity, demand side conditions of local economy and supply side conditions of local areas as well as historical local industrial path dependency (Lanahan and Feldman, 2015; Martin and Sunley, 2006). We need to understand the interrelationships between different types of local authorities (e.g. municipalities, cities, prefectures, prefecture capitals, core/designated cities, and others). Further quantitative analysis is needed with the survey data to examine the relationships between these factors (see Okamuro and Nishimura, 2018).

CONCLUSION

The aim of this paper was twofold: first, to better understand the interaction between different levels of governments in terms of innovation support; and second, to make a theoretical contribution to the MLG literature by revealing ongoing multilevel institutional processes, drawing on the 'territorial adaptability' concept at the very local level. More specifically, this paper analyzed the Japanese MLG mechanisms in the centralized STI national system. We highlighted:

- a) a set of centralized institutional mechanisms and vertical multilevel coordination mechanisms evolving over years;

- b) existing differences and coordination in R&D support activities for SMEs and characteristics across local authorities at the prefecture and municipality/city level; and
- c) the interactive and reiterative multilevel adaptive processes, particularly focusing on the institutional creation and learning of local actors.

Main contribution of the paper is as follows. Firstly, the paper contributes to the theoretical understanding of the concept of complex adaptive systems at work within the multilevel governance of STI policy. Such complex adaptive systems balance the coordination mechanisms between hierarchical national and local governance systems, and the flexibility conditioned by local organizational structures, resources and institutional incentives provided by various actors that share responsibilities over different territorial levels. Adaptive evolution at a local level can be seen as a substitute to the institutionalized vertical coordination mechanisms often embedded in the *Type I MLG* model. Regional adaptability may lead to spontaneous and flexible multi-scalar processes, leading to an institutional creation (*Type II MLG*). Such regional adaptability and co-evolutionary processes may be effective in terms of reducing the transaction costs of both vertical and horizontal coordination especially in a highly centralized system such as Japan where the sub-national governments possess weaker autonomy and control over their own policy areas.

Secondly, this paper empirically contributes to the historical and contextual understanding of Japanese local SME innovation support from an evolutionary perspective. The case of local innovation support mechanisms in Japan is relatively understudied from the MLG and subnational perspectives. We argue that the recent development of the MLG policy structure in Japan shows the subnational institutional creation with unique local adaptive processes characterized by the *Type II MLG* model. The paper empirically highlighted the existing institutional variation of R&D subsidy programmes for SMEs in terms of their

resources, activities and their characteristics between the levels, through the unique data-sets at prefecture and municipality levels. Through the survey data and semi-structured interviews, we explored the nature and processes of the complex adaptive systems on the ground. While the qualitative interviews are illustrative in nature and limited in explanatory power, we illuminated micro-dynamics behind the complex adaptability at the local level.

Thirdly, this study contributes to policy discussions. An understanding of the multilevel coordination process is important for policies for the SME capacity building across the levels of governments. Many national policies can be reinterpreted at the local government level to make them better fit the needs of a specific locality and local SMEs. National policymakers are no better informed than the local government officers and managers about the economic potential of the regions and local firms. The emerging regional and local governance of science and innovation is an on-going process where different levels of policies are interdependent and interact each other. We capture such an iterative and evolutionary process, rather than seeing it as a simple transfer of power from the central to local level.

Further empirical investigation – both quantitative and qualitative - is needed to understand the territorial adaptability across localities in different national contexts. The relationships between Type I /Type II MLG (Hooghe and Marks, 2003) on one hand, and a network approach (horizontal collaboration) and a multi-scalar strategic orientation (vertical collaboration) (Clark, 2010) on the other, need to be evidenced by more empirical research. The availability of data at the very local scale is still limited internationally (Lanahan and Feldman, 2015). While this study is limited to a single national context, both quantitative and qualitative studies in other national contexts are invited for further investigation from comparative perspectives.

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ⁱ *Kosetsushi Centres*, local public research and innovation support mechanisms have existed since the late 19th century and have played an important role by providing consultation services for local SMEs in manufacturing (Fukugawa and Goto, 2016). In recent years, most local governments have been drastically reducing budgets for *Kosetsushi* due to a substantial reduction in state aid. The scope of *Kosetsushi* has shifted from R&D oriented activities to more ‘needs-driven’ intermediary function, providing enterprise aid programmes, facilitating innovation among local SMEs, and building broader collaborative relationships with universities, sometimes going beyond local authority jurisdictions.

Table 1 SME R&D support programmes - comparison of ratios and mean values between prefectures and cities

Note: Figures indicate the ratio or mean value. Bold figures indicate that ratios or mean values of prefectures and cities are significantly different at the 5% level by the Mann-Whitney test.

	Questions	Prefecture	City
<i>Basic programme contents</i>	Starting year	2009	2007
	For single-firm project only	0.13	0.11
	For university-industry project	0.52	0.51
	Subsidy within 1 year	0.49	0.67
	Subsidy limit (ratio to project budget)	0.69	0.58
	Subsidy limit (million yen)	13	4
	Personnel expenses allowed	0.42	0.34
	Programme budget 2015 (million yen)	73	18
	Programme expenditure 2015 (million yen)	63	9
	# Applications 2015	22.5	6.1
	# Accepted 2015	12.8	4.6
	# Supported projects total	61.8	34.7
<i>Procedures for project selection and evaluation</i>	# Judges	7.95	5.79
	Ratio of committees incl. external judges	0.97	0.71
	Support after acceptance	0.72	0.46
	Midterm examination	0.94	0.65
	Final examination	0.48	0.48
	Follow-up after subsidy	0.94	0.55
<i>Backgrounds of programme designs</i>	No double subsidies by different levels of government	0.91	0.66
	Policy coordination with other local authorities	0.22	0.19
	Criteria considering national programme	0.38	0.25
	Criteria considering local firms	0.14	0.27
	Criteria based on previous programme	0.29	0.18
	Criteria based on neighbouring cities	0.05	0.21

Table 2 Relationships between SME support programmes at the prefectures and municipalities in Kyushu and Chubu Regions.

Region	<i>Prefecture</i> Cities	R&D programme	Starting year	Maximum budget per project	Maximum ratio of public subsidy	Maximum duration	Total R&D programme budget per year in 2016	Acceptance rate	Target subsidized	Location of R&D partner	Personnel expenses allowed	Advance payment possible	Support after acceptance	Double subsidies by different levels of government
Kyushu	<i>F1</i>	Manufacturing SME New Product Development Support	2013	5 million yen	50%	1 year	20 million yen	47%	Only firms	Only firms inside the prefecture	Yes	Yes	Yes	Not allowed
	<i>F1</i> City Ki1	Environmental Future Technology	2003	15 million yen	66%	3 years	65 million yen	71%	Firms / UIC	No limit	Yes	Yes	No	Allowed
	<i>F1</i> City Ku1	New Product/New Technology Creation R&D Support	2010	16 million yen	66%	2 years	72 million yen	86%	Firms / UIC	No limit for university	Yes	Yes	Yes	Not allowed
	<i>N1</i>	New Industry Creation Support	2008	10 million yen	75%	2 years	98 million yen	90%	Only single firm	n.a	No	No	No	Not allowed
	<i>N1</i> City S1	SME Creative Technology Development Support	1997	3 million yen	50%	3 years	10 million yen	80%	Only firms	No limit	Yes	Yes	Yes	Not allowed
	<i>N1</i> City O1	Creative Technology Development Support	1999	3 million yen	25%	3 years	?	No applicant	Only firms	?	?	Yes	?	Allowed
	<i>N1</i> City N1	Challenging Collaborative R&D support	2014	3 million yen	50%	1 year	10 million yen	100%	Only UIC	No limit	No	Yes	No	Not allowed
<i>N1</i> City U1	Industry Support	2012	5 million yen	50%	2 years	12 million yen	100%	Firms / UIC	No limit	Yes	No	Yes	Allowed	
Chubu	<i>F2</i>	Industry-University-Government-Finance Collaborative	2015	10 million yen	66%	1 year	62 million yen	78%	Only UIC	No limit	Yes	No	No	Not allowed
	<i>F2</i> City F2	New Business Creation Support	2015	15 million yen	66%	3 years	10 million yen	13%	Firms / UIC	No limit	No	Yes	Yes	Not allowed
	<i>F2</i> City O2	Challenging SME Support	2009	1 million yen	50%	2 years	1 million yen	100%	Only firms	Only firms inside the prefecture	No	No	No	Allowed
	<i>F2</i> City E2	Challenging New Business Support	2006	3 million yen	50%	1 year	10 million yen	100%	Only single firms	n.a	No	No	No	Not allowed
	<i>F2</i> City Ka2	Manufacturing Development / R&D Support	2013	1 million yen	50%	1 year	1 million yen	100%	Only firms	Only firms inside the prefecture	No	No	Yes	Not allowed
	<i>I2</i>	Next Generation Industry Creation Support	2010	20 million yen	66%	1 year	253 million yen	53%	Only firms for collaboration	No limit	Yes	No	Yes	Not allowed
	<i>I2</i> City Kn2	New Product Development and Improvement Promotion	2005	10 million yen	66%	1 year	26 million yen	88%	Firms / UIC	No limit for university	No	No	No	Not allowed
	<i>I2</i> City Ko2	Industry-University-Government Collaborative Research	2006	3 million yen	66%	1 year	3 million yen	100%	Only UIC	No limit	No	No	?	?
	<i>I2</i> City Kh2	Local Specialty Development Support	2013	1 million yen	66%	1 year	1 million yen	100%	Firms / UIC	Only firms and universities	No	Yes	?	?
<i>I2</i> City Wa2	SME Industry Development Support	2001	2 million yen	50%	3 years	4 million yen	67%	Only firms	Only firms inside the prefecture	Yes	Yes	No	Allowed	