Regional Innovation Systems in Korea:
with reference to Taejon and Changwon

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1. Introduction

Since the early 1990s, the concept of regional innovation systems(RIS) have become popular as a framework for explaining differences in competitiveness between firms and industries at both local and regional levels. This paper attempts to explore the regional systems of innovation in Korea in an empirical way. We tries to analyse a case study in a comparative way; Taejon and Changwon in Korea owing to the actual differences of industrial characteristics. Taejon is characterised that a lot of hi-tech new start-up firms have been, in recent years, spun off from R&D centres in Daeduk Science park, while Changwon industrial district which was initiated to promote heavy and chemical industries by the government during the 1970s has grown as a major mechanical industry cluster.

2. The characteristics of the regions selected and Research Methodology

1) The present of local industries: Taejon and Changwon

There are 1,300 manufacturing firms and 40,000 manufacturing workers in Taejon. 90% of which account for small firms which are identified firms less than 50 workers.   260 firms of them in the region are operating respectively at four Taejon industrial parks which have been established to attract firms by local government and 10,000 workers are employed in those firms. Meanwhile, Taeduk science park which may be considered to be one of the typical science parks designed to promote hi-tech industries as well as to resolve the excessive concentration of industries into Seoul metropolitan area by Korean government has 60 research institutes and more than 15,000 scientists and engineers. In 1999, around 270 new hi-tech start-up firms operate in Taejon. What draws attention here is that a large number of those firms have spun off from research institutes in Daeduk science park. This means that research institutes in the science park are critical engines to

contribute to starting new firms since a number of founders of new start-ups worked there in the past.

Changwon industrial district was initiated to promote heavy and chemical industries by the government during the 1970s. In 1999, there are over 750 establishments, including 70 number of affiliated companies of *Chaebol*, and more than 70,000 workers in Changwon industrial district.[1] Firms in Changwon are still to a large extent based on the system of Fordist mass production, while it shows a tendency that customer firms have began to collaborate with suppliers in accordance with seeking flexible manufacturing practices such as JIT and TQM.

2) A framework for analysis and a methodology on survey

① An analytical framework

This study is organised in three ways as shown in <Figure 1>; (1) inter-firm networks, (2) extra-firm networks such as firm-R&D institutes and firm-administrative institutions and (3) the degree of local labour market flexibility and localised industrial culture such as trust and reciprocity.

<Figure 1> An analytical framework: components of RIS (agents, network, culture)

② A methodology on survey

This study adopts both a questionnaire survey method by direct visit to firms and face-to-face interviews with managers and CEOs, in order to obtain information about local innovation and network in Taejon and Changwon. In more detail, firms selected for survey are limited to manufacturing firms in four industrial estates and new hi-tech start-up firms in Taejon and manufacturing firms in Changwon industrial district. These field works had been made between December 1999 and January 2000. Finally, total 155 firms in two regions are used for the analysis[2]. Regarding the ratio of industry, four industrial estates in Taejon account for 7.1% of food manufacturing,

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[1]) For details on Changwon industrial district, see Chul-Woo Lee· Jong-Ho Lee (1998, 2000).

[2]) 56 firms in four industrial estates and 33 new start-up firms in Taejon, and 66 manufacturing firms in Changwon industrial district.

16.1% of textile and clothes, 3.6% of wood and paper manufacturing, 5.4% of petro chemicals, 3.0% of non-metals, 8.9% of primary metals, 44.6% of assembly metals, and 1.8% of others, whilst most of the new hi-tech start-up firms are associated with precision machinery, semiconductor, and computer hardware and software. However, firms in Changwon surveyed belong to assembly metal manufacturers.

(Table 1) The list of key questions

Category		Questions
Sources and routes of innovation		Organizational and regional sources to obtain information on innovation? - Organization: suppliers, customers, competing firms, R&D institutions, public information and etc. - Place: local, domestic, and overseas
Inter-firm networks	material linkages	Amount and places of sales and purchases
	innovation	To what extent do local firms contribute to firm's innovations?
Extra-firm networks		1. Have you got any supports from public institutions such as central or local government, chamber of commerce, local financial institutions? If so, what kind of support? 2. Have you ever been in collaboration with
Diffusion of innovations		1. Where to employ skilled labours and engineers? 2. The number of spin-off firms from local firms and research institutions
Local industrial culture		Local industrial atmosphere - corporative or exclusive?

3. Results of the analysis

A. What is the regional factor to influence firm's innovation?

Research has emphasized that factors, like user-producer relationship (Lundvall, 1992), knowledge infrastructure (Nelson, 1982, 1985), labour

mobility (Saxenian, 1998) and local trust culture (Cooke & Morgan, 1998) might be crucial for creating regional innovation system. In particular, an approach to regional innovation system has stressed local trust culture or industrial atmosphere. Our study tries to understand all the factors regarded as critical to sustain regional innovation system.

① Question about the importance of intra-regional relationship as a source
  of innovation –
It shows that the importance of intra-regional relationship is higher in Changwon rather than in Taejon. While, in Taejon, hi-tech start-up firms regard the importance of intra-regional relationship as relatively more important than manufacturing firms in four industrial estates.

② The levels of constituent elements of regional innovation system –
The levels of constituent elements in sustaining regional innovation system, in terms of inter-firm relations(supply innovation network), extra-firm relations, labour mobility and local trust culture are as follows(These summarized sub tables 2~7).

(Table 2) The levels of each element in sustaining regional innovation system

(unit: %)

	Inter-firm relations[1]	Local R&D centres· universities[2]	Administra- tive	Local labour	Local trust culture[5]
Manufacturing firms in Taejon	43.8	50.0	18.8	39.1	54.7
Hi-tech start-ups in Taejon	58.6	72.7	34.5	74.2	78.8
Manufacturing firms in Changwon	70.7	34.8	8.9	71.0	60.0

*Source
  1) from sub tables 2(helpful suppliers)
  2) from sub tables 5(having joint research)
  3) from sub tables 4(having help from local government)
  4) from sub tables 6(employment within the region)
  5) from sub tables 7(cooperative)

③ We attempt, in turn, a correlational analysis between the degree of
  importance of intra-regional relationship in innovation and the levels of
  elements composed of regional innovation system to understand which is the

crucial factor in regional innovation system. In Korea, local inter-firm networks and local labour market are recognised as crucial to develop intra-regional cooperation, whilst local trust culture and extra-firm networks are not.

(Table 3) Correlational analysis between the degree of intra-regional relation and individual elements composed of RIS

	Supplier innovation	Customer innovation	R&D· univ-ersities	administrative institution	labour market	trust culture
degree of intra-regional	0.988	0.652	−0.479	−0.465	0.766	0.119

④ What then are the factors which lead to inter-firm cooperation? The analysis of the correlation between inter-firm cooperation and variables related such as local trust culture, the level of industrial specialization, the intensity of material linkages, shows that economies of localization and the intensity of local material linkage are crucial factors to facilitate inter-firm cooperation. As an approach to regional innovation systems emphasizes trust culture or industrial milieu embedded in a region (Cooke & Morgan, 1998), building locally embedded trustworthy and cooperative environment might be considered to be the best way to make `well established' regional innovation systems.  However, Korean industrial culture has been generally characterized as less trustworthy and cooperative one.  Thus this culture need to be fostered in the process of seeking and repeating inter-firm networks, so called `studied trust' (Sabel, 1992).

(Table 4) Correlation between inter-firm cooperation and variables related

	Trust culture	Level of industrial specialization[1]	Supplier material networks[2]	Customer material networks[2]
Intensity of supplier	0.265	0.989	0.979	−
Intensity of customer	−0.673	0.403	−	0.554

1) The level of industrial specialization – the ratio of concentration of an same category of industry
2) Supplier· customer material networks – the average ratio of supplying

or purchasing materials in the local area

B. Explaining innovation systems of Taejon and Changwon -

① In Changwon, supplier networks, local labour market and trust culture have
  been well established, while local government, R&D centres and
  universities play a less important role in building regional innovation
  systems.

② By contrast, in Taejon, local government and R&D centres· universities
  are a greater extent crucial for sustaining innovation systems, supplier
  networks, local labour market and trust culture are less important.

③ The problems with regional systems of innovation in Taejon are as follows.
First, it has segmented structure between manufacturing firms in industrial
estates and new start-up firms. Second, Daeduk science park has weak
relationships with manufacturing firms in industrial estates. Third,
although regional industrial policies have focused on creating and
supporting new hi-tech start-up firms, it is clear that the local economy
has, in terms of the number of firm and employment, been ironically driven
by manufacturing firms in industrial estates.
On the basis of these problems with Taejon's local economy, we propose some
implications for reinforcing RIS. First, it is needed to promote linkages
between existing manufacturing firms and new hi-tech start-up firms, between
Daeduk science park and industrial estates. Second, It is notably necessary
for the local government to seek to reinforce innovation systems of
industrial estates.

            (Figure 2) The characteristics of RIS by region

      Note: This figure does not reflect the degree of relative importance of each
            element composed of RIS.

C. Strength and weakness of Korean regional innovation systems -

① As appeared above, the role of local government and R&D centres· universities in
  Korea are less important in the process of regional innovation.

② As shown in the following (Table 5), innovations in firms are by and large
  originated from intra-organisational activities, whilst suppliers, customers and
  competing firms make a relatively less contribution to organisational innovations.

This outcome is the same as that of research by Yoon and Jang (1997).[3] They argue that the source of most critical information on technological innovation in Korean manufacturing firms is originated from 'intra-firm R&D activities' rather than supply linkage firms or R&D centres· universities. Accordingly, we suggest that it is time to attempt to move beyond industrial cluster without networks and embeddedness towards learning region or innovation district, by seeking industrial and regional policies to improve inter-firm networks based on reciprocity and trust.

Region / Supply source	industrial estates in Taejon	Changwon	Hi-tech start-up firms in Taejon
intra-firm	45.3 ①	44.6 ①	54.5 ①
suppliers/subcontr	13.2 ③	16.9 ③	3.0
customer/buyer	11.3	16.9 ②	12.1 ③
competing firm	5.7	4.6	6.1
universities/R&D institutes	7.5	6.2	9.1
Information generally	17.0 ②	9.2	15.2 ②
other	0.0	1.5	0.0
total	100.0	100.0	100.0

(Table 5)   Sources of innovation

(unit: %)

* ①②③: rank

4. Concluding remarks

It is seen that the concept of regional innovation systems is a useful framework for distinguishing factors affecting regional innovations as well as understanding the strengths and weaknesses of regional innovation systems in a comparative manner. Nevertheless, this study reveals some limitations in understanding innovation systems of a certain region.

① This study is dependent upon a questionnaire survey as a major research methodology.   However, the method may be not enough to understand

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[3]) Yoon and Jang, (1997), Survey on technological innovation in Korean manufacturing firms, STEPI, Korea, 97-121. This research is carried out on the basis of the result of postal questionnaire survey on 30,000 numbers of manufacturing firms in Korea.

institutional foundations both driving and being composed of regional
innovation systems. Further research would thus need to try to comprehend in
a qualitative way the role and function of local supportive institutions such
as local government and R&D institutions.

② This study does not analyse the relationship between innovative activities in
firms and economic outcomes of the region, like the growth rate of production and
export, employment rate and regional income. That is because statistical indices
which are associated with the outcomes of regional economic performance has too much
fluctuated by the cause of the Korean financial crisis. On the other hand, it is
basically due to a lack of effective indices to measure the performance of innovative
activities.

③ The local would be very critical for sustaining innovative competences of firms.
However, is should not be ignored that non-local networks in firm activities also
offer knowledge and information assets because region may be recognised is a kind
of open system. Thus we need to incorporate the local and the extra-local in
analysing regional innovation systems.

<Sub-table 1 > Sources of innovation by place			
Region/industry Sourcing place	Industrial estates in Taejon	Changwon	Hi-tech start-up firms in Taejon
intra-region	28.3 ②	65.1 ①	43.8 ①
Neighbouring area of the region	5.7	9.5 ③	0.0
extra-region	49.1 ①	19.0 ②	37.5 ②
overseas	17.0 ③	6.3	18.8 ③
total	100.0	100.0	100.0
<Sub-table 2> Relationship with intra-regional firms in innovation			
Customers	not helpful	58.4	46.6	66.7
	helpful	41.6	53.4	33.4
Competing firms	not helpful	65.4	57.4	80.0
	helpful	34.6	42.6	20.0
Suppliers	not helpful	56.2	29.3	41.4
	helpful	43.8	70.7	58.6
<Sub-table 3> The average ratio of intra-regional material linkages			
The average ratio of intra-regional purchase	23.0	39.5	35.1
The average ratio of intra-regional sale	11.8	49.3	31.6
<Sub-table 4> Have you got any help from local support institutions?			
Central government	Yes	56.5	57.5	81.7
	No	43.4	52.5	18.2
Local government	Yes	47.9	28.6	48.3
	No	52.1	71.4	51.7
Camber of commerce or trade union	Yes	37.5	31.6	34.5
	No	62.5	68.4	65.5
Local financial institutions	Yes	37.5	44.1	43.3
	No	62.5	55.9	56.7
<Sub-table 5> Have you had joint research with R&D centres· universities?			
Yes	50.0	65.2	27.3
No	50.0	44.8	72.8
Total	100.0	100.0	100.0
<Sub-table 6> Where to employ skilled labours and engineers? (labour mobility)			
within the region	39.1	71.0	74.2
Outside the region	60.9	29.0	25.8
<Sub-table 7> Local corporate culture			
exclusive	54.7	40.0	21.2
cooperative	45.3	60.0	78.8

* Rank : ① ② ③
** Unit: %.

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