Strategic Independent Innovation Policy and its Application-A Case Study of International Trade in Hi-Tech Products in West China

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Abstract

A decade after Beijing introduced its "go west" policy, China's western provinces remain a lagging region. Massive infrastructure investment and generous corporate income tax rebates failed to reduce western China's economic disparity with the burgeoning eastern provinces. Independent innovation can serve as the engine of growth for China's western provinces as they wake up to the challenges of a knowledge-based economy and globalization. By exploiting provincial trade data of hi-tech products and local government R&D expenditures in west China, the paper analyzes the current innovation situation and problems in hi-tech industries. A strategic independent innovation policy can play a major role in promoting innovation abilities of a firm, creating firm specific and then regional specific advantages. The paper makes a caseto improve west China's international competitiveness in hi-tech products to bebased ona carefully-structured strategic independent innovation policy.

Key words: West China, hi-tech products, strategic trade policy, strategic independent innovation policy, international trade

1. INTRODUCTION

Knowledge has become the main resource of economic development, and the application of technology and innovation are the fundamental means of creating knowledge. Science and technology (S&T) forms the basis for an industry's competitiveness which drives the foreign trade of high technology (hi-tech) products.[1]Development ofa high technology (hi-tech) industrystructure can be anessential ingredient of regional growthstrategy. Foreign trade in hi-tech products can re-create regional comparative advantages, improve labor productivity, and increase social wealth. Import of advanced technology, manufacturing, and management experiences from foreign countries are made possible by increased trade in high-tech products. All these are important for regional economies in China that are aspiring to break free from the clutches of cooperative farming or "sunset" industries based on cheaplabor.

West China is made up of 12 provinces (See Figure 1).West China is also home to more than 80% of ethnic minorities. Since the implementation of the reform and opening up policy in 1978, China made big strides in national economic development and foreign trade. In 2010 China was ranked as the world's second largest economy after the United States. Over the past 30 years China has been the world's fastest-growing major economy, with consistent growth rates of around 10%. China is also the largest exporter and second largest importer of goods in the world.

[1]The high-tech products statistics catalog has been jointly published by the Ministry of Science and Technology and Ministry of Commerce, which covered 9 technology areas of computers and telecommunications; life science technologies; electronics; computer-integrated manufacturing; aerospace; opto-electronics; biotechnology; materials; and other technologies. This catalog is compatible with the US export and import catalogs for advanced technology products.

In their implementation, China carried out a"stepped" reform and open policy that saw development of east China first, then move in to west China. As a result, it is the coastal regions of eastern China that benefited most from China's reforms as their economies quickly raced ahead. The western half of China lagged behind severely that caused a widespread disparity between them. Gu*et al.* (2004) notes that west China's contribution to national GDP decreased from 20.88% in 1990 to 17.13% in 2000; over the same period relative levels of GDP per capita in the West decreased from 73.30% in 1990 to 60.87% in 2000. Conscious of this development, China's regional development strategies were aimed at the relatively poorer regions in China in an attempt to prevent widening of inequalities. In 2000, the Western Development Strategy was put in place in an effort to help this less-developed area catch up with the relatively well-off coastal area.The strategy covers, among others, infrastructure construction and attracting foreign investment in the region. West China experienced a big boost in its economic development; at the same time the regions traditional culture, geographical limitations and its transportation bottlenecks accentuated its dual economic structure. The dual structure limits the exchange of the goods between the regions and the flow of the capital, technology and talents. In the end, west China's economy remains impoverished compared to burgeoning east.

Innovation is fast becoming a prerequisite for every successful business and nation facing the emergence of a knowledge-based economy and globalization. For a lagging region such as the west China, regional innovations are more important to establish its competitive advantage.Theories underlying Strategic Trade Policy, Competitive Advantages of Nations andstrategic independent innovation policy (SIIP) suggest government policies promoting innovation such as R&D subsidies can help to promote the development of lagging regions.

The purpose of this paper is to exploitthe data of international trade in hi-tech products in west China and to suggest some countermeasures for developing the hi-tech industries in west China under SIIP. Section 2 describes the strategic independent innovation policy and reviewsrelated literature. Section 3 analyzes international trade in hi-tech products in west China and the R&D expendituresby the provinces to highlight the problems in hi-tech industries in west China. Policy recommendations for developing hi-tech industries in western regions are presented in section 4. Section 5 concludes.

2. STRATEGIC INDEPENDENT INNOVATION POLICY (SIIP): BACKGROUND AND LITERATURE

The purpose of independent innovation is to encourage the whole nation, through their own efforts to invent- not to copy others' things. From the beginning of this century, China put forward the strategy of independent innovation. Segal (2010) reported that the PRC's policy had clearly moved from "Made in China" to "Innovated in China". The question here is whether independent innovation can be tied with trade policy. Accordingly, SIIP derives from the strategic trade policy (Niu, 2008). The objective here is to influence the government and enterprises both at home and aboard to take account of the independent innovation efforts from each other. Governments can use independent innovation policy to intervene in their external trade relations with the aim at changing the market structure or environment to form country specific advantages (CSAs), region specific advantages (RSAs) and firm specific advantages (FSAs) and then improve the competitiveness of home enterprises. It could mean the government and the enterprises take different strategy in the process of independent innovating. The way to carry out the SIIPlies in how the government supports the development of some hi-tech industries or "special" industries by formulating independent innovation policy and makes those industries produce industry specific advantages (ISAs). Specific examples of ISAs include their effectson scale economies and positive externalities. Realized optimization and upgrading of the industrial structure can push the sustainable development level of the whole economy.

To establish FSAs, RSAs and CSAsunder strategic independent innovation policy tied into international trade, it is important that firms, and local and national government get involved. The literature background of the SIIPincludes two aspects; the strategictrade policy and the competitive advantages of nations. In an early study of strategic trade policy, Spencer and Brander (1983,1985) used the Cournot output-setting model to analyze the behavior of domestic and foreign firms that compete in third-country markets. The FSAs are derived from the international trade policy in regard to tariffs and subsidies. For example, by imposing tariff an importing country can counteract a foreign monopolist's market power. The resultant increase in domestic price above monopolist's price harms the foreign monopolist as well as domestic consumers. However, by setting the tariff optimally, revenue generated by tariff can potentially exceed the incremental loss to domestic consumers.

This way the importing country as whole gains at the expense of the foreign monopolist, reducing the transfer abroad. This is the demand side application of strategic trade policy. An alternative application of strategic trade policy emphasizes the supply side. In 1986, Paul Krugman compiled 12 papers in his book "strategic trade policy and the new international economics" (see Krugman, 1986).Krurmanstressed the potential importance of factors like economies of scale, barriers to entry, learning by doing, and technological innovation in creating either permanent or temporary excess profit opportunities for domestic and foreign firms engaged in international trade.[2]In later years, R&D subsidiesand innovation became the main topics in the study of strategic trade policy where it is believed that more and more R&D and innovationsare required to establish the FSAs, RSAs and even CSAs. These later generation researches on the role of R&D subsidies include those byMiyagiwa and Ohnob (1997), and Diao *et al*. (1999).

A third important contribution to strategic independent innovation policyliterature came from Porter's Competitive Advantages of Nations (1990). Porter used his famous Diamond Framework to explain how firms establish competitiveness. Rugman and Verbeke (2005)then combined trade policy with FSAs. In their view, government policy including trade policy can influence the formation of FSAs.In addition, many authorsresearched the location advantages in forming of FSAs, RSAs and CSAs with clusters and agglomeration (see e.g.Porter, 1998; Rugman and Verbeke, 2005; Rosenthal and Strange, 2003). In his recent article, Porter (2008) has argued, the best way to understand the influence of government on competition is to analyze how specific government policies affect the five competitive forces; rivalry among existing competitors, threat of new entrants, threat of substitute products or services, bargaining power of suppliers, and bargaining power of buyers.

3. INTERNATIONAL TRADE OF HI-TECH PRODUCTS IN WEST CHINA

We use regional trade data and calculate some accepted numerical measures to assess the development of foreign trade in of hi-tech products. These includethe value of export and import at national and provincial levels and the ratio of dependency on foreign trade (FTR). We use data on export and import of hi-tech products in west China to calculate the index of trade competitiveness[3] (ITC) to illustrate the actuality and the problems in the hi-tech products' trade in west China. Based in these measures, we then offer a few suggestions and countermeasures to develop the hi-tech sector of west China.

Table 1show that trade in hi-tech products by west China hardly accounts for 1% of China's total trade in these products.This is miniscule given that the region comprises a whopping 70% of China's landmass, 28% of its population and accounts for 17% of the country's GDP. From the ITC measure, we also can find that the index shifted to positive territory since 2004 that shows improvement in national trade competitiveness in hi-tech products. However, for west China, the ITC of hi-tech products remained negative for the entire data period, showing no sign of regional competitiveness in these products. This shows that west China still remains backward in its hi-tech aspirations and possibly cannot do it alone without strategic policy intervention.

Tables 2-3demonstrate marked disparity among western provinces in their export and import of hi-tech products. The silver lining is emerging from some the south-west provinces of Guangxi, Sichuan, Yunnan, Chongqing and Shaanxi. In the north-west, only Xinjiang is noticeable in export and import of hi-tech products. Other provinces like Gansu, Qinghai, and Ningxia report a very small volume in exporting and importing hi-tech products. In addition, the trade intensity gap among provinces in east and west China is widening. We have chosen Jiangsu from east China as an example to demonstrate this point.[4] Both export and import of hi-tech products in combined west China provinces is less than Jiangsu, a typical province from east China. This situation is partly attributed to the stepped reform and open policy carried out in China since 1980s.

From Table 5 we can find the gross domestic expenditure on R&D (GERD) in west China is also miniscule- just like their trade.When compared to Jiangsu province, from Table 4 we can find the total GDP of west China is nearly twice that of Jiangsu province; but in terms of their GERD they are almost same (Table 4).

[2]seeCuddington (1988).

[3]$ITC_i=(X_i-M_i)/ (X_i+M_i)$ whereX_i is the export of the country i and M_i is the import of the country i.

[4]Jiangsu is one of provinces in east China (see figure 1: Map of China). The paper compares the data between west China and Jiangsu due to the large quantity of import and export in hi-tech products by Jiangsu province.

From the strategic trade policy and the competitive advantages of nations literature, we know that R&D expenditure or subsidies of the government can gain CSAs or change the economic environment of a region, or of the country (e.g. industry clusters, firm specific advantages).But the local governments in west China spendsvery little in R&D expenditures.

Another noticeable feature in tables 2-5 is that those provinces in west China (such as CHONGQING, SICHUAN, SHAANXI) with higher GERD also enjoy a large volume of export and import of hi-tech products. This is especially true in Sichuan and Shaanxi where the local governments investsheavily on science and technology (S&T) to improve their hi-tech industrial base.[5]

Trade in hi-tech products in west china is weak in competitiveness because of little R&D expenditure which keeps west China as a lagging region. This is approaching of a vicious cycle and calls for the local governments in the west China to pay more attention indevelopingtheir hi-tech industries.

4. SIIPFOR DEVELOPING TRADE IN HI-TECH PRODUCTS

More than 10 years after the Chinese government introduced its Western Development Strategy, also known as the 'Go West' campaign, economic disparity with the burgeoning eastern provinces has widened. The lagging economic progress of the region prompted the Beijing Government to offer incentives for business development, including a 10% reduction in corporate income tax. Massive infrastructure development both in urban and rural areas did not produce their desired results. A change in regional development strategy is in order. Our analysis of current situation of hi-tech industry from an international trade perspective shows that the strategy should focus on developing new strategic industries that can carry out strategic independent innovations described earlier in this paper.

4.1 SIIP to Establish Region Specific Advantages in West China

West China's export share of electromechanical and the hi-tech products are too small. Instead, current export structure is made up either bycommodity (agriculture and mining), orlabor-intensivemanufactures.This makeswest China weak in international competitiveness. To overcome this shortcoming, west China needs to develop region specific advantages for exports. This can be achieved by extending the industrial chain, processing raw materials at home, ensure and improve the quality of the export commodities and provide after-sale service to keep market share. Porter (1990) argues that the local government can play the role of accelerator to strengthen regional innovation in terms of political legitimacy and economic powers. So the government can take the SIIP to support the development of the hi-tech industry of the west China by subsidizing independent innovations, to recast the enterprises' technology by subsidies and to develop the ethnic regions by positive intervention. By providing such subsidies, it can improve the competitiveness of the enterprises in west China, change the export structure to high value-added content and push the regional economy at parity to east China.

4.2 SIIP to Increase Firm-Level Innovation Projects

Facing to the economic crisis since 2008, most countries are reaching for the "new economy"growth strategy that begins with a realignment of their industrial structure. Since this latest economic crisis, industrialization and urbanization of US, Japan and EU have stalled. Many are beginning to doubt on the effectiveness of traditional growth modelsthat rely on resources and endowments for inputs.On the other hand, new S&T can offer a way out of such doldrums. For west China this would mean each provincial government to work out a practical independent innovation policy and develop the new strategic industries. Therefore, each province should draw plans according to its own region specific advantages, guide enterprises from a macro level and support enterprises to innovate to develop new strategic industries. Examples would include the new energy industry including biofuels, the new materials industry, and electronics. This will allow west China to upgrade its industrial structure and accelerate its development pace.

4.3 SIIP to Promote Public/Private and Inter-Firm Cooperation

[5]Examples include expenditure on solar energy in Sichuan province. The local government also invests heavily on silicon crystal manufacturing to export to Europe. In Shaanxi, the local government invests heavily in manufacturing airplane parts.

In their research, Oughton*et al.*(2002) found thatR&D expenditures by the Government, businesses and the educational institutions are all positively and significantly correlated- meaning they all arecomplementary. From their research, it is easy to see that increasing innovation activity in state owned enterprises (SoE) or R&D expendituresby the government alone is unlikely to bear fruit. Policy must also increase the level of R&D spending by the businesses and education institutions.This would increase the region's capacity to absorb public (government and education) funding of R&D.IncreasingR&D expenditure/investment capacity of the business sector is a necessary condition for a successful implementation of a SIIP.

The enterprises and the universities in west China need incentives to respond to the government strategic independent innovation policies to form their own FSAs and RSAs. Under an innovating network system promoting Government-industry-university links, enterprises in west China would gain FSAs in order to compete with the characterized, differentiated products in international markets. Hence, our final recommendation is to upgrade industries in west China through cooperation between enterprises and academics.

5. CONCLUSIONS

The strategic independent innovation policy (SIIP)that is at the core of China's development policy is an offshoot from the strategic trade policy literature. Based on the evidence presented in this paper, we find that international trade of the hi-tech products in west China is in a seriously under-nourished infancy state. A decade after Beijing's "go west" policy was introduced with a big bang, west China is still a lagging region needing to improve its industrial and trade structure through innovation and R&D policy. From the analysis, we find that it is appropriate to carry out a strategic independent innovation policy to meet the stated objectives of innovation and R&D policy that is needed in west China. For implementation of the SIIP, the government needs to promote the innovating ability of firms in a province so that they can form respective RSAs and FSAs to change the economic structure of west China. This way, whole of China can prosper together.

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FIGURE 1: CHINA AND PROVINCES

TABLE 1: International trade characteristics of hi-tech products (2000-2009)*

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EXPORT OF CHINA	370.4	464.5	678.6	1103.2	1653.6	2182.5	2814.5	3478.2	4156	3769
EXPORT OF W CHINA	3.9	5.02	11.78	13.66	13.42	14.22	19.05	28.62	43.87	55
SHARE of W CHINA IN TOTAL EXPORT	0.0105	0.0108	0.0174	0.0124	0.0081	0.0065	0.0068	0.0082	0.0106	0.0146
IMPORT OF CHINA	525.1	641.1	828.4	1193.0	1613.4	1977.1	2473.0	2869.8	3418	3099
IMPORT-WEST CHINA	11.4	23.42	21.48	23.25	26.98	35.10	41.62	51.54	76.06	94.62
SHARE of W CHINA IN TOTAL IMPORT	0.0217	0.0365	0.0259	0.0195	0.0167	0.0178	0.0168	0.0180	0.0223	0.0305
CHINA TOTAL TRADE	895.5	1105.6	1506.9	2296.2	3267.1	4159.7	5287.5	6348.0	7574	6868
W CHINA TOTAL TRADE	15.3	28.44	33.26	36.91	40.4	49.32	60.67	80.16	119.93	149.62
SHARE of W CHINA IN TOTAL TRADE	0.0171	0.0257	0.0221	0.0161	0.0124	0.0119	0.0115	0.0126	0.0159	0.0218
ITC -WEST CHINA	-0.49	-0.65	-0.29	-0.26	-0.34	-0.42	-0.37	-0.29	-0.27	-0.26
ITC- CHINA	-0.17	-0.16	-0.10	-0.04	0.01	0.05	0.06	0.10	0.10	0.10

* Export and import figures are in USD 100 million.
SOURCE: National Bureau Statistics of P.R. China and author calculations

TABLE 2: **Export of Hi-Tech Products by West China (2000-2009)***

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
INNER MONGOLIA	1	1	1	2	20	152	73	20	60	51
GUANGXI	15	13	17	21	205	57	96	205	285	272
CHONGQING	30	25	61	73	181	137	135	181	205	212
SICHUAN	206	245	893	914	1581	543	946	1581	2598	3707
GUIZHOU	4	3	6	60	61	93	57	61	87	150
YUNNAN	48	62	54	56	148	73	101	148	186	115
TIBET	4	7	6	3	4	3	5	9	8	4
SHAANXI	68	129	120	181	185	268	363	531	813	825
GANSU	10	6	8	23	93	48	71	25	32	49
QINGHAI	0	0	0	0	1	3	1	1	1	1
NINGXIA	1	3	5	7	3	3	6	14	46	38
XINGJIANG	3	8	7	26	35	42	51	86	67	76
Total in west China	390	502	1178	1366	2517	1422	1905	2862	4388	5500
JIANGSU	5350	7277	12258	22944	35955	53030	70733	87506	105397	93960

TABLE 3:Import of Hi-Tech Products by West China (2000-2009)*

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
INNER MONGOLIA	28	35	69	33	108	229	54	108	179	256
GUANGXI	76	75	74	98	233	165	245	233	280	336
CHONGQING	74	80	298	211	403	230	270	403	494	445
SICHUAN	472	1004	669	973	2823	1116	2018	2823	4442	5705
GUIZHOU	14	51	93	178	77	125	74	77	114	92
YUNNAN	61	217	201	109	240	458	286	240	232	256
TIBET	2	1	4	8	1	3	7	8	7	3
SHAANXI	347	430	497	529	666	826	967	884	1457	1823
GANSU	13	28	56	45	54	136	85	55	145	138
QINGHAI	2	10	7	9	18	9	36	24	35	39
NINGXIA	8	22	13	17	32	27	22	133	78	77
XINGJIANG	43	389	167	115	107	186	98	166	144	292
Total west China	1140	2342	2148	2325	4762	3510	4162	5154	7607	9462
JIANGSU	5648	7063	10147	19205	28687	40929	51081	58293	71306	61140

All figures for export and import are in million USD
SOURCE: National Bureau Statistics of P.R. China and author calculations

TABLE 4: Provincial Level GDP of West China and Jiangsu Province (2000-2009)*

* All GDP figures are in USD 100 million

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
INNER MONGOLIA	169.24	207.06	234.50	288.56	367.42	475.55	620.22	844.71	1223.34	1425.89
GUANGXI	247.65	275.38	304.91	340.84	414.83	497.55	595.37	765.84	1010.93	1135.87
CHONGQING	191.99	213.32	240.43	274.59	325.34	374.83	490.13	614.96	834.21	955.94
SICHUAN	484.42	518.73	570.86	644.33	770.78	901.54	1090.12	1389.06	1814.41	2071.63
GUIZHOU	120.01	136.92	150.23	172.33	202.71	241.59	293.41	379.29	512.82	572.78
YUNNAN	236.17	258.34	279.43	308.81	372.36	423.95	500.28	627.63	819.59	903.20
TIBET	14.19	17.64	20.12	22.85	26.62	30.67	36.47	44.90	56.85	64.61
SHAANXI	200.63	242.92	272.25	312.64	383.67	448.71	595.05	757.14	1053.20	1195.99
GANSU	118.79	135.96	148.85	169.12	204.00	236.09	285.59	355.39	455.98	495.91
QINGHAI	31.84	36.26	41.16	47.14	56.31	66.33	81.35	104.86	146.67	158.29
NINGXIA	32.08	40.77	45.57	53.81	64.90	73.99	91.06	120.87	173.35	198.11
XINGJIANG	164.81	180.21	194.84	227.90	266.90	317.91	382.00	463.33	602.33	626.12
Total in west China	2011.82	2263.51	2503.13	2862.91	3455.86	4088.69	5061.06	6467.97	8703.66	9804.34
JIANGSU	1036.76	1142.54	1281.48	1503.31	1812.73	2234.66	2727.37	3421.68	4460.98	5044.25

SOURCE: National Bureau Statistics

TABLE 5: Local Government R&D Expenditure in West China (2000-2009)*

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Inner Mongolia	0.40	0.47	0.58	0.77	0.94	1.43	2.07	3.18	4.88	7.63
GUANGXI	1.01	0.97	1.09	1.35	1.44	1.78	2.28	2.89	4.72	6.91
CHONGQING	1.22	1.21	1.52	2.10	2.86	3.91	4.63	6.18	8.67	11.64
SICHUAN	5.42	6.95	7.48	9.59	9.42	11.79	13.52	18.29	23.08	31.40
GUIZHOU	0.51	0.65	0.74	0.95	1.05	1.34	1.82	1.80	2.72	3.86
YUNNAN	0.82	0.93	1.18	1.33	1.51	2.60	2.62	3.41	4.46	5.45
TIBET	0.02	0.02	0.06	0.04	0.05	0.04	0.06	0.09	0.17	0.20
SHAANXI	5.98	6.25	7.33	8.22	10.09	11.28	12.72	16.00	20.63	27.74
GANSU	0.88	1.01	1.33	1.55	1.74	2.39	3.01	3.38	4.58	5.46
QINGHAI	0.16	0.14	0.25	0.29	0.36	0.37	0.41	0.50	0.56	1.11
NINGXIA	0.21	0.18	0.24	0.29	0.37	0.39	0.63	0.99	1.08	1.52
XINGJIANG	0.39	0.39	0.42	0.46	0.72	0.78	1.07	1.32	2.30	3.19
Total in West china	17.02	19.17	22.23	26.94	30.57	38.10	44.85	58.04	77.87	106.12
JIANGSU	8.83	11.15	14.17	18.18	25.86	32.94	43.42	56.58	83.64	102.77

* All figures are in USD 100 million.
SOURCE: National Bureau Statistics of P.R. China.