Promoting Applications of Intelligence Technology in Response to the Trend of Regional Innovation – A Look at Intelligent Tourism

Chih-Lun Chen*, and Yi-Hsin Ho

Market Intelligence & Consulting Institute (MIC), Institute for Information Industry (III), Taiwan
(**Received 24** November 2014; **Published on line** 1 December 2014)
*Email: chihlun@micmail.iii.org.tw

Industrial and Regional Development of Taiwan

Over the past 30 years, Taiwan's industrial structure has transformed from manufacturing to service. In 2013, contributions of manufacturing and service industries to Taiwan's GDP were 31.0% and 67.3% respectively, suggesting an industrial structure that is similar to developed countries. Meanwhile, the main factor driving economic growth has changed from capital to multifactor productivity, including technological changes, improvement in management, enhanced investment quality and production efficiency, returns to scale, changes in industrial structure, and the re-allocation of resources.

However, the people in Taiwan seem not to sense the benefits brought about by industrial developments, technological advancements and economic growth. From the industrial perspective, the renowned contemporary economist, Tyler Cowen, uses the term "the Great Stagnation" to describe the predicament in industrial technology innovation. Professor Cowen believes that, after the Industrial Revolution, fast-growing economies have reached a technological plateau, where most entry-level technologies have been developed, raising the threshold of success in industrial innovation.

In 2012, the ratio of added value of Taiwan's manufacturing industry was 20.3%, which was around 10% less than those of the United States (35.2%), Japan (31.9%) and Germany (30.2%). However, Taiwan has advantages in cost of investment for its relatively affordable quality, while its industrial clusters are confirmed by international rating agencies. Therefore, with Taiwan's endeavors to enhance added value and efficiency, different ideas and methodologies must be applied. In Taiwan, the growth rates of the service in recent years have been comparatively low, and therefore the service industry's contribution to overall economic growth has not been as stable as the manufacturing industry. Industry association analysis on the development of Taiwan's service industry suggests that only the retail and finance/insurance sectors support other industries, while other services industries neither support nor drive the development of other industries. That is to say, developments of most industries in Taiwan are independent from one another and lack interdisciplinary cooperation. These are what have caused the high threshold of industrial upgrade.

The spatial planning of Taiwan's industrial development and land supply in the past was separate, resulting in the current situation where the government often has to invest additional budget in adapting public spaces to industries in order to carry out industrial restructuring. This is relatively uneconomical when faced

with limited resources.

In summary, this study suggests the application of a "regional innovation system" while leveraging the advantages Taiwan has in the ICT industry to promote cross-industrial collaboration that features regional intelligence and characteristics. This will enable the incubation of local characteristics and facilitate localized and balanced development of the industry, creating sustainable competitiveness.

The definition of a regional innovation system

The concept of innovation system was proposed by the Danish scholar Bengt-Ake Lundvall in 1985 to explain the interaction among laboratories, research institutions and customers. Subsequent study categorized the functions and scale of the application of an "innovation system" into three levels: a "national innovation system", a "regional innovation system" and an "industrial innovation system".

The theory of regional innovation systems emerged in the 1990s in response to globalization. The theory discusses how states may create regional innovation systems to advance regional competitiveness in an era of fast-flowing capital, technology and talent to stand out in the cross-border and cross-regional competition. In other words, regional innovation systems are subsystems or the foundation of a national innovation system with localized characteristics. The innovative capacity of a country cannot rely solely on system designs and guidance of the central government. Instead, it should be based on regional innovation capacity. Integrating regional resources and advantages that are different from one another may create different innovative capacities, enhancing competitiveness in the midst of globalization. Comprehensive regional innovation systems are prerequisite to the establishment of a sufficient national innovation system.

A regional innovation system refers to a system that facilitates formal and informal interactions among private and governmental institutions and organizations (companies, universities, research institutions, public sector and associations, etc.) within a particular geographical area to promote knowledge exchanges and thus continuously improve innovation output within the region. Due to differences in knowledge spillover, usage and search, each region might deliver different results, while the innovation system of each may have different features as well.

Selection and assessment of application areas and locations of intelligence technology under the concept of regional innovation

If we wish to apply the concept of "regional innovation systems" to enhance operational efficiency and effectiveness of our industries and to promote interdisciplinary collaboration, this study suggests that, on the basis of our strength in ICT industry, promoting applications of intelligence technology while developing local characteristics and expanding interaction among the industrious, political, and academic sectors will be a feasible approach. The following content discusses the priority areas, regions, and recommended methods of applying intelligence technology in Taiwan.

Firstly, the direction of intelligence technology application depends on government departments that are in charge of the budgets. Therefore, after visiting related agencies under the Ministry of Science and Technology, Ministry of Economic Affairs, Ministry of Transportation, Ministry of Health and Welfare and Council of Agriculture and relevant scholars, this study identifies the following areas as the first priority for the program: transportation and tourism, intelligent shopping districts, electronic (government) data, massive data analysis, health cloud, cold chain logistics, e-commerce, and food & beverage industry. Generally speaking, the aforementioned areas, such as business district, F&B and transportation may be considered parts of the tourism industry. Therefore, this article takes intelligent tourism as example for further research and analysis.

Moving on, this study takes quantitative approach to assess and identify regions that should be considered first in the development of intelligent tourism (due to limitations on the statistics obtained, "region" in this study refers to counties/cites). The quantitative analysis is further divided into two parts, "regional innovation capability" and "potential in promoting intelligent tourism", which are described in the following:

1. Regional Innovation Capability

In order to identify key factors affecting regional innovation capability, this paper studies benchmarking cases of international and regional innovation, including the Medicon Valley in Sweden and Denmark, regional specialized center in Kuopio, Finland, Research Triangle Park in North Carolina, USA, Tsukuba Science City in Japan, Daedok Science Town in Korea, as well as Suzhou Industrial Park in China, and identifies the following five factors leading to success of regional innovation:

- Close partnerships among innovation bodies; the industry, government and research institutes work together to create knowledge and critical technologies through joint or commissioned research.
- The intermediary agency has excellent integration capability and is able to line up supplies and demands of knowledge/critical technologies, manpower and funding through vertical and horizontal integration. Some intermediary agencies can even provide services such as incubators and business management consultancy.
- Sufficient funding for research and development. As the cost of innovative research and development can be substantial, support from the government, foundations or venture capitalists are required.

- Developing local competence, valuing commercialization and marketing of innovation outcome, developing innovation incubation center and providing technology incubators counseling to accelerate commercialization of R&D results.
- The innovation infrastructure is complete, increasing participation of research institutes, industry and professionals.

In view of the above success factors while considering the availability of national statistics, this study develops three indices to assess regional innovation capabilities, including intelligence technology innovation capability, local financial support, and capability in driving intelligence technology services. The indicators adopted for each index are listed in the Table 1 below:

Table 1. Regional Innovation Capability Index

Intelligence Technology Innovation Capability	Local Financial Support	Capability in Driving Intelligence Technology Services
Percentage of factories that has invested in research and development (%)	2011 to 2013 growth rate of public debt (%)	Ratio of intelligence technology services tenders versus annual expenditures in 2013 (%)
Average R&D expenditures of enterprises investing in research and development (in thousand dollars)	Ratio of county/city-owned sources of financing versus annual expenditures in 2013 (%)	Average size of intelligence technology services tenders in 2013 (in $10,000)
Scientific papers per ten thousand people (number of papers)	Total debt per capita (NTD)	
Patents acquiring capability of colleges and universities (patents/school)		*The underlined items are negative indices.

Source: III MIC, November 2014

The calculation: After standardization, each indicator is represented by a T score. Then, the three indices are weighted with 33% each to calculate the final scores. As a result, the top five regions are, sequentially, Hsinchu City, Taichung City, Taoyuan County, Tainan City and Taipei City; New Taipei City and Kaohsiung City are ranked No. 9 and 12 respectively.

2.   Potential to promote intelligent tourism

Evaluation of potential in promoting intelligent tourism is based on tourism-related environmental conditions, resources and construction of each county/city. The indicators used are listed in the Table 2 below:

The indicators are calculated as the previously mentioned index and weighted to represent the potential in promoting intelligent tourism. As a result, the top five regions are Taipei City, New Taipei City, Taichung City, Kaohsiung City and Tainan City. The regions with the least potential are Chiayi County, Keelung City and Yunlin County.

Combining the analysis results on "regional innovation capability" and "potential in promoting intelligent tourism", Taipei City, Taichung City and Tainan City are identified as the top priority regions for developing intelligent tourism services and industrialization of relevant technological applications.

Table 2. Indicators assessing potential in promoting intelligent tourism

Number of sightseeing bus routes	Number of cultural activities in 2013 (events)
Rate of public transportation use (journey using public transportation versus total journeys)	Number of various attractions in 2014
Length of biking lane (km)	Average sunshine hours (hours)
Number of Wi-Fi hotspots in public areas (total number of hotspots provided by iTaiwan, Chunghwa Telecom, Taiwan Mobile and other operators as of May 2014)	Number of landslides-latent streams
Number of B&B and Hostel in 2013	2013 percentage of Air Quality PSI Index greater than 100 days (%)
Number of financial institutions in 2014	2013 percentage of unqualified drinking water (%)
Number of major convenience stores as of May 2014	*The underlined items are negative indices.

Source: III MIC, November 2014

3. Recommendations on promoting intelligence technology services and intelligent tourism

In the past, Taiwan has had executed programs of intelligence technology services applications, for example, i236 project executed by the Ministry of Economy during 2010 to 2013. The objectives of i236 were to localize daily-life applications, industrialize application services, and globalize service products. This project delivered direct and derived benefits that exceeded the performance targets in terms of patents, technology transfers, commissioned cases, and thesis paper output. However, after interviews and literature study, this paper identifies the following three issues that should be addressed and resolved in future projects:

A. Regional Innovation Capability

- Innovative services require extensive adjustment before they can be brought to the market. Many emerging services on the Internet lack a suitable testing environment and this makes failure likely.
- In terms of location selection, the traditional method in selecting locations considers mainly geopolitical factors and networking instead of comprehensive assessment. Therefore, the supply (technology) and demand (problem) might not have been successfully matched.

B. Too much emphasis on technology and not enough service depth

- The technology-oriented approach in the past emphasized the creation of new services through integration. Integration for integration's sake meant a lack of understanding on the requirements and no thought was given to how system integration matches the "value statement". The result was an uncertain business model, lack of service depth and commercialization setbacks

C. Lack of long-term commitment from key vendors

- Innovative services often require inter-industry integration. It is difficult for a single company to construct a complete service chain. For example, healthcare requires hospitals, system integrator and equipment vendors.
- The team requires leadership and active involvement of the key vendor to set up an appropriate business model.

In response to the above issues and to help realizing the concept of promoting intelligent tourism for driving regional innovation development, this paper consolidates expert advices and preliminary research results to make the following recommendations for the major parties involved in a regional innovation system:

A. Government agencies:

- Actively developing free Wi-Fi services: Intelligent architecture concept may be applied to newly developed areas, such as shopping malls and underground shopping areas, to incorporate Wi-Fi related equipments and pipelines into the design and construction. The cost of constructing wireless internet service and the usage may be included into the rental of the shops. By doing so, the public can enjoy Wi-Fi services while the business owners benefit from the intelligence service. As for developed areas, construction of fiber-optic network can be considered. The cost of such construction is lower than that of one network line per household, and people can benefit from it.
- Continuous efforts in providing basic transportation/traffic information (such as roads under construction, traffic, public transportation timetable, etc.) and tourist information.
- Regulations such as "Act Governing Issuance of Electronic Stored Value Cards" and "Personal Data Protection Act" have increased the difficulty in gathering information on tourist purchasing behavior and traffic information, and these issues shall be addressed and resolved.

B. Research/institutional organizations

- Playing the role as intermediary agencies to cooperate with central and local governments and help develop and position local features, while at the same time introducing technology application services that are complementary to the local features.
- Developing technological applications responding to demands, planning business models, developing sensible location selection model, and transferring the skills and technology to enterprises for business operation.
- Creating mechanism for enterprises in the design industry and the government to participate in technology and service developments.

C. The business sector

- The business sector is a major party in the promotion and application of intelligence technology services; it is also the key how the public can experience the development. The

business sector may actively use various data provided by the government to design and provide related services. Meanwhile, schools or institutions may transfer related technologies and business models to the business sector to provide services, for example, online seat selection system for buses, panel PC or other information devices that individual tourists may rent, etc.

● Enterprises are expected to have the capability to manage orders, cash flow, and profit sharing, so that they can assist SMEs to apply ICT applications. Collaboration within the business sector may result in market expansion, reduced costs, changes in the profit-sharing structure, and eventually a win-win result for both the enterprises and the public.