
R&D and industrial districts in Asia: an application to Taiwan

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Abstract: This research analyses the role of public policy and the state in science and technology industries in Asia. The research is based on field studies undertaken at the Hsinchu Science and Industrial Park (HSIP) in Taiwan. The state has been seen as crucial to the phenomenal economic success of capitalism and the business systems in Asian countries such as Korea and Taiwan (Wade (1990) *Governing the Market*, Harvard University Press, Cambridge, MA). On the other hand, entrepreneurship has been seen to flourish in countries where the state's role has been minor (in Hong Kong for example), and as concluded in the paper, the state has played a major role in nurturing entrepreneurship in Taiwan. The contributions of this paper are twofold: first, to better understand Taiwan's success and lessons for R&D management, and secondly, to raise the potential role of public policy for entrepreneurship and its close relationship with Asian business systems (Phan (2004) 'Entrepreneurship theory: possibilities and future directions', *Journal of Business Venturing*, Vol. 19, No. 5, pp.617-620).

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1 Introduction

This paper is about comparative capitalisms in Asia, and the role of public policy and the state in global entrepreneurship. It is not about entrepreneurship in the well-researched mature capitalism of the USA, UK, Japan and Germany. The focus of this paper is on Taiwan, which in 2003 had become the world's third largest IT producer after the USA and Japan; it is also one of the world's major producers of semiconductors (Saxenian and Hsu, 2001). Despite this phenomenal economic and business success, research on Taiwan's business system, especially its entrepreneurship, has been relatively neglected in R&D and technology studies.

The paper is set out as follows. First, Taiwan is analysed in the context of research on East Asian business systems, and the continuing debate on the drivers of economic and business success in these countries (Phan, 2004). Secondly, an analysis of Taiwan's business system, and the role played by entrepreneurship and public policies towards entrepreneurship in Taiwan's business system, is provided. In general, Taiwan is provided as an example of the positive role of public policy in the nurturing of science, technology and entrepreneurship, and the impacts of public policy on R&D management.

At the same time, the key contribution of this paper is to show the potential linkages in research between global entrepreneurship and existing Asian business systems (Saxenian and Hsu, 2001; Whitley, 1990).

2 Research in entrepreneurship

'Entrepreneur' has been a major research topic within business school disciplines for decades.

In the earlier days, the analysis requires disciplines such as economics, including Schumpeter's (1934) well-known works on creative destruction. Researchers such as Kirzner (1997), who had developed a more adaptive approach to entrepreneurship, have also more recently shown the potential strong linkages between Schumpeter style Austrian economics and international management and business research.

In later years, the interest in entrepreneurship in business school research has been driven by the global importance of technology in business success. This in turn has been combined with not only the importance of technology, but also how such clusters or groupings of technology firms can exist closely together in industrial districts (Saxenian and Hsu; 2001). Major examples of such clusters include Silicon Valley in California, USA, Cambridge University Science Park, in Europe, and Sophie-Antipolis Technology Park in Nice, France.

A third aspect of research in entrepreneurship, which is particularly relevant to this paper, is the importance of the social, institutional and legal foundations relating to economics and business success (North, 1990; Choi, Lee and Kim, 1999). In some sense, this area of research has been driven by globalisation, and the increasing importance of studying business or firms in the context of a national business system, and of seeing the firms in a broader, business environment. This area of research shows that there certainly seems to be more than one type of national business system that leads to economic and business success (Dore, Laconic and O'Sullivan, 1999; Yin and Choi, 2005; Whitley, 1990).

More specifically, in terms of entrepreneurship in Asia, there is limited work in the academic literature on how entrepreneurs have played a crucial role in the success in the business sectors (Cassar, 2004; Leiblein and Reuer, 2004; Redding, 1990). However, various theories have been developed in the social sciences and management disciplines on the rapid industrialisation and economic growth in Asia. The key frameworks are summarised in the Table 1 below:

Table 1 Schools of thought on East Asian economic success

<i>School of Thought</i>	<i>Major Frameworks</i>	<i>Example of Literature</i>
International Free Trade	Neoclassical international economics; global free trade and comparative advantage; low cost of labour; macroeconomic factors	Krugman (1991)
Growth theory, development	Outward export orientation; import substitution; traditional economic growth theory; some industrial policy	Pack (2001); Yin and Choi (2005)
The State, institutional change	Governing the market; strategic trade policy; coordinating prices and information; microeconomic factors; international political economy; institutional analysis	Amsden (2001); Amsden and Chu (2003); Rodrik (1997)

3 Taiwan's economic success

The Taiwanese economic 'miracle' has transformed an agricultural society to an economy that boasts of a diversified industrial base with a growing service sector. The government actively directed the industrialisation of Taiwan through National Economic Plans that targeted key sectors of the economy and set long-term development goals. However, the role of the state is limited to creating a favourable environment for private sector investment and trade.

In the 1950s, economic growth centred on improvements in agriculture combined with a government policy that encouraged the development of import-substitution industries such as paper, fertilisers, textiles and cement. Taiwan benefited from the generous American aid (until 1965) as well as the infrastructure built by the occupying Japanese at the time.

In the 1960s, the government changed direction and export industries were to be the new engine of growth. Taiwan benefited from the open American economy and a protected domestic economy during this phase of economic development. The development of labour-intensive light industry and assembly for export markets utilised Taiwan's low cost labour advantage and relatively low levels of investment and technology. The export success from this stage of economic development enabled Taiwan to move to the more capital- and technology-intensive industries.

In the 1970s and 1980s, Taiwan's comparative advantage declined in labour-intensive textiles and consumer goods assembly as wages rose, necessitating the transition to secondary import-substitution industries such as steel, petrochemicals and manufactured goods industries for export. Accordingly, it was witnessed in the 1980s perhaps the most significant public policy that determined Taiwan's future economic and business success – the creation of the Hsinchu Science-based Industrial Park (HSIP).

In the 1990s, manufacturing exports and imports of inputs for this sector account for two-fifths of current price GDP. This dependence on foreign trade on the supply and demand sides means Taiwan has a vested interest in the GATT negotiations. Taiwan is responding to American pressure to liberalise and deregulate her domestic economy, which increases foreign competition and encourage domestic firms to invest in higher-technology and skill-intensive industries.

4 Taiwan versus the USA: business systems

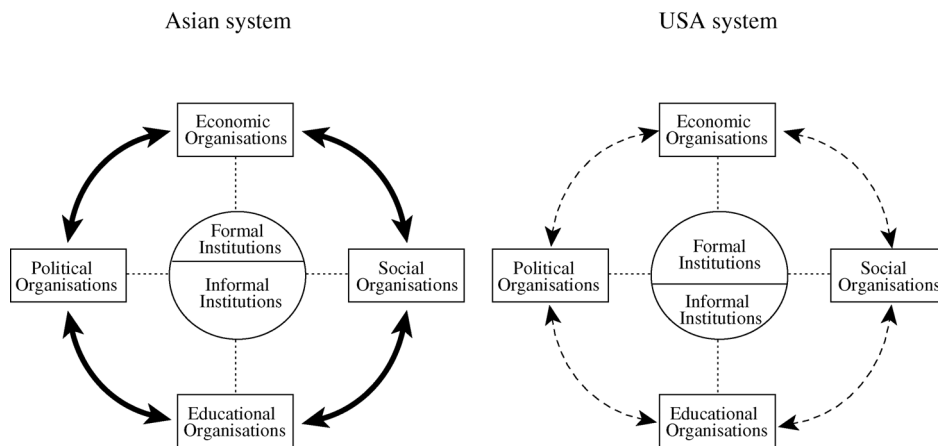
Taiwan can be analysed as a technology driven, entrepreneurial business system, and many of its successes may be based on Silicon-valley style business practices. However, from the perspective of business systems, it should be noted that the Hsinchu Science-based Industrial Park (HSIP) was set up by government decree and government coordination, unlike the natural formation of Silicon Valley in California, USA.

Apart from government intervention, institutions and organisations on one hand and the proportion of formal and informal institutions on the other can also influence the business system in a nation. In the former instance, a business system could have very strong linkages with institutions and organisations, as in many collective societies in Asia and in continental Europe (Choi, 1992; Fruin, 1992; Roe, 1994). In the latter case, the relative proportion of formal versus informal institutions is a determinant of

performance in a country's legal systems, and the degree of separation between the legal systems and institutions and organisations in the country (Fruin, 1992; Roe, 1994; Orru, Biggart and Hamilton, 1997).

As in many part of Asia, in Taiwan many types of 'non-market' institutions also exist (Besley, 1995). Informal credit and insurance arrangements are often used instead of banking and insurance services that are linked to formal legal contracts. A feature in the former arrangement is that non-market institutions require non-anonymous peer reviews, and the monitoring of non-market institutions is based on trust. From the perspective of illustrating the relationships between entrepreneurship and business systems, the USA system (with its emphasis on formal institutions) is contrasted generally with the Taiwanese system (with its emphasis on informal institutions) is shown in Figure 1.

Figure 1 Different national business systems



Source: Adapted from North, 1990 and Choi, Lee and Kim, 1999

5 Asian entrepreneurship research

The phenomenal economic success of Asia since the 1960s was widely studied by researchers in many disciplines such as Fruin (1994) on Japan and Amsden (1989) on Korea in the 1980s and 1990s. In terms of generalisations, 'export-led' growth was the key driver of success in the five, now developed economies of Asia: Japan, Korea, Taiwan, Hong Kong, Singapore, or known as the five tiger economies (Vogel, 1991). The role of the 'entrepreneur', as well as the role of a business environment conducive to entrepreneurship, however, has been neglected by researchers, especially in international business. Observations seem to suggest that the development of entrepreneurship and associated business systems are more or less continuous or adaptive as analysed by Kirzner (1997), with Taiwan the exception, which is the focus of this paper.

Speaking at the 2000 World Congress on Information Technology, Carly Fiorina, the CEO of industry giant Hewlett-Packard said: "From our tiny start in 1970, we have grown to a US \$4.5 bn purchaser and partner with Taiwan in the year 2000, and see the words 'Made in Taiwan' come to mean high quality, world class technology." (Taiwan's Ministry of Finance, 2000). Taiwan ranks as the world's third-largest IT provider after

the USA and Japan (Saxenian and Hsu, 2001; Amsden and Chu, 2003). In 2000, the island exported high-tech and telecom products worth US \$45 bn worldwide, a 20% gain from US \$37 bn in the previous year, according to Taiwan's Ministry of Finance (2000). Fundamental to this economic success was 'technology' and R&D. The foundations of technology in Taiwan in turn were based on the industrial district set up in 1980: the Hsinchu Science-based Industrial Park (HSIP), a consequence of government policy and action, the implications of which are explained in the next section.

6 Public policy and industrial district creation

There are two major ways that technology-based industrial districts can be created. First, they can be created over time and are often based around a major research university. For example, the natural formation of Silicon Valley in the US benefited from the technologies developed within universities such as Stanford. Silicon-fen in the UK is a similar example the formation of which benefited from the technologies and knowledge generated by Cambridge University. Secondly, the technology based industrial districts can be regulated and created through government intervention. The government provides subsidies to high technology companies as incentives to locate in a particular part of the country. The best example of this type of formation is Sophie-Antipolis in Southern France; it has now attracted over 1,500 high technologies companies (Cassar, 2004). Taiwan's technology district, Hsinchu Science Technology valley, is a hybrid of the more university-based system of Silicon-fen, UK and Silicon Valley, USA, and the government-business collaboration system in Antipolis, France.

In terms of the role of public policy and government, the Hsinchu Science-based Industrial Park (HSIP) is similar to the successful case of Antipolis in southern France in that the Taiwanese government worked closely with domestic companies to encourage foreign companies to develop their technology in the Hsinchu district (Pack, 2001). But unlike the companies at Antipolis, France where the government encouraged well-developed technology companies to locate there, the companies at the Hsinchu Science and Technology Valley were also encouraged by the government to create new technology as well as to develop the export of new technologies to the global economy.

Thus, the link between Taiwan's economic success, contribution by technology, and the formation of the Hsinchu Science-based Industrial Park (HSIP) illustrates the implications of public policy, the role of the state and the collaboration between government and business on firm decisions such as foreign direct investment, geographical location and strategy.

The relationship between entrepreneurs and the state is reciprocal, and not just one way. The entrepreneurs' contribution is that they help to overcome uncertainties in property rights, especially in what was a rapidly emerging business environment such as Taiwan. In this sense, the entrepreneurs in industrial districts such as Hsinchu Science-based Industrial Park (HSIP) become a knowledge coordinators between economic public policy makers in government, and the business and financial community at the industrial district. In this sense, entrepreneurs and entrepreneurship are fundamental factors in the success of certain Asian business systems.

7 Conclusions and further research

This paper is about comparative capitalism in Asia, the role of the state in global entrepreneurship and its implications for technology industries and R&D management. The purpose of the paper is to analyse the role of entrepreneurship in the countries that are 'latecomers' to industrialisation and to the OECD or globally developed economies; these countries include the four East Asian countries of Korea, Taiwan, Hong Kong and Singapore. The focus of this paper is on Taiwan, which in 2003 had become the world's third largest IT producer after the USA and Japan, and it also was one of the world's major producers of semiconductors (Phan, 2004; Saxenian and Hsu, 2001). The public policy and the state had played a significant role on Taiwan's dynamic economic growth and Taiwan's business system. The idea of an entrepreneurial state has lessons for other countries in terms of R&D management (Brockner, Higgins and Low, 2004; Leiblein and Reuer, 2004).

There are at least two areas that warrant further research. First, are there implications of Taiwan's entrepreneurial state on other latecomers in Asia (China for example) to industrialisation, especially in terms of R&D management strategies? Secondly, an empirical and global analysis comparing industrial districts where the state has played a substantial role in their creation and the implications for a country's business system would enhance the understanding of the subject matter further. It is not unlikely that the idea of an entrepreneurial state, public policy and its connection to industrial districts is a subject of continuing importance for R&D management research.

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