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TECHNOLOGICAL INNOVATION, NATIONAL URBAN POLICY AND LOCAL DEVELOPMENT: POLICY IMPLICATIONS OF THE CONCEPT OF TECHNOPOLE AND JAPAN'S TECHNOPOLIS PROGRAMME FOR DEVELOPING COUNTRIES

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AND LOCAL DEVELOPMENT:
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1. INTRODUCTION

1.1 Introduction

In recent years there has been considerable interest in technology-oriented regional development policies in many industrialised countries. The attempt to create the so called 'technopole' (Castells and Hall, 1994) is one of these policies. The proliferation of such an effort in so many countries on the stimulation of high-technology industry through technopole planning appears to be based on the assumption that technological innovation leads to economic growth, and directing the location of high-technology industry is relatively easy because of its 'foot-loose' nature and therefore can be a key industry for the development of hitherto underdeveloped backward regions (Malecki, 1991). Thus with the hope of replicating the apparent success, numerous attempts have been made to identify the factors governing the formation of classical examples of innovative industrial complexes such as Silicon Valley in the US. However, there has been little agreement so far, as to what are the governing factors behind the success of such innovative regions and to what extent planning intervention can help the formation of innovative industrial districts.

In spite of these debates, the concept of technopole and its policy implications can be of particular interest to developing countries for a number of reasons. First, it suggests the way to build national technological capability which has been widely recognised by many researchers as crucial to national economic development (Hewitt & Wield, 1992; Malecki, 1991; Aharone & Hirsh, 1997). Second, it indicates the way to achieve regional development and thus the reduction of regional disparities which is a marked feature of so many developing countries. Third, it suggests the way to create organisational mechanisms in which technological innovation can contribute to local entrepreneurship and thus to local economic development and to help local level governments in developing countries to manage their cities more effectively by maximising locally-specific development potential.

However, by its nature, technopole building entails various types of state intervention such as appropriate national economic development strategies, industrial policy, national urban policy or regional policy, and local development planning. These strategies must be co-ordinated so the do not contradict each other (Castells & Hall, 1994). This leads to the issue of national spatial strategy (or national urban/urbanisation policy) in developing countries, which has been widely debated over the past few decades. One of the main conclusions drawn from this debate is that direct state intervention to influence the spatial pattern of development has not been successful, and the growth of large cities should not be restricted at high costs to the public purse but rather their economic potential should be maximised. Large cities are important contributors to national economic development and thus should be effectively managed, but this does not mean smaller cities can be neglected. Indeed, many researchers suggest that while local governments should play an active role in the development of their own cities, the central government should also play a vital role to assist their efforts (Gilbert, 1991; Watts, 1992). The questions now arise: What are the roles of central and local governments? How should national economic development policy, national spatial policy and local urban development planning interrelate so as to achieve redistribution with growth at a national scale? These questions are closely related to the principle of successful technopole building mentioned above. Technopoles have the potential to contribute to national economic growth through upgrading technological capability and promoting local economic development by encouraging indigenous efforts. In other words, they could be the model for redistribution with growth. Thus, it is a concept that ought to be examined in the light of the current debate about urban development in developing countries.

Japan's Technopolis Programme is perhaps the only the case in which the technopole concept has been applied within a systematically applied policy framework at a national scale (Castells & Hall, 1994; Fujita, 1988) and which therefore can be a useful study case. It is intended to create a series of high-technology-oriented industrial cities in peripheral areas, in order to simultaneously promote new technologies and backward regions. It has a legal basis in the Law for Accelerating Regional Development based on High-Technology Industrial Complexes (Technopolis Law) enacted in 1983. Since the programme was implemented and many technopolises have been constructed, numerous studies have been undertaken to evaluate its performance. Generally the conclusions drawn from these evaluations are negative in terms of achievements. These negative conclusions are usually based on the analysis of the interaction and power relations between central government ministries, agencies and local government, and interaction between different

elements of the programme, such as the policies for industrial development, regional development and local urban development. Thus, these analyses offer the key to answer the questions posed above regarding the possible contribution to a policy of 'redistribution with growth' through a technopole strategy.

Urban development possibilities are particular to each country and city and therefore the experience of Japan cannot be applied directly to other countries. Nonetheless, it is thought and held as a premise, that an understanding of the reason of the success or failure of certain policies and projects in a specific milieu can provide an adequate basis for the application of the concepts upon which these polices are based. This basic assumption underpins the choice of Japan's Technopolis Programme as a case study from which it is hoped lessons to other countries - especially in developing countries - may be learnt.

1.2 Aim and Objectives

One of the main challenges encountered by developing countries is how to achieve 'redistribution with growth'. One of the options development planners have is to build or assist the formation of technopoles. As suggested above, a technopole programme is intended to promote both national economic growth and local development through the promotion of technological innovation. However, it raises several issues such as the role of different levels of government, the relationships between national spatial strategy, macro-economic policy, industrial policy and urban development policy in technopole construction and the extent to which these sectoral policies can influence the spatial pattern of economic development, and how they should be co-ordinated to maximise their effects. The aim of this paper is to examine these issues in the context of the debates on national urban development strategies in developing countries.

The objectives of the research are the following:

(a) to examine the usefulness of the concept of "technopole" for developing countries.
(b) to explore the possible contribution of a technopole programme to a national urban policy.
(c) to assess the effects the implementation of this concept has had in the case of Japan's Technopolis Programme.
(d) to highlight policy implications of the experience of the Technopolis Programme, for developing countries, focusing on the role of different levels of government, and the interaction between sectoral policies for development.

1.3 Methods and Data Sources

The idea for this paper was very much inspired by the growing interest in the debates on the extent to which planning intervention can manipulate the formation of technopoles through various sectoral policies, mainly through macro-economic policy, and spatial policy at national level, and urban planning at local level, and by the dearth of studies linking the technopole concept to the growth of developing countries.

The analysis relies largely on a review of the literature in English and Japanese. The data and related argument of Japan's Technopolis Programme are largely drawn from Japanese literature, of which academic journals and government publications are the main sources. The research involved on primary data collection.

1.4 Structure of the Paper

The paper is comprised of six chapters. the current chapter is introductory and has hitherto provided a brief explanation of the topic and its relevance to current debate, a statement of aims and objectives, and a description of the methodology and data sources employed.

Chapter Two provides the theoretical foundation for the case study, attempting to link the concept of the technopole with national economic development, spatial strategy and local development in developing countries, and to explore the key issues necessary to be examined in the case study, thereby giving answers for the objectives (a) and (b) set out in Section 1.2. above.

Chapter Three gives a description of Japan's Technopolis Programme and an account of how the programme has been formulated and implemented.

Chapter Four attempts to assess the performance of the Technopolis programme by summarising various empirical studies. Emphasis is given to the degree to which the original vision and objectives of the programme were achieved.

Chapter Five discusses how the implementation process of the Technopolis programme described in Chapter Three affected the overall performance of the programme demonstrated in Chapter Four, focusing on the interrelations between different sectoral policies and the actors involved, and attempts to draw policy implications from this experience for developing countries.

Chapter Six generalises the discussion made above in relation to the concept of technopole and

concludes with a brief answer to each of the four initial objectives.

2. THE TECHNOPOLE CONCEPT AND NATIONAL DEVELOPMENT POLICY

2.1 The Technopole Concept

The term 'technopole' has been adapted from the French by Castells and Hall (1994). According to these authors 'technopoles' are:

> "various deliberate attempts to plan and promote, within one concentrated area, technologically innovative, industrial-related production: technology parks, science cities, technopolises and the like (p.8)."

Castells and Hall extend the notion of the technopole to cover semi-spontaneous innovative industrial complexes such as Silicon valley and Boston's Route 128 in ths US and older major metropolises in the world such as London and Paris. Thus, technopoles are highly diverse, but Castells and Hall suggest several features as key elements of the technopole as following:

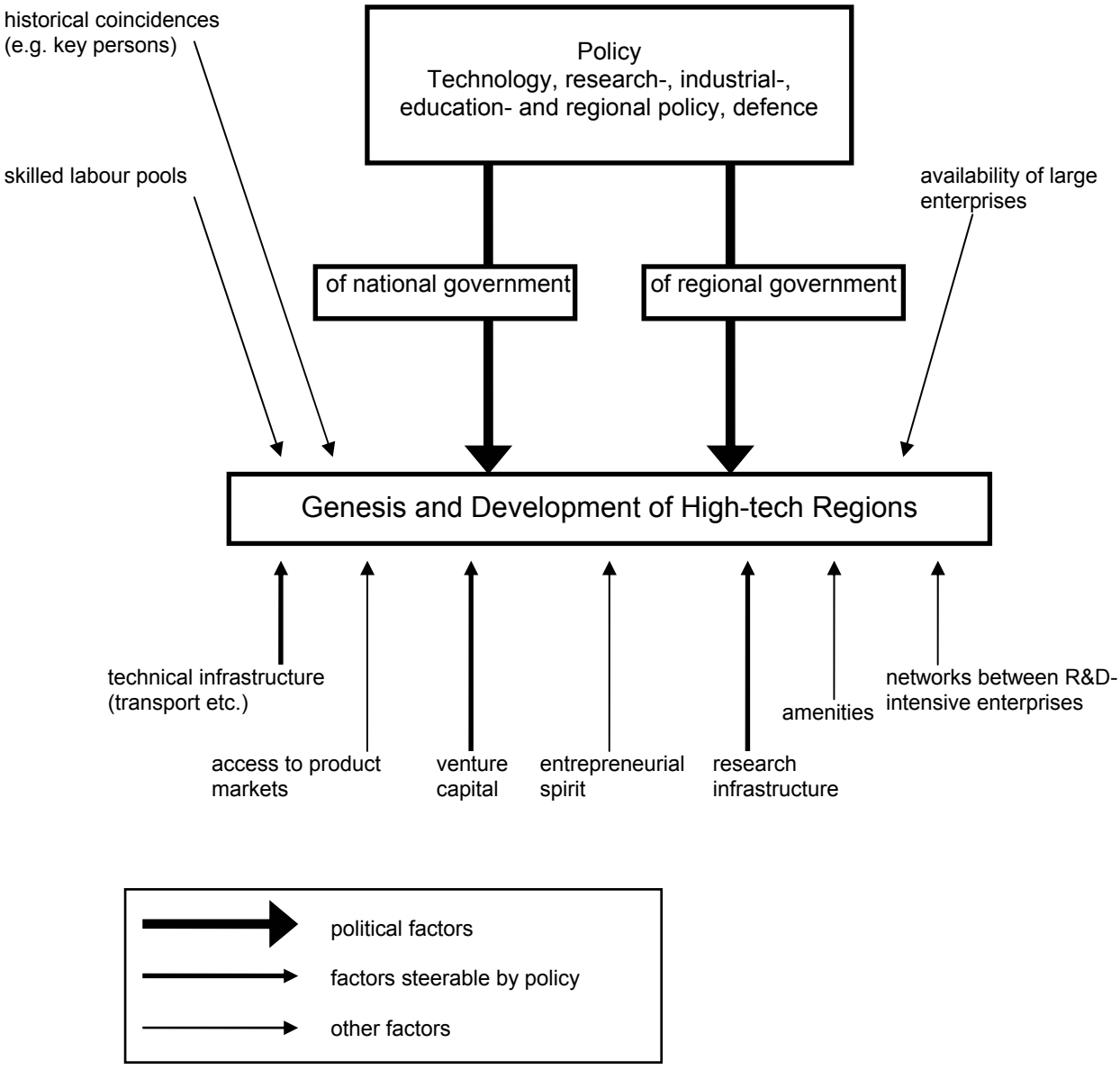
- some form of generation of - or access to - new, valuable technological information;
- a highly skilled labour force; and
- capital ready to take the risk of investing in innovation (1994: 237).

It is clear from the above that although the term 'technopole' is relatively new, the concept behind the term is not. The technopole has long been a subject of major debate concerning the relationship between high-technology industries, innovation, post-Fordist production systems, industrial districts and regional development. Numerous attempts have been made by scholars to demonstrate the relationships between these elements, but there has been little agreement as to the theory to explain why particular places enjoy the agglomeration of innovative dynamic industrial sectors, while others not, and to what extent planning intervention can manipulate the spatial pattern of growth of innovative industries.

These theories include approaches such as product cycle theory, long wave theory, flexible specialization theory and the theory of innovative milieux and networks (Sternberg, 1996). The formation of the technopole, whether planned or spontaneous, depends on various factors (see figure 2.1), and cannot be explained by any one of these theories alone. Each theory has particular strengths and weaknesses in particular aspects as summarised in Table 2.1 and an eclectic mixture of these theories would appear to help explain the emergence of (spontaneous or semi-spontaneous) technopoles (ibid.).

Castells and Hall's discussion is based on the theory of innovative milieux and networks. As shown in Table 2.1, this is particularly useful for explaining the regional conditions under which innovations can emerge. It has strong implications for the emergence phase of innovation and related growth pole theory. It provides theories for explaining regional innovation processes: it identifies the elements of formation of innovative milieux and how the networks between firms and regions affect their formation. An innovative milieu is defined by Castells and Hall as "the social, institutional, organisational, economic, and territorial structures that create the conditions for the continuous generation of synergy and its investment in the process of production that results from this very synergistic capacity, both for the units of production that are part of the milieu and for the milieu as a whole" (Castells & Hall, 1994: 9). Thus, it is clear that there is no universally applicable archetype of innovative milieu. It is specific to each region, and it is assumed that it is each region's task to create their own innovative milieu. They assert that an innovative milieu is essential to the formation of the technopole and identify cities and regions as principal agents for the formation of technopoles. Castells and Hall go on to classify technopoles into five types as shown in Table 2.2.

Figure 2.1: Factors governing the genesis and development of high-tech regions



Source: Sternberg (1996: 534)

Table 2.1: Assessment of the theoretical approaches to high-tech regions

Theory	Applicability to regions		What is the relative information to be obtained from high-tech products and/or regions regarding their		Consideration of technology policy instruments
	In general	Regional examples	Genesis	Growth	
Product Cycle Theory (regional version)	●	Southward and, later, westward migration of industry in USA	❍	●	❍
Long Wave Theory	Originally❍ Later●	British Standard Regions, US federal states, Northern Italy	●	❍	❍
Theory of Flexible Production and Specialization, Industrial Districts	●	'Third Italy', parts of California, Baden-Wurttemberg	❍	●	❍
Innovative Milieux, Network Approach	●	So far very few case studies, mainly in France and (concerning production networks) in Silicon Valley	●	❍	●

● very appropriate, useful explanations; ❍ not appropriate, no useful explanations.

Source: Sternberg (1996: 533)

Table 2.2: Typology of Technopoles

Type	*Characteristics*	*Example.*
High-tech industrial complexes	- built on the basis of innovative milieu, linking R&D and manufacturing, - created out of global industrialisation, without deliberate planning.	Silicon Valley, California Boston Route 128
Science cities	- strictly scientific research complexes, with no direct linkage to manufacturing. - intended to reach a higher level of scientific excellence through synergy, with deliberate planning.	Akademgorodok in Siberia Taedok in South Korea
Technology parks	- aims to induce new industrial growth, in terms of jobs and production, by attracting high-technology manufacturing firms to a privileged space. - deliberately established high-technology business area, resulting from government- or university-related initiatives.	Hsinchu in Taiwan Sophia-Antipolis in France Cambridge in England
Technopolis programme	- a set of policy instruments aimed at regional development and industrial decentralisation.	Japan
Quintessential innovative milieu	- not usually regarded as innovative milieux, but most of the world's actual high-technology production and innovation still comes from these areas.	Great metropolitan areas of the industrialised world. Tokyo, Paris, London, etc.

Source: Castells & Hall (1994: 10-11)

As can be seen above, the technopoles with true command of innovation are only what Castells and Hall call high-tech industrial complexes and 'quintessential innovative milieu', and the theory of innovative milieu seems to be developed from these classical examples which are genuinely innovative. Thus as Sternberg (1996) argues, the theory has little implications for the innovative regions in which older but nevertheless technology-intensive products flourish. It seems to apply only to the country or regions which are in the same level of industrialisation or economic situation in which such innovative milieux are created.

Thus, as a theory to explain the technopole formation, Castells and Hall's milieu approach is incomplete since their definition of technopole includes those which have been created in the countries which previously lacked the capacity to create such innovative milieux (e.g. South Korea, Taiwan, and Japan). Thus it is no use to discuss here what innovative milieu is, and the question here is *not* whether such innovative milieux in Silicon Valley, Route 128, etc., can be replicated elsewhere, but what can be learnt from past government efforts to build technopoles and to what extent and how planned intervention can affect the process which leads to further development (this process is not confined to mean the emergence of innovative milieu, but *any* process which leads to the formation of successful technopoles. There is no single theory to explain what this process is supposed to be, as explained by Sternberg (1996)).

Rather, the virtue of Castells and Hall's study (1994) lies in its clear implications for policy. They argue that the organisational combination of such specific sources of capital, labour, and raw material can hardly happen spontaneously, and some form of institutional entrepreneurship, either government, non-profit, or private, must intervene in the process. Having carried out extensive empirical studies of technopoles around the world, they concluded with some suggestions for overall development strategies and implications for location policies specific to each level of industrialisation and economic growth, which has also implications for developing countries (see Table 2.3). As a guideline for development policies, their technopole concept well deserves careful analysis.

2.2 Technopole Concept and Developing Countries

In order to consider the implications of the technopole concept for developing countries, as a first step, it seems desirable to answer the following questions: What can be expected to be achieved through technopole building? and What kind of technopole policy may have implications to developing countries? In the following the main objectives of technopole policy are identified and their relevance to developing countries are discussed.

According to Castells and Hall (1994), in general, there are three main objectives of technopole policy: (1) to develop new industries as a national policy, (2) to regenerate a declining or stagnant region, and (3) to develop a milieu of innovation. Having recognised the contradictory nature of these objectives, Castells and Hall go on to suggest that the choice of priority according to each country's level of development, is critical, which can be summarised as Table 2.3. Although this may look too simplistic, it certainly provides a useful starting point for the analysis.

Table 2.3: Technopole building and levels of development

Stages of Development	*Overall Development Strategy*	*Implications for Location Policy*
1. Least developed	- Building science or technology parks as magnets for inward investment, in order to import existing technologies. - Upgrading of both physical and social infrastructure.	- Science or technology parks within or in the vicinity of the national capital region.
2. Less developed	- In addition to the above factors, importance of well-educated labour force, hence widespread university education. - State technology policy to foster applied research for the target sectors of economy (e.g. agriculture, craft production, or tourism). - Building major research universities.	- Negative externalities of the leading region may justify regional policy. - Planned development of a few technological parks or technological cities outside the sphere of the leading metropolis, normally in leading provincial cities which have established base of infrastructure and skills. - Relocation or new establishment of the leading university in leading provincial cities.
3. More developed	- The role of the state become more complex and subtle. - Creating the mechanism to foster the collaboration between academics and industries. - The linkage may be created spontaneously in highly-individualistic societies, but in more formalised ones, the link will have to be built through intermediate or bridging institutions.	- The innovative networks may widen or deepen within the expanding metropolitan region, rather than dispersing to provincial cities. - Desirability of more extensive dispersal of technopoles is still controversial, but Japan's Technopolis Programme may offer the answer.
4. Most developed	- Try to identify niche technology. - Develop a paradigm of collaborative research, between the public and private sectors, that seeks to resolve local problems or barriers, or serve specialised local submarkets and then to look to the private sector to find wider markets.	- No implication for location policy.

Source: Castells & Hall (1994: 239-247).

Now, it is necessary to identify the level of the countries on which the following discussion is focused. This paper deals with the countries at the level 2 in Table 2.3, because this level is the stage at which the elements of regional development (i.e. spatial dispersal) first appear and thus the interaction between economic development, industrialisation and local development become complex. Richardson (1988) also suggests that spatial policies are much more likely to be effective at intermediate stages of development.

For the countries at this level, Castells and Hall recommend that efforts be made to plan the development of technological parks outside the leading metropolitan region, while trying to upgrade national technological competitiveness through technology policy. Here, the contradictory nature of both objectives is apparent. Castells and Hall's implications for locational policy seems to be based on the assumption that a few number of technological parks in the provincial capitals would not harm the efficient development of the leading metropolis, and contribute to local development of the provincial cities.

However, this kind of efforts have already been undertaken in several countries, which throws doubt on Castells and Hall's assumption. Notable example is South Korea. In South Korea, since the 1970s, a number of policies including the development of a new industrial town in Banweol, encouraging relocation of industries away from Seoul were implemented, and have proved to have had little effect on the relocation of industries sited in Seoul (Lee, 1987). Similarly, a more recent study shows (Markusen & Park, 1993) that Changwon industrial district built under strong state control, has so far contributed little as a major innovation centre for the nation, nor to the local development of surrounding area. Another study by Markusen and Park (1995) on Korean new industrial districts, also shows that in the countries where the state has strong command over development policy, industrial complexes without local external economies, vertical disintegration, or local networking, are likely to dominate. Albeit not a country the level 2, one study on Israeli high-tech policy for urban development (Shacher & Felsenstein, 1992) also draws similar conclusion. Japan's Tsukuba Science City has long been recognised as a policy failure in terms of generating embedded innovative synergy. Although it is termed 'science city', it was indeed aimed at the formation of the linkage between high-tech research and development (R&D) with local industries (Yamazaki, 1991). Throughout these studies, the lack of positive effect of these technology parks or industrial districts on locality are emphasised, and a negative influence of the central state's policy on the formation of the local linkages is pointed out.

Therefore, at level 2 of development, the choice of priority among the three objectives becomes an extremely difficult task. The argument made above suggests that if there is a way to achieve these objectives simultaneously, such possibilities should be explored, and in the context of developing countries at the level 2, each of the three objectives of technopole building can be reinterpreted respectively as: (1) industrialisation and building national technological competitiveness, (2) regional development, and (3) local development through the creation of a locally based milieu of innovation. The first and second objectives are closely related to national economic development policy and national urban policy (or spatial strategy), and the third objective is largely a matter of local development planning. To achieve these goals simultaneously, requires co-ordination of these policies at different levels of government. Building technological parks, as suggested in Table 2.2, without such a co-ordination would lead to the rather undesirable situation experienced by the countries quoted above.

In this respect, the experience of Japan's Technopolis Programme would provide an example of planned efforts to achieve such multi-objectives. The Technopolis Programme is based on two strategies: one is to upgrade national technological capacity, and the second is to promote the development of provincial cities through an advanced branch-plant economy (MITI, 1983; Itou, 1992; Sakata, 1991; Tanaka, 1991; Yamasaki, 1992). It is intended to achieve both objectives simultaneously, encouraging regional initiatives with central state assistance. Thus, for developing countries at level 2, a technopolis-type strategy is worth considering to adopt.

Before going to the case study, however, it seems necessary to examine the importance and related issues of the three objectives in the context of developing countries, which will identify potential contributions of technopoles and related issues in developing countries' context, thereby establishing the analytical framework for the case study.

2.3 Technopole and National Economic Development Policy

Technopole strategy may serve as a national economic development policy for developing countries through fostering the process of national technological capacity building. Technological competitiveness of the nation has been identified as the key to national industrial and economic development (Aharoni & Hirsh, 1997; Hewitt & Wield, 1992; Malecki, 1991). Hewitt and Wield (1992) suggest that technology can be acquired through deliberate attempt at local level. It depends on the 'user innovation', based on learning by using, and technological capability is not just a matter of R&D, which implies the

possibility of technological capacity building through innovation in developing countries (ibid.). Thus technological innovation here means the process of technological acquisition, not something only stemming from high-tech R&D. While technological innovation often tends to be associated with research and development (R&D) of high-technology industry and thus industrialised countries, high technology itself is vaguely defined and cannot be considered to be the firm basis for economic development, neither can private or university R&D (Malecki, 1991). Henderson (1989) also argues that the globalisation of *high-technology* production itself cannot help developing countries to acquire technology. Transnational corporations' (TNCs) foreign direct investment (FDI) in developing countries may help the host economy to generate sufficient surplus for importing and adapting new technology, but the question is how to *adapt* new technology. The issue, as Castells and Hall (1994) suggest, technological diffusion rather than high-technology production. This is achieved through planned and organised effort (Castells & Hall, 1994; Hewitt & Wield, 1992). This implies the need for state intervention. The question is: what kind of state intervention is required? and Which level of government should initiate the action?

In general, there are four ways in which central government can affect technological change: "government influence on the factor, organisational, and international "climate" for innovation; government surveying and communication of emergent technologies in other industries and other countries; government co-ordination of standards and directions for technological development; and governmental operations to fill gaps in the commercial development and dissemination of technology" (Harrington & Warf, 1995: 175). These government activities, especially climate setting, communication, and development/dissemination can affect the scope of local government actions and have a direct impact on the distribution of industrial activity (ibid.). In this sense, local governments seem to have little influence on technological change.

However, there is a counterargument. As Castells and Hall suggest, in a globally integrated world, "national governments suffer from failing powers to act upon the functional processes that shape their economies and societies. But regions and cities are more flexible in adapting to the changing conditions of markets, technology, and culture" (1994: 7). The importance of locally based innovation on building technological capability and economic development has been widely acknowledged (Hewitt & Wield, 1992; Malecki, 1991; Castells & Hall, 1994; Wilson, 1995). Furthermore, regions and cities, like nations, occupy different developmental levels and thus require different types of policies (Castells & Hall, 1994). Obviously large metropolitan areas are the first recipients of technological progress (Malecki, 1991). This however, does not preclude smaller cities' possibility of innovation-oriented development strategy. The review of the empirical evidence on the nature of the relationship between high-tech development and urban development done by Shachar and Felsenstein (1992), shows that urban size and level of urbanisation are not clear determinants of innovative activity. Therefore, local government can, and should play a pivotal role in technological innovation, and cumulative efforts of each city and region, together, would eventually contribute to national technological capacity building. Various polices made at national level, may either foster or hinder this process, whilst the latter tend to be the case in most developing countries. Thus, a locally-based technopole strategy would contribute to national technological capacity building, hence industrial and economic development, provided that the central state policy does not obstruct the activity of local governments.

2.4 Technopole and National Urban Policy

National urban policy, or national spatial strategy, have been adopted in many developing countries, and their ability to alter national settlement pattern is still controversial (Gilbert, 1992; Richardson, 1988; Watts, 1992). One of the objectives of technopole policy, regional development, corresponds to this long debated strategy, as it tries to impact spatial pattern of the growth of innovative and often, high-technology industries. Can technopole policy be a viable alternative to national urban policy in developing countries? In what follows, key issues of national urban policy and their relevance to the technopole concept is briefly discussed, in order to identify potential contribution of technopoles for shaping national settlement pattern, and some problems associated with it.

Although national spatial strategy in developing countries has long been the subject of major debate and there is a wealth of literature on this topic, some of the objective accounts of the debate can be found in Gilbert (1992), Richardson (1988), and Watts (1992). According to this literature, national spatial strategies adopted in developing countries have been constantly failing to meet their goals, or if there is some trends that correspond to the objectives of national spatial strategies, the direct impacts of such strategies are difficult to measure.

In general, national spatial strategies are aimed at promoting efficiency, reducing interregional and interpersonal income inequalities, and improving the quality of life, through achieving such mechanisms as: slowing down primacy, opening

up new frontier regions and improving the economic prospects of lagging regions, promoting small towns and intermediate cities (STICs), and reducing rural-urban migration rates through a mix of rural development strategies (Richardson, 1988). However, a fundamental conclusion drawn from many country experiences is that the population distribution patterns are the result of three sets of forces: the implicit spatial impacts of macroeconomic and sectoral economic (and social) policies, and explicit spatial policies, among which explicit policies have the least impact (ibid.).

The need to distinguish 'place prosperity' and 'people prosperity' has also been widely asserted (Gore, 1984; Gilbert, 1992), and spatial distribution of economic activity through explicit spatial strategies, without co-ordination with other macroeconomic and sectoral economic and social policies has often led to further concentration of income within certain privileged groups in society (Gore, 1984; Gilbert, 1992; Watts, 1992). In other words, reduction in inter-regional disparity does not guarantee reductions in inter-personal disparity and can even make it worse. In developing countries, where the policies for GDP growth tend to be so dominant over other policies aimed at more equitable distribution of wealth, regional development and spatial dispersal policies are bound to be ineffective (Gore, 1984). Rather, explicit spatial policies are often used as politicians' tool to legitimate their stance for development strategy, which is often GDP growth-oriented and give little consideration for inter-personal equity (ibid.).

Having recognised the limitations of explicit spatial strategies, most studies quoted above (except Gore) conclude that state intervention on spatial pattern of development is still justifiable on the following grounds: First, the market mechanism cannot distribute wealth more equitably in a society as a whole. Local strategy alone cannot overcome market forces (Watts, 1992). Second, there are negative externalities associated with urban development. Third, there is a need to help those negatively affected by market mechanism (Devas & Rakodi, 1993). To be successful in intervention in national urban development pattern however, requires co-ordinated action of implicit and explicit strategies (Richardson, 1988) or even reconsideration of currently prevailing development paradigm (Gilbert, 1992).

Thus, co-ordination of different types of policies becomes the critical juncture between developing countries and the technopole concept, since technopole strategy entails implicit and explicit spatial policies, including industrial policy, spatial strategy and local development planning. However, the choice among different types of technopoles is critical, since not all the technopoles are intended to achieve the co-ordination of these policies. For developing countries in transitional phase into industrialised countries, Castells and Hall (1994) suggest to build a few number of technological parks in provincial capitals (see Table 2.3.), in which priority seems to be given to building technological competitiveness through research university, without consideration for co-ordinated actions. However, as mentioned earlier, Japan's Technopolis-type technopole strategy is worth examining as it is intended to achieve this kind of co-ordination between different policies.

As mentioned above, spatial policies have several objectives. Among those objectives, Japan's Technopolis Programme, in its original vision (see Chapter 3.) has much in common with the strategy to promote small town and intermediate cities (STICs) which Richardson (1988) suggests as an useful way to promote regional development, rather than to control primacy. Both stress indigenous development, rather than mere attraction of large industry from outside, and give more attention to social infrastructure (e.g. local organisation for diffusing innovation, in the case of technopole), rather than exclusive attention to physical infrastructure. Richardson (1988: 213-214) provides a long list of policy requirements for successful implementation of STIC strategies, which he admits no country has adopted all of them, but Japan's Technopolis Programme is certainly one of those which has tried to encompass many of these requirements, but has been argued by many researchers to have failed (Fujita, 1988; Itou, 1994; Nakamura, 1993; Oda, 1992; Onuma, 1992; Tanaka, 1996; Yamasaki, 1992, Yamazaki, 1991). Identifying sources of failure would provide useful policy implications for the countries contemplating to launch co-ordinated innovation-led urban development strategy.

Finally, spatial impact of innovation should be considered. When the spatial impact of innovation (e.g. the formation of innovative industrial complexes) is taken into account, the issue becomes extremely complex since the pattern of the development of industrial complexes cannot be equated with the spatial pattern of economic development in general, and thus innovation-led urban development may requires particular type of urban development strategy both at national and local level.

While implicit policies have greater *impact* on spatial pattern of development, these policies themselves *cannot direct* the spatial pattern of industrial development, and where technological innovation occurs. The literature on flexible specialisation and industrial districts suggests that national level macro-economic and sectoral policies, have little influence on the location pattern of innovative industrial districts, which instead, owes much more to the locally specific social and

business culture (Schmitz & Musyck, 1994; Storper & Walker, 1989). Nevertheless some implicit policies such as central government's interventions for technological change (see Section 2.3) *delimit the scope of local actions* for innovation (Harrington & Warf, 1995). Here, the difficulty is conspicuous: implicit spatial policy cannot direct where innovation-induced development occurs and explicit spatial policy has little impacts, either. Therefore, the central government's task would be to minimise the negative impacts of these policies on local governments' ability to control their own cities, rather than to affect the spatial pattern of development. At the same time, local governments should try to create the milieu of innovation and to diffuse the positive impacts of the innovation to the local community. This leads to the point discussed in the next section.

2.5 Technopole and Local Development Planning

As demonstrated in the above sections, the importance of locality in national technological capacity building, economic development and national spatial strategy is unquestionably clear. Thus, these higher level strategy should be co-ordinated so as to assist the local governments' development effort. Local government on the other hand, could promote indigenous technological innovation to stimulate the local economy. Thus, technopole building is one obvious choice for local economic development. It must be noted however, physical characteristics of technopoles should not be overemphasised here, rather, technopoles' organisational characteristics for innovation diffusion is the key issue for local development. Locally-based technological innovation would contribute not only to local economic development, but also national technological competitiveness, as shown earlier. Schmitz and Musyck (1994) highlight the catalyst role played by municipal and regional institutions in helping to establish networks among small scale enterprises, which led to the formation of innovative industrial districts. Thus, "embracing locality in local economic development" (Wilson, 1995) becomes critical issue. After all, "development is subject to favourable external factors but is not the necessary outcome of external factors" (Garofoli, quoted in Wilson, 1995: 650).

As Castells and Hall (1994) argue, such co-ordinated efforts hardly happen spontaneously. Since the development of local area through innovation requires various specialised skills and knowledge, to draw a maximum synergy from indigenous potential, co-ordination of various forms of expertise is essential. This is where the role of local government becomes crucial. The co-ordination of interests of different groups seems to be done only through the public sector or other kind of non-profit organisation. Castells and Hall's (ibid.) case studies on technopoles around the world suggest that some form of locally based organisations, either public or private, have played a vital role for locally-based innovation. As suggested earlier, there is no archetypal model for such innovative organisation, it depends on the specific conditions of each locality.

2.6 Key Issues

The relevance of the technopole concept to developing countries is now identified. For developing countries pursuing economic development and industrialisation through technological capacity building, technopoles would be one of the alternatives development planners should consider.

What is clear from the discussion above is that a technopole strategy should be formulated at a subnational level, since innovation potential varies from region to region and from city to city. As discussed in Section 2.4., national spatial policies cannot direct where innovation should occur and thus faster the emergence of innovative milieu. In this sense, technopole strategy is largely a matter of local urban development planning and thus the task of regional or local government. Although Castells and Hall (1994) suggest cities and regions are a key economic actor, their policy implications summarised in Table 2.2. do not make this point clear, suggesting the location of technological park and research university, which is likely to be at the hands of central governments in many countries. However, as argued in Section 2.3. above, R&D and thus the location of research university itself has little positive impacts on innovation. Therefore, it is a less relevant issue for the technopole strategy aimed at indigenous innovation.

Viewed in this light, in theory, regional development element - the manipulation of spatial pattern of industrial development - should be omitted from the technopole concept. Technopole strategy could not be a viable alternatives for national urban policy for developing countries. Nevertheless, as suggested in Section 2.3., central government's policy may affect the efforts towards innovation at regional or local level.

However, this is a theoretical conclusion drawn from the literature on technological innovation, national spatial strategy, industrial districts, and local development quoted in the above sections. There has been so far no empirical study of the technopole strategy aimed to achieve three objectives - industrialisation, regional development, and the creation of synergy at local level - simultaneously in relation to the debate on national urban policy. If such a co-ordination of policies and different layers of governments is possible, it would be a viable alternative for national urban policy. This idea however, is not new. As Watts (1992)

shows, governments in many developing countries have been seeking more coherent development strategies, encompassing economic development, regional development, and local development.

However, Japan is the only country which has attempted to simultaneously achieve the three possible objectives of the technopole at a nation-wide scale (Castells and Hall, 1994). Japan's Technopolis programme has attempted to decentralise high-tech R&D across the country and to utilise relocated R&D facilities for indigenous innovation-led development. Thus, it is already obvious that it contradicts the arguments made in the above sections: high-tech R&D itself has little impact on indigenous innovation; explicit spatial policy cannot direct the location of industries. However, it is distinctive in the sense that it is also aimed to link the R&D with indigenous innovation under regional initiatives through locally-based quasi-public organisation called "technopolis organisation" (Itou, 1994). In other words, this is an attempt to convert 'place prosperity' into 'people prosperity', through the co-operation between central and regional governments, and through the combination of various sectoral policies. Therefore, the Technopolis programme is worth examining in order to test the validity of the hypothesis developed above. Can the central government do nothing to assist the technopole building at local level? Can technopole strategy be used as an STIC development strategy? How different sectoral policies and different levels of government ought to be interrelated to be successful in achieving such multi-objective programme? These are key issues which must be addressed throughout the case study.

3. THE CASE OF JAPAN'S TECHNOPOLIS PROGRAMME

3.1 Historical Background

The Technopolis programme is a national plan, led by Japan's Ministry of International Trade and Industry (MITI), to create a series of science cities in peripheral areas across the country. It has three main objectives: (1) promotion of industrial development by raising the technological level of local businesses and establishing new high-technology industry, (2) sustained regional development through encouraging research and development (R&D) at local level, and (3) the creation of attractive living communities in which people can live and work (MITI, 1983; Itou, 1994; Yamasaki, 1992).
Behind these objectives lie Japan's efforts towards industrial restructuring and the reduction of regional disparities in population and economic activities. Although numerous studies have been carried out on Technopolis, examining both specific Technopolis sites and Technopolis policy as a whole, opinions vary as to which of these issues more strongly affected the formation of the Technopolis concept. Below, historical background of Technopolis programme is briefly presented from both aspects: Japan's industrial development, and regional economic development.

First, in order to understand the Technopolis programme from the perspective of industrial development, it is necessary to describe Japan's industrial and economic development policy since 1970's. This is well described in Fujita (1988), who suggests that Japanese government's pursuit of high-technology industry development is a result of the 1973 oil crisis which threw significant doubt on the future of heavy industry as the country's economic base. Industries such as steel and petrochemicals, which had led Japan's rapid economic growth prior to the oil crisis, began to lose their significance in Japan's industrial strategy. High-tech industries such as computers, artificial intelligence and biotechnology gained a status as key industries in Japan's industrial development policy. It should also be noted here that high-tech industries need various type of infrastructure such as airport, expressways, information networks etc., but unlike heavy industries, they do not need large-scale plants and other kinds of investments. High-tech products also have a high price per unit. These high value-added and foot-loose high-tech industries also matched the need to ameliorate regional imbalances, which formed the second and the third objective of the programme. Fujita (ibid.) also suggests that the Technopolis programme was associated with MITI's strategy to circumvent trade friction with the United states and EEC and the threat of protectionism by producing high-tech products for export since these products were considered highly technical and specialised and thus would ensure little competition from other nations.

The second issue, as already suggested above, was the high degree of spatial concentration of private sector research and development (R&D), as well as population and economic activities in Japan, especially around Tokyo (Yamazaki, 1991). As summarised by Castells and Hall (1994), by the early 1980s, Tokyo had one-quarter of Japanese population; Japan's three major metropolitan areas, Tokyo, Nagoya and Osaka had close to half. Furthermore, private R&D capacity was even more concentrated: almost 80 per cent of corporate laboratories, 70 per cent of all scientists and 60 per cent of all university professors were in Greater Tokyo and Osaka areas. Greater Tokyo alone had about half of total manufacturing by shipment, and more than 50 per cent of private R&D facilities, which accounted for 65 per cent of all computer installation and 61 per cent of information-processing employment in 1984. Thus, there was a strong interest in the spatial dispersal

of industry away from the major metropolitan areas, to peripheral areas.

In response to these issues, MITI first announced the concept of Technopolis in 'MITI's vision for the 1980s' in 1980 (Fujita, 1988), and then, the Law for Accelerating Regional Development based on high-Technology Industrial Complexes (Technopolis Law) was enacted in 1983. The Technopolis programme was seen as a way of providing attractive working and residential environments for R&D and high-technology industry, and for decentralising industrial development to provincial and remoter parts of Japan through the construction of new technological infrastructure.

3.2 Japan's Planning System and the Technopolis Programme

The above section has outlined the historical context in which the Technopolis programme has emerged. This section attempts to set the Technopolis programme into the context of Japan's development planning history since the end of World War II.

Japan has a two-tier system of local government: 47 prefectures and about 3,000 municipalities. The 47 prefectures are usually aggregated into ten regions for regional development planning purposes (see Figure 3.1). Regional development planning is closely related to national economic planning, and is strongly directed by central government ministries especially with regard to land use and public investment plans (Kosaka, 1992; Minatsu, 1990; Sakata, 1991). Development plans are prepared for all regions by the National Land Agency in conjunction with prefectural governments, except for Hokkaido and Okinawa which have their own development agencies preparing their own plans. Prefectural and most municipal authorities also publish comprehensive development plans (Abe & Alden, 1988).

In theory, central government provides the legislative framework, defining the directions of policy and making provisions for the award of incentives. The prefectures have the task of implementing the policy in accordance with regional conditions. However, in reality the division of the role played by different levels of government is more complicated than expected from the principle stated above. On the one hand, central government is often involved in the implementation of policies. On the other hand, the prefectures have substantial resources and are able to design economic development policies of their own. In addition, the initiative for regional development has been gradually shifting to regional public bodies (Fujita, 1988).

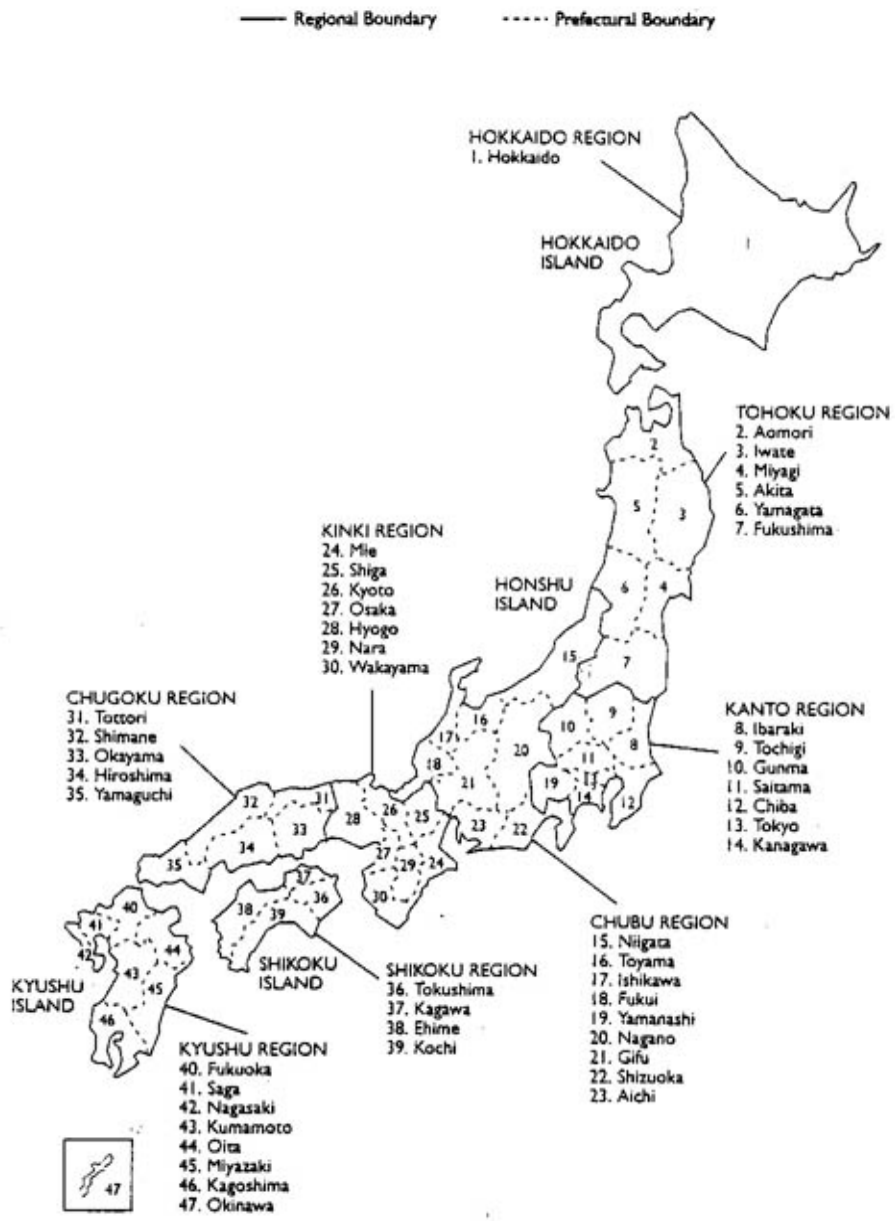
The distinction between top-down and bottom-up planning process is obscured further by the process of law-making. This involves considerable prior discussion between numerous political, economic and social interest groups at different levels with the aim of obtaining widespread consensus for laws before they are enacted. This process can lead to major modifications of policy concepts (ibid.).

The Technopolis programme can be seen as part of Japan's national development planning. Since the end of World War II, the Japanese government has announced a number of national development plans (Broadbent, 1989; Glasmeier, 1988; Sakata, 1991) (see also Appendix 1). National development plans provide the major means of state intervention. In the formulation of these national development plans, as Johnson (1982) suggests, MITI has been quite influential, albeit some researchers are rather sceptical as to MITI's political power in regional development planning (Fujita, 1988, for example.).

The Japanese government produces two types of national development plans: economic and social. Economic plans are concerned with industrial restructuring, and social plans are concerned with the amelioration of socially negative impacts of the economic plan, mainly the concentration of industry in metropolitan areas and environmental pollution (Broadbent, 1989). National plans are indicative, rather than commanding.

Economic plans are prepared by the Economic Planning Agency. But also implicit economic planning is practised as a 'vision-making' exercise. 'Vision-making' is the Japanese version of implicit economic planning. It is intended to build a consensus within the nation's industrial structure among all sectors of the society, to ensure continuity and stability of industrial policy, and to provide information useful to firms in their efforts to plan long-term corporate strategy (Fujita, 1988). MITI is particularly influential in the process of 'vision-making' (Johnson, 1983; Broadbent, 1989; Minatsu, 1991; Okimoto, 1991; Yamasaki, 1992). The Technopolis programme was also the 'vision' of MITI. It was first announced in 'MITI's vision for the 1980s', produced by the Industrial Structure Council, an advisory organ of MITI (MITI, 1980).

Figure 3.1: Prefectures and regions in Japan



Source: OECD (1996: 10)

Social planning on the other hand, is carried out as 'National Comprehensive Development Plan' (NCDP), for which National Land Agency is responsible. It mainly deals with spatial, as well as social aspect of development such as the relocation of industry away from major metropolitan areas, through various measures such as growth pole strategy, creation of development corridor through physical infrastructure network across the country, etc. In this way, NCDP is exercised as regional development planning, which is aimed at the reduction of regional imbalances in development pattern (Sakata, 1991). National Land Agency has a mediating role between the Ministries which have their own perspective in national development, such as MITI, Ministry of Construction, Ministry of Transport, Ministry of Agriculture, Forestry and Fisheries, and Ministry of Post and Telecommunications, etc. (ibid.).

The origin of NCDP dates back to the 1950 National Comprehensive Development Law (NCDL) (see Appendix 1). NCDL proposed that all national socio-economic and industrial policies be co-ordinated to help integrate 'backward regions' into the national economy (Glasmeier, 1988). Following NCDL there have been a series of NCDPs: 1962 First NCDP, 1960 New NCDP, 1977 Third NCDP, and 1987 Fourth NCDP. The first plan encouraged growth pole formation around coastal areas; the second plan tried to promote regional development through developing new transport and communication network; the third plan introduced the concept of permanent residence area in order to restrict migration from local cities to major metropolitan areas; and the fourth NCDP placed an emphasis on high-technology industry as a key to the development of peripheral regions and encouraged the relocation of high-tech industries to peripheral areas through tax incentives and provision of physical infrastructure network. It also emphasised the need of local initiatives to achieve its goals (Sakata, 1991). Thus it is obvious that the main concept of the forth NCDP was adjunct to the Technopolis Law that was enacted in 1983.

3.3 Basic Concepts: The integration of spatial strategy, industrial policy and local urban development policy

The term 'Technopolis' is derived from the fusion of 'technology' and 'polis' and it means a high-tech-oriented science city (Fujita, 1988). The basic concept of the Technopolis is defined in MITI's 'Vision for the 1980s' as "a city in which high-technology industry, academic sector and residential sector are organically integrated. It attempts to create new community culture as well as to attain regional development, supported by industrial and academic sectors. This is different in its concept from earlier practice of regional development whose main focus had been on the provision of land and infrastructure" (MITI, 1980: 117). Similarly, the report by the Technopolis Construction Committee of Japan Industrial Location Centre (JILC), which formed the basis of the 1983 Technopolis Law, defines Technopolis Programme as "a strategy to simultaneously accomplish upgrading of national industrial structure up to the level of knowledge-intensive society (upgrading of national innovation capacity), and regional development (creation of permanent residential areas), through urban community development based on organic integration of high-technology industry, academic institutions, and residential amenity" (JILC, 1982: 1). The legal basis of the Technopolis concept is the 1983 Technopolis Law. The basic concept of the Technopolis is envisaged in more practical terms in Sections Two, Three and Four of the Technopolis Law: Definition of Technopolis Development, Development Guideline, and Development Planning, respectively (MITI, 1983), from which the type of development to be pursued in Technopolis areas can be summarised as following:

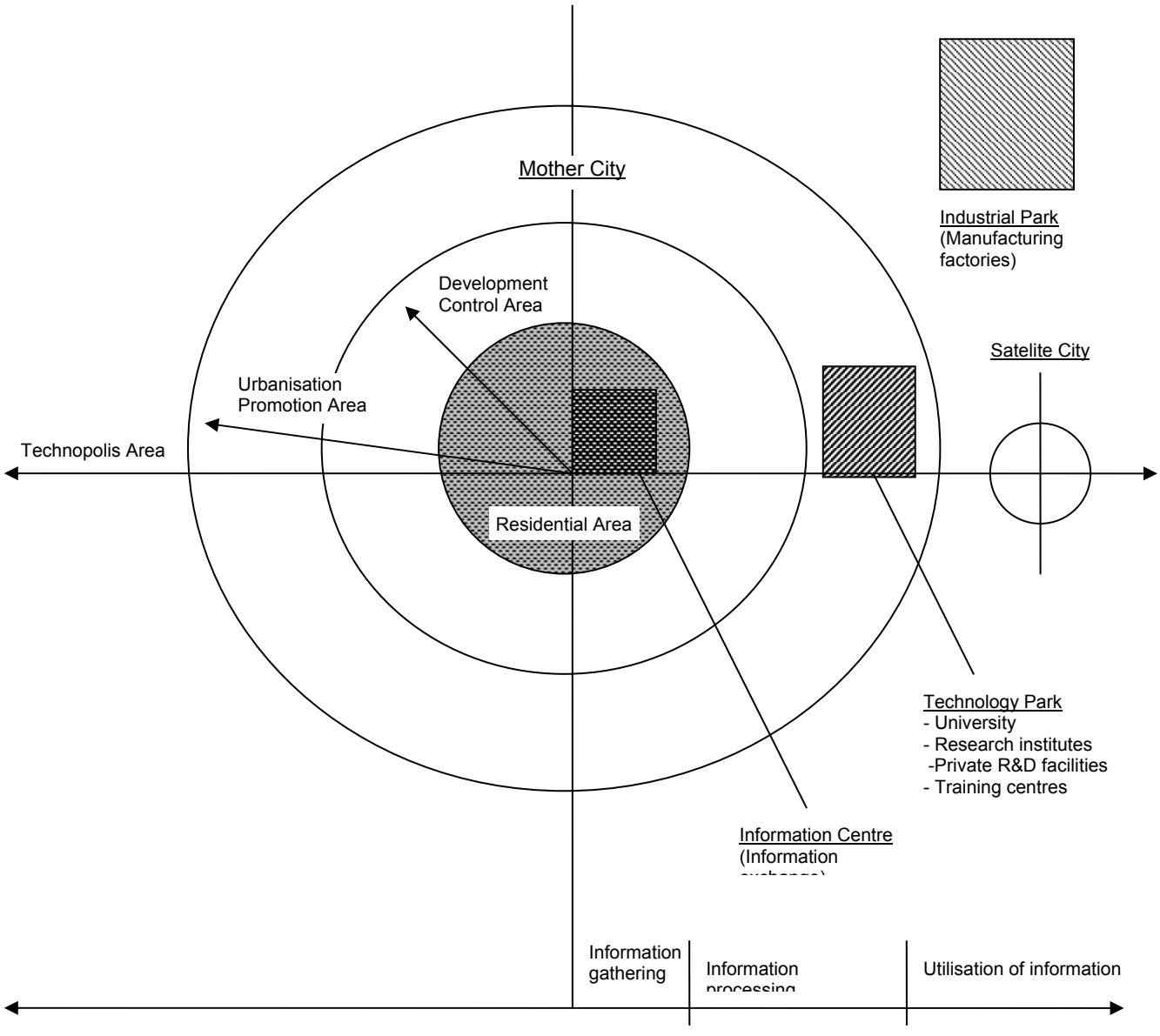
- The integration of industry, academic sector and habitation in areas where industry was not already heavily concentrated; metropolitan areas, especially the three major cities (Tokyo, Osaka, and Nagoya), were not eligible for technopolis status.
- A close relationship to a local "mother city" with a population of at least 150,000, providing certain urban facilities.
- The formation of industrial complexes by attracting new high-technology industries and the development of existing local enterprises, (i.e. They should be areas with a considerable number of enterprises which are either engaged in high-technology activities or have the potential for doing so.
- The creation of new R&D and the transfer of new technologies to existing industries, on the basis of easy access to a university or other institute of advanced technology where course and research facilities of a high-technology nature would be available.
- The exploitation of region-specific development potential. (MITI, 1983)

As can be seen above, it is clear that the Technopolis programme is intended to achieve three major objectives: (1) promotion of industrial development by raising the technological level of local businesses and establishing new high-technology industry, (2) sustained regional development through encouraging research and development (R&D) at local level, and (3) the

creation of attractive living communities in which people can live and work (MITI, 1983; Itou, 1994; Yamasaki, 1992). Thus the Technopolis policy has three dimensions as a development policy: (1) industrial and science & technology policy, (2) spatial dispersal strategy (3) local urban development policy.

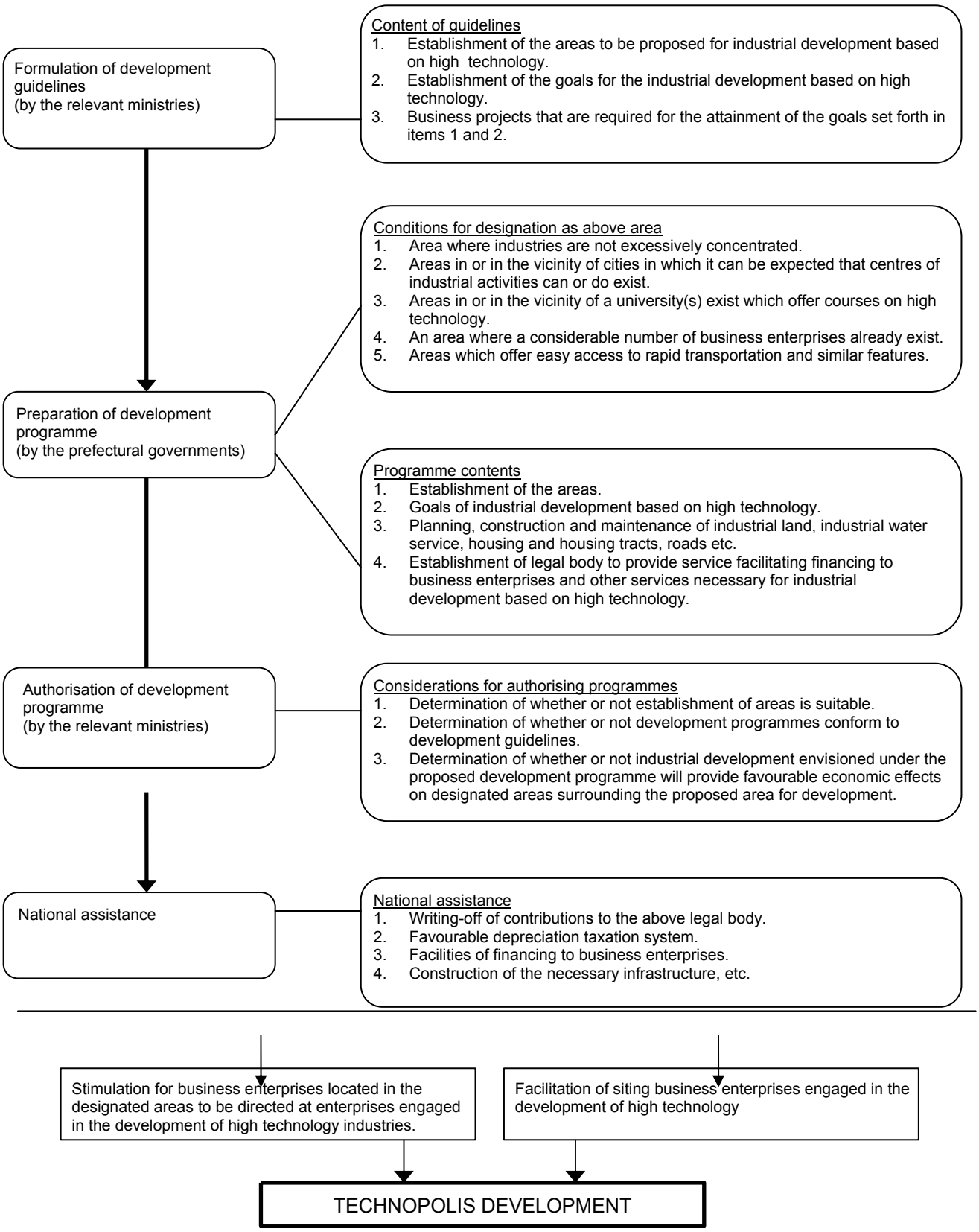
In view of the settlement pattern envisaged in the Technopolis programme (see Figure 3.2.), each Technopolis is to be created within an existing regional centre whose core population is more than 200,000 (the mother city). It integrates high-tech industries, academic and scientific research organisations and the living complex within an organically co-ordinated environment. The mother city must be located within a one-day return trip from one of the three metropolises (Tokyo, Nagoya, and Osaka). Industrial complexes are formed by introducing new high-tech industries to the city and by encouraging 'self-development' of existing local industries (Fujita, 1988). Two types of R&D are emphasised in the technopolis: one is the 'frontier type' which aims to produce innovations competitive in the world market, and the other is the transfer type whose main role is to transfer new technology to local industries. The technopolis is a national project but it aims to achieve regional development through local initiative by making use of existing land, education and research facilities, and cultural and other assets of a region's heritage (MITI, 1983).

Figure 3.2: Schematic settlement pattern of the Technopolis



Source: Adapted from Fujita (1982: 58)

Figure 3.3: Summary of Japan's Technopolis Law



Source: MITI (1983)

3.4 Evolution of the Implementation of the Technopolis Programme

The implementation process stated in the Technopolis Law is summarised in Figure 3.3 above. Responsible central government ministries and agency shown in Figure 3.3 are MITI, the Ministry of Construction, Ministry of Agriculture, Forestry and Fisheries, and National Land Agency. As can be seen in Figure 3.3, although the central government gives general guidance over the Technopolis programme, regional governments are required to develop their own implementation plan specifying geographical boundaries, development goals, long-term planning of construction and maintenance of infrastructure and the legal status of the organisation responsible for the execution of the plan. According to the proposal made by the Technopolis committee, a private organ of MITI and responsible for the development and implementation of the Technopolis programme, at the local level, Technopolis is supposed to be developed by a non-governmental organisation supported by private, public and academic sectors (Fujita, 1988). However, before actions can be taken at local level, the plan must be approved by MITI. In this process, MITI issued guidelines and an invitation to prefectures or municipalities to submit proposals for co-ordinated and integrated high-technology-based programmes according to specified criteria. The process was intended to be competitive, with central government selecting the best bids.

According to the Technopolis Law, to qualify for technopolis designation, a region must meet the following criteria:

1. certain degree of high-tech industries' cluster or potential growth possibilities;
2. the capability of conducting R&D through the co-operation of industry, university and government;
3. a national university that engages in education and research relevant to high-tech development;
4. sites and water for industrial use; and
5. land for residential development; and expressway and airport connections.

(MITI, 1983)

These criteria precludes the most backward areas and regions around three major metropolitan areas (Tokyo, Nagoya, and Osaka), which means in turn, basically almost all the prefectural capital cities in Japan meet these criteria (Yamasaki, 1993; Itou, 1994).

Originally, MITI envisaged only a few experimental projects. Early plans proposed the construction of several New Model Towns throughout Japan, each with a population of about 50,000 on an area of approximately 2,000 hectares. However, interest in the idea led to submissions of the plan from 40 prefectures. Thus the law was soon modified to enable the development of existing facilities and potentials, rather than creating new towns. Nine regions were approved initially as technopolises; the number was increased to 14 during 1984; and further regions were designated during the late 1980s to produce a total of 26 technopolis regions (Itou, 1994; Yamasaki, 1992) (see Figure 3.4.). Technopolises are usually classified into two groups according to the year in which they are designated as Technopolis areas: the First group refers to those designated as a Technopolis before 1986, and the Second group after 1986 (Itou, 1994; Tanaka, 1996; Yamasaki, 1992). 20 technopolises of the first group have undergone the first (period up to 1990) and second phases (period up to 1996) and now in the third phase of their plan (ibid.).

As for specific actions for the implementation at regional level, host prefectures are required to set the boundaries of the area, target of the plan, and provide both hard and soft infrastructure (see Table 3.1). Central government's assistance are a range of investment incentives made available to enterprises in the form of tax allowances (special depreciation on buildings and machinery, exemption or reduction of local taxes) and subsidies, primarily through low-interest or interest-free loans. Central government is also partly responsible for the provision of infrastructure at national scale such as national road, communication and railway network.

Figure 3.4: Technopolis Development Plan regions

Source: OECD (1996:21)

Table 3.1: Key features of selected Technopolis projects

Area	Main city	Number of cities/ town villages in technopolis (not including main city)	Population (technopolis area: main city)	Features of industrial complex	Features of R & D concept
Hakodate	Hakodate	3 towns	380,517	Marine industries, resources utilization industries, frigid area community development	Integrated regional marine research centre, resource utilization research
Aomori	Aomori	4 cities 2 towns 2 villages	604,325 287,597	Mechatronics-biotechnology industries	Local industry research, modern technology research laboratory, institutes of industry and technology, etc
Akita	Akita	2 towns	304,823 284,863	New materials, resource energy development, electronics, mechatronics related industries, biotechnology related industries, etc	Metal frontier centre, local technology centre, medical centre for the elderly, etc.
Utsunomiya	Utsunomiya	1 city	469,944	Mechatronics, electronics, fine chemicals, new materials, etc.	Mechatronics laboratory, regional industrial institutes of physics/technology, etc
Shinanogawa	Nagaoka	7 ciies 6 towns 1 village	638,509 183,756	High-dimension systems, new materials processing, urban business, fine industry, fashion	Development Education Research Promotion Centre of Nagaoka Technical University (established), Technopolis Development Centre, Kashiwazaki Softpark
Toyama	Toyama Takaoka	3 towns	568,291 480,110	Biotechnology, mechatronics, new materials, etc	Toyama Technical Development Corporation Bioscience Research Centre, Modern Technology Interchange Centre
Hamamatsu	Hamamatsu	2 cities 2 towns	619,621 490,824	Photo-industry, musical instruments, sophisticated mechatronics, information communication system, etc.	Photo-information Technology Integrated Research Centre, Electronics Centre, life behaviour research organs etc.
Kurume Tosu	Kurume	1 city 5 towns	332,487 216,974	High-system industry (information-associated industry, community development, mechatronics) new materials, biotechnology, etc	R & D park, integrated information centre, etc
Kumamoto	Kumamoto	1 city 12 towns 2 villages	738,558 525,662	Applied machine industry, biotechnology, computers, information systems, etc	Research park (Bio wood), electronics applications, machine technology research labs, etc
Kan-Omurawan	Sasebo	2 cities 1 town	440,778 251,188	Ocean development associated instruments, resources and energy development based on mechatronics, etc	Research Park (Bio wood), labs for research in electronics applications for machine technology and for semi-conductor applications
Kenhoku Kunisaki	Oita Beppu	4 cities 13 towns 2 villages	281,513 496,963	IC, LSI, new materials, soft engineering, techno-green industry, regional resources utilization, etc	Regional economy information centre, industry-university-government co-operation system, etc
Miyazaki	Miyazaki	6 towns	356,876 264,855	Electronics, mechatronics, new materials, biotechnology (fine chemical, biomass, etc)	Co-operative Research Development Centre, IC laboratory, etc
Kokubu-Hayato	Kagoshima	1 city 12 towns	691,909 505,077	Advanced equipment (electronics, mechatronics), new materials (fine ceramics), regional industry (modern fishing and agroindustry biotechnology, etc)	Technology promotion organization material resources research centre, regional industry promotion associations, etc.

Although local initiatives for Technopolis development is highly region-specific, common types of infrastructure investment can be identified as follow: (Sakata, 1991, Tanaka, 1996, Yamazaki, 1991):

- Basic infrastructure: industrial estates, roads and expressways, telecommunications, high-speed transportation, airports.
- Housing and residential services.
- Enhancement of R&D functions such as the creation of software parks, establishment of new research institutes and technology centres, new establishment and enhancement of universities, and expansion of public sector laboratory facilities.
- Provision of facilities to promote high-tech advancement of local enterprises such as on-line technological information systems, training facilities for information technology, electronics etc.; education and training services.

For the provision of this infrastructure, host prefectures of Technopolis established Technology Promotion Organisations as the core organs of technopolis construction, consisting of representatives from industry, universities and local governments. Formed as non-profit organisations with tax exemption from the Ministry of Finance, they are funded by the business community and local governments including the prefecture, cities and towns in each technopolis area. The range of funding has varied with the degree of concentration of high-tech industries and local governments' fiscal situations. These organisations promote technological advancement of local industries; co-ordinate joint R&D with industry, university and government; promote joint venture business; provide labour training for small and medium businesses; and conduct social research on the effects of the technopolis on the local community (Fujita, 1988; Tanaka, 1996; Yamasaki, 1992).

To assist the technological development of local industries, between 1982 and 1986 host prefectures of the first group established through their technology development organisations funds for new R&D centres or expanded existing research facilities and universities. Their R&D centres focus on joint research and the development of new technologies and products with a team of university, local industry and government research institutes. Joint research and the development of frontier-type technology is subsidised by the Small and Medium Business Agency of MITI; and several technopolises are already engaged in frontier-type R&D funded by the agency.
Host prefectures are also developing their own information network systems, supported by MITI's project to create 'Techno-Mart' (technology exchange market). Techno-Mart is an information network based on an on-line system connecting technology transfer and technology exchange. Techno-Mart is planned to connect the world in the near future; for now, it connects the big metropolitan areas with the technopolis areas (MITI, 1983).

Thus, most technopolises are developed under regional initiatives. Some special supports related to technopolis construction, however, come from central government agencies such as MITI, the Ministry of Agriculture, Forestry and Fishery, Construction, and the Land Agency.

MITI subsidises frontier-type R&D through the Small and Medium Business Agency, and it provides local industry with funds for technological advance through the National Academy of Industry and Technology. MITI provides industrial relocation promotion incentives for industries that go to the technopolis areas. MITI also gives advice and guidance to the technopolis areas by sending experts and specialists from business, university and public sectors (Fujita, 1988).

The Ministry of Construction provides the hard infrastructure necessary to the technopolis. Roads and expressways connecting the technopolis with the mother city, R&D facilities, universities, industrial parks and airports are being constructed everywhere in the technopolis areas. The Ministry is also involved in housing and land adjustment of housing sites in Kurume-Tosu, Hiroshima, Toyama and Miyazaki areas. Urban development projects like Akita New Town, Nagaoka New Town, Kibi-Kogen City, Kamo Science City in Hiroshima, and Miyazaki Science City are partly supported by the Regional Development Corporation in the Ministry. The Ministry also helps to construct living environments protected from pollution and urban facilities such as Nagaoka New Town Park, People's Park in Toyama, Hamamatsu Central Park, and the Wood of Biotechnology in Kumamoto (ibid.).

The Ministry of Agriculture focuses on R&D for the biotechnology industry in the field of agriculture, fishery and forestry (ibid.).

Finally, some of the changes in the legal basis of the programme, which have taken place since 1983, must be noted (see Appendix). Firstly, as already mentioned, there was a support from the Fourth Comprehensive Development Plan 1987 that introduced the concept of "techno-network plan", to promote increased commercial and

technical linkages and joint ventures between high-technology enterprises coming to a region and native enterprises, colleges and governmental organisations through information exchange, technology transfer and marketing measures. This can be seen as a response to the lack of a critical mass of focused research or technological development in some regions and the lack of joint industry-university-government research (Itou, 1994). MITI's 'Techno-Mart' Plan mentioned above can also be seen as a support measure taken to foster this process (ibid.). Secondly, the need to promote more active shift to "soft" industrial activities such as laboratories and software houses, many of which were concentrated in Tokyo, led to the 1988 Brains-of-Industry Law. The Law recognised that the "brains" of industries, such as information processing and design, were crucial for the development of regional industries and more sophisticated local industrial structures around the country. Thirdly, in 1992, the Law for Comprehensive Development of Regional Core Cities with Relocation of Office-Work function (Regional Base Law) was enacted to promote further relocation of industries, focusing on administrative facilities of firms. Regional Base Law enables prefectural governors to designate 'base areas' within which municipalities are encouraged to work together to exploit the creative and innovative potential of regions (Itou, 1994; Tanaka, 1996). Above all these legal support the development guideline of the Technopolis Law itself which was modified in 1991. In this modification, emphasis was shifted from the relocation of high-technology industry, to upgrading of local indigenous firms and industry, more specialisation based on region-specific potential, and the creation of the mechanism to foster entrepreneurial spin-offs (ibid.).

4. AN ASSESSMENT OF THE TECHNOPOLIS PROGRAMME

4.1 Goal Achievement

As stated in Chapter 3, the Technopolis programme is intended to achieve three major objectives: (1) promotion of industrial development by raising the technological level of local businesses and establishing new high-technology industry, (2) sustained regional development through encouraging research and development (R&D) at local level, and (3) the creation of attractive living communities in which people can live and work (MITI, 1983; Itou, 1994; Yamasaki, 1992). As demonstrated in the previous chapter, at each technopolis, these objectives have been pursued largely through the attraction of corporate R&D and the creation of local linkages with these relocated R&D. This chapter attempts to demonstrate to what extent these measures have been successful, and then considers the effectiveness of these measures as a way to achieve the three objectives of the Technopolis programme.
This examination will lead to the issue of how the adoption of these measures by so many technopolises have been affected by the implementation process of the programme.

First, it is necessary to examine the general performance of Technopolises. The majority of empirical research on technopolis performance in Japan is based on official data for industrial shipments, industrial employment, population, and industrial value-added, which are provided at the end of this section (Tables 4.3.- 4.6.).

Several points become clear from these data. Firstly, the performance of the technopolises in new factory location over the 1983-93 period ranges from more than 700 new plants in the Shinanogawa technopolis in the centre of the country to under 100 in Hakodate on Hokkaido. many of the technopolises with least success in attracting new plants are located in the south-west of Japan. Secondly, although large numbers of new plants are being established in the technopolis areas, relatively few are high-tech. Thirdly, the proportion of new high-tech plants appears to account for at least some of the performance in terms of industrial value added and employment.

Having observed these trends in Technopolis development, it seems useful to compare the performance of the technopolis area as a whole, with national average, which is done by Yamasaki (1993) and summarised in Table 4.1 and 4.2. below (The term, 'industrial' in the tables refers to both high-tech and non-high-tech industries.).

Table 4.1: Growth rate of Technopolis area and national average (1980-89)

	Industrial shipments	Industrial employment	Population	Industrial value added
TP areas	50.1	4.2	5.6	33.5
N.Average	51.7	6.5	5.3	37.4

Source: Yamasaki (1992: 120)

Table 4.2: Growth rate of Technopolis area and national average (1980-85 & 1985-89)

	Industrial shipments		Industrial employment		Population		Industrial value added	
Year	80-85	85-89	80-85	85-89	80-85	85-89	80-85	85-89
TP areas	18.5	21.3	3.7	0.5	3.8	1.8	16.5	14.6
N.Average	24.9	21.4	5.6	0.7	3.3	2.3	19.1	15.3

Source: Yamasaki (1992: 123)

What is clear from these tables is the following: First, industrial shipments in the technopolis area had increased in the periods 1980-85 and 1985-89 much more than the national average. Second, industrial employment increased between 1980-85 and 1985-89 moderately faster than the national average. Third, between 1980-85 and 1985-89, the population growth rate in the technopolis areas decreased more than the national average. Finally, the industrial value-added in technopolis area increased moderately higher than the national average. Thus in the phase 1 (period up to 1990), the performance of technopolises had been quite modest vis-à-vis national average. It is often argued that the performance of technopolises should be evaluated in the long time span, but Table 4.2 indicates that there had been little improvement in performance during the phase 1 period. Furthermore, the comparison of population growth rates between technopolis area and national average appears to imply continuous out-migration from technopolis areas. In this sense, the third objective of 'the creation of attractive environment in which people live and work" seems not to have been achieved.

Together with the results shown above, many evaluation studies on the Technopolis programme seem to confirm the general conclusion suggested by Castells and Hall, as follows:

1. Failure to achieve original vision.
2. The 'branch-plant" syndrome (i.e. Failure to foster technology transfer between incoming factories and local industries.).
3. Failure to develop university-industry links.
4. Lack of "soft" infrastructure (e.g. R&D consortia, venture capital funds, university research, etc.)
5. The failure to move R&D.
6. Lack of inter-industry linkages.
7. Lack of spin-off.
8. Failure to attract key workers (i.e. skilled labour).
9. Fiscal burden on local governments.
10. The continuing challenge of offshoring (i.e. competition with less-expensive sites abroad).

(Castells & Hall, 1994: 139-141)

Having recognised these general conclusions indicating a failure of the programme, the following sections 4.2. and 4.3. examine more closely the extent to which spatial dispersal of R&D and the creation of local linkages have been attained, as this the major approach to achieve the objectives of the programme. Section 4.4. then attempts to examine the validity of these measures as a way to achieve the objectives of the Technopolis programme. Based on the analysis made, Section 4.5. attempts to examine various political factors which have affected the implementation and thus have led to the adoption of the methods examined. This is followed by the discussion of the implications for developing countries.

Table 4.3: Trends in new factory location in technopolises (1981-93)

Technopolis	81	82	83	84	85	86	87	88	89	90	91	92	93	Total	Average
Douou	0	0	0	0	17	17	13	35	52	36	25	26	18	239	18
Hakodate	5	1	1	4	4	4	4	14	12	12	17	13	8	99	8
Aomori	4	5	7	9	17	5	13	27	32	29	32	20	5	205	16
Kitagamigawa	19	15	18	28	12	9	8	18	26	46	15	5	6	225	17
Akita	1	1	4	6	4	8	8	10	23	16	7	8	4	100	8
Yamagata	31	16	23	31	23	12	26	22	53	34	27	13	8	319	25
Kita-Sendai	5	3	4	12	16	16	14	21	24	20	11	18	16	180	14
Koriyama	5	5	11	12	9	14	15	24	20	24	12	8	7	166	13
Shinanogawa	41	29	39	39	64	40	47	87	85	76	70	48	46	711	55
Utsunomiya	22	16	8	20	15	7	10	24	28	16	7	11	7	191	15
Kofu	15	9	10	10	10	14	9	15	16	10	7	10	18	153	12
Asama	15	22	17	32	23	34	23	18	39	14	19	30	15	301	23
Hamamatsu	8	4	4	5	0	31	11	21	14	42	14	7	4	165	13
Toyama	16	17	21	23	11	17	16	18	25	34	43	59	15	315	24
Nishiharima	17	7	10	11	18	8	9	32	23	22	39	16	9	221	17
Kibikogen	5	2	3	5	14	14	5	8	16	20	15	8	9	124	10
Hiroshima-chuou	6	8	8	14	13	5	9	20	24	7	1	16	4	135	10
Ube	9	12	5	5	13	9	4	15	18	18	9	9	8	134	10
Kagawa	17	9	11	11	19	22	17	42	27	18	30	17	11	251	19
Ehime	30	26	15	11	20	13	12	21	33	27	20	25	9	262	20
Kurume-Tosu	5	2	4	8	16	11	14	9	17	13	8	3	3	113	9
Kan-omurawan	21	12	14	11	13	8	10	6	11	14	10	4	5	139	11
Kenhokukunisaki	13	7	11	19	15	11	10	14	13	15	15	12	17	172	13
Kumamoto	6	14	20	13	6	9	12	8	15	16	26	18	8	171	13
Miyazaki	1	3	21	23	20	8	9	15	13	22	21	15	10	181	14
Kokubuhayato	7	9	11	10	6	8	10	27	19	25	17	8	9	166	13
Total	324	254	300	372	398	354	338	570	678	626	517	427	279	5 437	418

Table 4.4: Trends in new high-tech factory location in Technopolises (1981-93)

Technopolis	81	82	83	84	85	86	87	88	89	90	91	92	93	Total	Average
Douou	0	0	0	0	0	4	1	5	4	4	2	3	0	23	2
Hakodate	0	0	0	0	0	0	0	1	2	2	3	0	0	8	0
Aomori	0	3	0	3	5	1	0	3	2	3	3	2	0	25	2
Kitagamigawa	3	3	7	9	3	3	3	4	7	8	2	0	1	53	4
Akita	0	1	2	2	2	1	3	3	2	2	0	1	2	21	2
Yamagata	4	6	7	11	7	4	5	5	11	6	6	3	4	79	6
Kita-Sendai	0	1	0	5	5	3	1	3	5	0	0	1	3	27	2
Koriyama	1	2	6	3	5	2	4	7	5	4	0	1	1	41	3
Shinanogawa	0	0	0	0	12	5	1	6	6	3	2	4	1	40	3
Utsunomiya	3	7	7	8	6	2	4	5	1	1	1	1	1	47	4
Kofu	4	1	3	2	4	2	2	7	6	1	1	2	1	36	3
Asama	3	4	8	7	6	6	5	3	1	2	3	5	3	56	4
Hamamatsu	1	1	0	1	0	6	3	5	2	12	3	1	1	36	3
Toyama	5	5	2	6	5	3	2	4	8	4	4	4	0	52	4
Nishiharima	1	0	0	1	2	1	0	4	3	4	4	0	2	22	2
Kibikogen	1	0	0	0	1	0	0	2	0	1	1	1	1	8	0
Hiroshima-chuou	0	0	0	3	1	1	0	1	2	1	0	1	0	10	0
Ube	1	0	2	1	4	1	0	2	0	1	0	0	0	12	0
Kagawa	2	0	1	1	3	3	1	2	0	1	1	0	0	15	1
Ehime	4	1	1	2	5	1	1	1	0	0	0	3	1	20	2
Kurume-Tosu	1	0	0	0	2	2	1	1	0	1	1	0	0	9	0
Kan-omurawan	1	1	2	1	3	2	1	1	1	0	3	1	0	17	1
Kenhokukunisaki	3	2	0	4	4	1	3	2	2	2	2	0	0	25	2
Kumamoto	0	1	3	4	1	1	2	2	1	3	4	4	1	27	2
Miyazaki	0	2	1	7	3	0	3	1	1	2	1	0	1	22	2
Kokubuhayato	2	2	2	2	0	2	0	6	19	2	5	0	0	42	3
Total	40	43	54	83	87	57	46	86	73	70	51	38	24	752	58

Table 4.5: Trends in technopolis employment (1981-82)

Trends in technopolis employment, 1981-1992

Technopolis	1981	1986	1992	Change (No.)	1981-86 (%)	Change (No.)	1981-92 (%)
Douou	15 189	15 935	21 452	746	4.91	6 263	41.23
Hakodate	16 856	15 005	17 242	−1 851	−10.98	386	2.29
Aomori	23 021	23 354	28 242	333	1.45	5 221	22.68
Kitagamigawa	22 409	29 027	34 438	6 618	29.53	12 029	53.68
Akita	14 527	15 197	17 908	670	4.61	3 381	23.27
Yamagata	49 121	58 595	63 358	9 474	19.29	14 237	28.98
Kita-Sendai	33 242	37 725	38 047	4 483	13.49	4 805	14.45
Koriyama	39 193	47 389	45 948	8 196	20.91	6 755	17.24
Shinanogawa	111 229	113 064	119 118	1 835	1.65	7 889	7.09
Utsunomiya	48 192	98 711	58 300	50 519	104.83	10 108	20.97
Kofu	39 049	73 505	51 550	34 456	88.24	12 501	32.01
Asama	52 577	57 896	57 716	5 319	10.12	5 139	9.77
Hamamatsu	97 656	98 711	97 077	1 055	1.08	−579	−0.59
Toyama	73 043	73 505	72 079	462	0.63	−964	−1.32
Nishiharima	93 480	88 339	89 330	−5 141	−5.50	−4 150	−4.44
Kibikogen	50 587	54 825	55 380	4 238	8.38	4 793	9.47
Hiroshima-chuou	43 088	40 247	44 025	−2 841	−6.59	937	2.17
Ube	30 871	30 795	34 099	−76	−0.25	3 228	10.46
Kagawa	66 730	64 754	60 608	−1 976	−2.96	−6 122	−9.17
Ehime	65 088	62 905	66 234	−2 183	−3.35	1 146	1.76
Kurume-Tosu	29 709	29 190	30 957	−519	−1.75	1 248	4.20
Kan-omurawan	25 997	25 105	28 380	−892	−3.43	2 383	9.17
Kenhokukunisaki	15 189	21 020	26 382	5 831	38.39	11 193	73.69
Kumamoto	36 912	41 516	44 430	4 604	12.47	7 518	20.37
Miyazaki	13 253	15 673	18 655	2 420	18.26	5 402	40.76
Kokubuhayato	32 944	34 841	34 393	1 897	5.76	1 449	4.40
Total	1 142 572	1 194 745	1 255 688	52 173	4.57	113 116	9.90

Source: Iapan Industrial Location Center.

Table 4.6: Trends in Technopolis industrial value added (1981-82)

Trends in technopolis industrial value added, 1981-1992

Billion Yen

Technopolis	1981	1986	1992	Total	Average	1981-86 (%)	1981-92 (%)
Douou	176	230	340	746	249	30.68	93.18
Hakodate	82	102	133	317	106	24.39	62.20
Aomori	91	109	121	321	107	19.78	32.97
Kitagamigawa	86	155	225	466	155	80.23	161.63
Akita	80	96	127	303	101	20.00	58.75
Yamagata	225	335	429	989	330	48.89	90.67
Kita-Sendai	218	238	372	828	276	9.17	70.64
Koriyama	196	253	364	813	271	29.08	85.71
Shinanogawa	479	426	736	1 641	547	−11.06	53.65
Utsunomiya	327	426	627	1 380	460	30.28	91.74
Kofu	197	340	381	918	306	72.59	93.40
Asama	645	644	427	1 716	572	−0.16	−33.80
Hamamatsu	559	677	772	2 008	669	21.11	38.10
Toyama	513	553	668	1 734	578	7.80	30.21
Nishiharima	645	644	923	2 212	737	−0.16	43.10
Kibikogen	328	458	483	1 269	423	39.63	47.26
Hiroshima-chuou	208	215	484	907	302	3.37	132.69
Ube	285	310	458	1 053	351	8.77	60.70
Kagawa	397	368	487	1 252	417	−7.30	22.67
Ehime	539	539	603	1 681	560	0.00	11.87
Kurume-Tosu	208	215	256	679	226	3.37	23.08
Kan-omurawan	168	246	194	608	203	46.43	15.48
Kenhokukunisaki	81	130	181	392	131	60.49	123.46
Kumamoto	189	225	319	733	244	19.05	68.78
Miyazaki	53	89	120	262	87	67.92	126.42
Kokubuhayato	168	246	240	654	218	46.43	42.86
Total	6 914	8 180	10 472	25 566	8 522	18.31	51.46

Source: Iapan Industrial Location Center.

4.2 Spatial Dispersal of R&D Facilities

The trends of industrial plant establishment since the approved year of 20 technopolises of the first group (those approved before 1986) are demonstrated in Table 4.7. What is clear from this table is that the number of new establishment of high-tech industrial plants within the technopolis areas as a whole is quite modest, with annual average around 2.0. at the same time, those which exhibit relatively large number of high-tech plant establishments - koriyama, Shinanogawa, Utsunomiya, Hamamatsu, and Toyama - are those relatively close to Tokyo area. In contrast, those in remote area, - Hokkaido, Kyushu, and Chugoku, Shikoku regions (see Figure 3.1.) - demonstrate quite low performance in high-tech plant establishment.

Table 4.8. indicates that between late 1980s and early 1990s, relatively large number of R&D facilities had been established across the country. However, as high-tech industries' plant establishment, new R&D establishments are heavily concentrated in Kanto region. Similarly as shown in Table 4.9., Kanto region's strength in attracting high-tech industries' plants is obvious. Howevr, it must also be noted here that Tohoku region demonstrates comparable degree of new high-tech plant establishment. One possible reason seems to lie in the fact that during 1980s, high-speed railway network (Shinkansen) had been expanded into Tohoku region, which greatly improved the access to the region.

As most of the data-based evaluation studies (Stohr & Ponighaus, 1992; Sternberg, 1995; OECD, 1996; Itou, 1994; Oda, 1992; Tanaka, 1994, 1996; Onuma, 1992; Yamasaki, 1992) suggest , the disparities in research and technological activity across Japan remain wide. The transfer of technology to peripheral areas has, in some cases, involved relatively little significant high technology, and peripherally located technopolises have some of the lowest performance levels. Especially studies done by and Funaba (1994), Ponighaus & Stohr (1992) and Sternberg (1996) demonstrate that the size of technopolises and rate of high-tech firm formation decreases with distance from Tokyo, both in terms of geographical distance and time travelled via rail way network. Furthermore, R&D facilities remain heavily concentrated in the three metropolitan areas (Tokyo, Osaka, Nagoya) and in Pacific coastal area which is well served by high-speed train (Shinkansen) network. Official figures show that industries such as fibre-optics, semi-conductors, computers and robotics are still mainly concentrated in the Pacific coastal belt (Funaba, 1994). Social factors should also be neglected here. The best schools and the majority of corporate headquarters are still concentrated in Tokyo and primary cites around Pacific coastal area (Sasaki, 1986; Yamasaki, 1992). Since MITI's plan calls for no major financial support to decentralise premier education and research institutes out of Tokyo, one of the key catalysts of local technology diffusion has been missing in many Technopolis cities (Glasmeier, 1988; Yamasaki, 1992).

Thus, the development of R&D facilities seems to owe much more to the pre-existing physical infrastructure and the concentration of major universities in these areas and thus the direct impact of the Technopolis programme is difficult to measure. On the other hand, the majority of technopolises are located in non-metropolitan areas which tend to have the lower, more basic functions, even among high-technology industries. Consequently, while some technopolis zones demonstrate above-average growth rates for indicators such as employment and output, in most cases the level of industrial value-added is slightly below the national average. Viewed in this light, it is reasonable to conclude that the Technopolis programme has had little impact on spatial dispersal of corporate R&D facilities, nor on manufacturing industries as a whole, as indicated in Tables 4.1. and 4.2. above.

Table 4.7: The number of new industrial factory in 20 Technopolises (First group)

		Total (Approved year - 1993)		Annual average (Approved year - 1993)	
Technopolis	Approved year	Whole industry	High-tech industry #	Whole industry	High-tech industry #
Hakodate	1984	92	8	9.2	0.8
Aomori	1985	180	19	20.0	2.1
Akita	1984	94	18	9.4	1.8
Sendai Hokubu	1986	140	16	17.5	2.0
Koriyama	1986	124	24	15.5	3.0
Shinanogawa	1984	602	40	60.2	4.0
Utsunomiya	1984	145	30	14.5	3.0
Hamamatsu	1984	149	34	14.9	3.4
Toyama	1984	261	40	26.1	4.0
Nishi Harima	1985	176	20	19.6	2.2
Kibi Kogen	1984	114	7	11.4	0.7
Hiroshima Chuo	1984	114	9	11.4	0.9
Ube	1984	108	9	10.8	0.9
Kagawa	1985	203	11	22.6	1.2
Kurume-Tosu	1984	101	10	10.1	1.0
Kan-Omurawan	1985	81	12	9.0	1.3
KenhokuKunisaki	1984	141	19	14.1	1.9
Kumamoto	1984	138	21	13.8	2.1
Miyazaki	1984	156	19	15.6	1.9
Kokubu Hayato	1984	139	18	13.9	1.8

High-tech industry is defined by MITI as following sectors: (1)chemicals, (2) information technology, (3)microelectronics computer, (4) applied microelectronics, (5)electric measuring device, (6) electric appliances,
(7)pharmaceuticals, and (8)optical instruments.

Source: Itou (1994: 222)

Table 4.8: Trends in new R&D establishments by region#

	1985	1986	1987	1988	1989	1990	1991	1992	1993	Total
Hokkaidou	1	2	3	2	8	2	9	5	0	32
Tohoku	0	1	1	6	6	0	7	6	2	30
Kanto	15	25	29	21	31	12	11	8	12	164
Chubu	2	1	10	3	8	19	9	3	11	66
Kinki	1	5	4	12	8	7	3	14	6	60
Chugoku	2	2	3	3	0	2	3	1	4	20
Shikoku	0	1	0	1	2	1	0	0	2	7
Kyushu	2	4	4	1	0	3	8	9	1	32
Country Total	24	41	54	49	63	46	50	46	38	411

see Figure 3.1. for regional boundaries.

Source: Survey on the Trends of Industrial Location (MITI: Various years).

Table 4.9: Percentage of the new high-tech factories#, by region## (%)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Kokkaidou	2.4	0.5	2.3	3.2	3.2	2.5	5.9	4.4	3.5	1.1
Tohoku	32.8	34.1	34.8	38.4	41.9	38.7	33.0	33.6	26.9	27.5
Kanto	31.3	28.7	29.5	26.7	21.1	25.1	21.2	20.2	31.0	31.9
Chubu	11.9	13.6	13.8	11.8	12.0	11.4	14.2	14.5	15.2	16.5
Kinki	5.3	4.1	8.0	5.4	5.9	5.7	6.2	7.3	3.0	3.3
Chugoku	3.3	5.6	3.4	2.8	5.9	4.9	4.5	3.7	7.0	5.5
Shikoku	2.6	3.4	1.9	1.4	1.6	2.5	3.8	3.2	4.1	3.3
Kyushu	10.4	10.2	6.1	10.4	8.5	9.2	11.1	12.9	9.3	11.0
Country total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

High-tech industry is defined by MITI as following sectors: (1)chemicals, (2) information technology, (3)microelectronics computer, (4) applied microelectronics, (5)electric measuring device, (6) electric appliances,
(7)pharmaceuticals, and (8)optical instruments.
see Figure 3.1. for regional boundaries.
Source: Survey on the Trends of Industrial Location (MITI: Various years.)

4.3 Creation of Local linkage with Relocated R&D Facilities

This aspect is difficult to measure by quantitative methods. However, many case studies on individual technopolis sites indicate that a pattern of large, isolated production facilities is characteristic of high-tech development in a number of technopolis areas, and although there has been some expansion of related industries in a few technopolis areas, for the most part, high-tech industry takes the form of large, isolated, capital-intensive component facilities whose markets are overwhelmingly export-oriented. The activities of Technopolis organisations at each designated area have been limited to those related to the attraction of branch plant of high-tech firms, due to the lack of financial support from both central and regional governments. This is partly explained by fierce competition among 26 designated technopolis areas, which in turn, has forced regional governments to various tax incentives to attract high-tech firms and financial support for relocated branch plants. In fact, the development plans proposed by each technopolis look so similar to each other in their development strategy and types of technology pursued and there is no sign of how to link high-technology to local industry (see Table 3.1.).

Thus, although development of social infrastructure such as training for small and medium scale enterprises (SMEs) and the creation of community-based business network were articulated as an important activity of technopolis organisations, most of the organisations primary concern has been the attraction of firms and the development of physical infrastructure for R&D (Glasmeier, 1988; Itou, 1994; Oda, 1992; Onuma, 1992; Tanaka, 1994&1996; Yamasaki, 1992). Furthermore, even those technopolises which have operated such training programmes for SMEs, training for women, however, is limited to information technology and processing and the vast number of female production workers are totally excluded from the training programme in the Technopolis programme (Fujita, 1988). The creation of the linkages for embedded technology-led development has been neglected until 1991 when MITI modified the development guideline of the Technopolis Law to re-emphasise the importance of the development of organisational framework for technopolis development, and even after this modification, the attraction of high-tech R&D seems to remain the dominant concern of many host prefectures, partly due to the lack of sufficient budget for social infrastructure (Itou, 1994; Tanaka, 1996).

Finally, it must be noted that while huge investment have been done for industrial estates within technopolises to attract high-tech firms, the physical development of residential area has been totally neglected in most technopolis sites except for those quoted in Chapter 3 above. In addition, most of these industrial estates have been left without sufficient number of tenants. Urban community in which high-technology, academic sector and residential area are organically integrated, can rarely be found in most technopolises. In this sense, the creation of an attractive community for realisation of the 'permanent residential area' concept has failed, which has led some researchers to conclude that technopolis is merely an industrial policy disguised as local development policy (Glasmeier, 1988; Itou, 1994; Tobikawa, 1984; Yonenami, 1986).

5. DISCUSSION OF THE RESULTS OF THE TECHNOPOLIS PROGRAMME

5.1 The Validity of the Methods Adopted in the Technopolis Programme

Although many studies suggest the need to take a long term view to evaluate the performance of the Technopolis programme, inappropriate methodologies adopted in the programme are also pointed out, which are examined in this section. The underperformance of technopolises seen above indeed confirms the points argued in Chapter 2. Firstly, explicit spatial policy to relocate industries has little impact. In spite of various incentives made by both central and regional governments, the location of industries seems to have been primarily influenced by the development of transport network and pre-existing social agglomerations.

Secondly, high-tech R&D itself makes little contribution to embedded local development. Even those technopolises in which the attraction of corporate R&D has been effective (namely those around Pacific coastal area), these R&D activities seem to have little relevance to locally specific development potential. Glasmeier (1988) suggests, firms producing pure research, "one-of-a-kind", or standardised products may have limited potential to create or encourage spin-offs. In both cases, the parent firm gains few benefits from the creation of spin-offs, and may incur considerable costs when personnel leave their employment. Given that a large number of the planned technopolis cities already have a high-tech base of standardised production facilities, and given the continued emphasis on attracting such operations, there is no wonder that technopolis cities have not been generating new integrated industrial complexes, nor fostering embedded local development.

Apart from the difficulty to generate spin-offs, inadequacy of the high-tech-led local

development concept based on the 'linear innovation model', has also strongly been put forward by Massey, et al. (1992). An examination of the Tsukuba Science City (Castells & Hall, 1994; Glasmeier, 1988) also indicates that the focus on R&D establishments alone is not likely to lead to production innovation nor integrated or propulsive industry-led economic growth. Unless explicit programmatic elements link the R&D of government research organisations and universities to the local industrial base, university-based research will have little influence on the creation of new centres of innovation. Viewed in this light, many technopolises seem to have become nothing more than 'pure research parks or science parks'.

Thus, the attraction of R&D and R&D-based local development are not effective measures to achieve the original vision of the Technopolis programme: "a strategy to simultaneously accomplish upgrading of national industrial structure up to the level of knowledge-intensive society (upgrading of national innovation capacity), and regional development (creation of permanent residential areas), through urban community development based on organic integration of high-technology industry, academic institutions, and residential amenity (JILC, 1982: 1)." However, while Glasmeier (1988) suggests the adoption of these measures is based on misguided assumption that spin-off creation and the linkage between R&D and local industries are natural consequences of high-tech development, this is not the case. Technopolis policy makers were well aware that the attraction of R&D alone would not lead to embedded local development (Itou, 1994; Yamasaki, 1992). In fact, the creation of these linkages is supposed to be developed by technopolis organisation in each locality, and the actions of the central and local governments are supposed to be co-ordinated, so are the relevant sectoral policies. This leads to the question of political factor. Next section deals with this issue.

5.2 Political Factors: The interrelations between industrial & technology policy, regional development policy, and local development planning

In Chapter 3 a description of Japan's Technopolis programme was given. Chapter 4 attempted to analyse and summarise the achievements of this programme in terms of the original vision and objectives for the programme. This chapter has so far highlighted the ineffectiveness of the measures adopted to achieve the objectives of the programme. In this section two political issues are addressed: (a) the interactions between industrial & technology policy, regional development policy, and local development planning; (b) the influence of the relationships between the central government ministries and regional government, which hold the key to the policy implications of the case study. These two issues are closely interwoven as different policies are formulated and implemented by different ministries within the central government and different levels of government, and thus discussed altogether.

First, the process in which the attraction of high-tech R&D has been given primary emphasis in most technopolises, should be considered. as stated in Chapter 3, Technopolis programme is supposed to be implemented under regional governments' initiatives. However, in practice, as shown in Chapter 3. (see Table 3.1.), most technopolises pursued similar type of development strategies, focusing on the high-technology industry specified by MITI (1980) in their "Vision" as key technology as following:

(1) chemicals,
(2) information technology,
(3) microelectronics computer,
(4) applied microelectronics,
(5) electric measuring device,
(6) electric appliances,
(7) pharmaceuticals, and
(8) optical instruments.

(Bio-technology is also implied as a target technology).

Although the pursuit of these technologies was not included in the designation criteria in the Technopolis Law, given that development proposal has to be approved by MITI, most host prefectures seem to have followed the MITI's Vision. Here, MITI's influence as an industrial policy maker is manifest, which strongly delimited the scope of regional originality in many technopolises.

Second, underlying the designation of as many as 26 prefectures as technopolis sites, is the political conflict between MITI and the Ministry of Construction. As Glasmeier (1988) point out, the underlying issue of the overall performance of the Technopolis programme is the relationship between the MITI, as the industrial policy maker, and the Ministry of Construction as Urban Development Policy Maker and physical infrastructure provider. Since when MITI began to act as an industrial locator (i.e. spatial policy maker), conflicts between these ministries seems to have become inevitable. Over the last 30 years, the MITI has led Japan's industrial development since World War II. In the past, the MITI selected sectors for development and required industries to constantly rationalise in order to remain competitive. In this role, MITI showed little concern for where economic development occurred (Glasmeier, 1988; Okimoto, 1991, Yamasaki, 1992). However, as MITI's relative powers have begun to decline, partly due to the

huge government debt used to finance the post-war industrial development that now must be recovered, it has become necessary for MITI to seek the new field of activity in order to expand its political influence across the country (Yamasaki, 1992). At the same time, Japanese public opinion towards the country's investment emphasis has been shifting toward rebuilding infrastructure, increasing the available stock of housing and improving urban living conditions, rather than industrial development (ibid.). Furthermore, revaluation of the yen makes manufacturing in Japan extremely costly and is forcing Japanese manufacturing investment abroad.

In Japan, central government ministries exert their political power on local area by delegating officials to regional and municipal governments as an advisor, which generates the human network in local community and increases the possibility of retired officials to be elected as an mayor in these locality (Yamasaki, 1992). Thus, Technopolis programme is an opportunity for MITI to expand its new role as an industrial locator is closely tied to MITI's political interest (Okimoto, 1991; Yamasaki, 1992). In prefectures designated as a Technopolis, the officials from MITI has been sent to advisor for Technopolis development (Yamasaki, 1992), which explains why so many technopolises are approved on the contrary to initial plan to build a few major technopolis with higher potential, as stated earlier, has led to the fierce competition among host prefectures to attract high-tech firms at the cost of social infrastructure and the development of "an attractive community". Furthermore, given the fact that National Land Agency is a relatively new agency in the government and most of the senior officials are occupied by the delegated officials from MITI (Yamazaki, 1991), it seems not to have been functioning as an intermediate co-ordinator between the ministries. Likewise, various national spatial policies made by the agency (e.g. National Comprehensive Development Plans) has been argued to be used as a rhetoric to ease the opposition movement from peripheral prefectures for their being neglected from MITI-led industrial development (Kosaka, 1992; Yamasaki, 1992).

Third, the conflict between the ministries described above implies the lack of co-ordination between physical development policy and industrial development policy. In other words, power struggle within the government has led to the failure to co-ordinate implicit and explicit spatial policies. Ministry of Construction is responsible for physical infrastructure provision which has been demonstrated to have the biggest impact (at least in Japan) on explicit spatial policy i.e. the location of domestic industries. On the other hand, MITI has also been responsible for explicit spatial policy (industrial location policy i.e. the Technopolis programme) as well as implicit policy (i.e. technology policy to specify key high-technology industries in the "Vision" (MITI, 1980)). However, although the Technopolis programme was clamed to be high-tech-led regional development with elements of local urban development, as many researchers (Glasmeier, 1988; Itou, 1994; Tanaka, 1996; Tobikawa, 1984; Yamazaki, 1991; Yonenami, 1986) acutely point out, the programme is nothing more than industrial policy. With declining funds available for large-scale industrial subsidisation, it is evident that the programme's underlying purpose is to unlock entrepreneurial investment capital concentrated in regions, which can be used to finance additional industry and, secondarily, to build needed infrastructure.

Finally, as suggested above, in the Technopolis programme stemming from political power struggle between the central government ministries, there is few element of local urban development. Although there is positive view that the technopolis concept has clearly been successful in stimulating prefectures to design and implement integrated technology development programmes in conjunction with the central government (Castells & Hall, 1994; Tanaka, 1996; Yamazaki, 1991), the regional and local governments' ability to promote their own city has been significantly undermined by the Technopolis programme.

Viewed in this light, the programme's failure as a regional development and urban development strategy is obvious. As a responsible ministry which gives approval of development proposals from prefectures, MITI has wielded its political power to direct the technopolises, which has negated the exploitation of region-specific potential by regional and local governments. At the same time, MITI's financial support for regional governments has so far proved to be modest (Itou, 1994; Tanaka, 1996; Yamasaki, 1992).

What these conclusions suggest to the concept of technopole is that the successful implementation of the concept depends on simple and flexible institutional structure. Difficulties of co-ordination have been shown. The central problem is not technical but political. As described in Chapter 3, the Technopolis programme incorporated various policies, ministries and regional governments, and is supposed to co-ordinate them altogether. However, since this programme is proposed by MITI, MITI's influence on decision-making throughout the implementation of the programme is manifest, and MITI is nothing more than industrial policy maker, which has made Technopolis programme "industrial policy in disguise of urban and regional development policy". Policies based on the technopole concept,

by its very nature, entail various policy instruments and various governmental bodies. The conclusion that Japan's Technopolis programme failed because of the government's institutional framework, may provide implications for more desirable institutional framework for the implementation of the technopole concept, which is discussed in the following section.

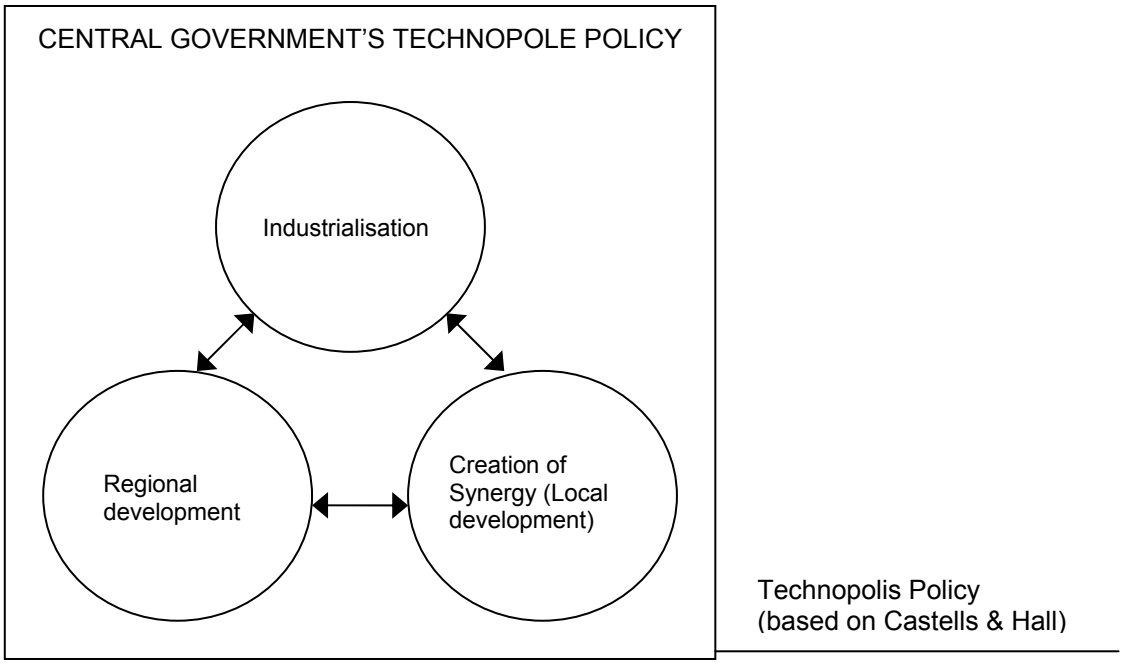
5.3 Implications for Developing Countries

5.3.1 Basic concept of the technopole strategy

First, for developing countries, the development potential of technopoles perhaps solely lies in fostering entrepreneurship, spin-offs and new firm formation through innovation based on locally-specific potential, but not in high-tech R&D whether private or university-based. As Malecki (1991) suggests, the principal route by which economic benefits stay within a region is new firm formation, and the spin-off process is ultimately the route of local technology transfer and economic growth. furthermore, the process of entrepreneurship may be a far more important one to regional and local economies than the process of technological change, especially for developing countries where technological level is much lagging behind those of more developed countries.

In this sense, Castells and Hall's term "Technopole" would be misleading since it includes various type of technopoles such as science parks,
technology parks, science city, etc., which has proved to be not appropriate for the stimulation of indigenous innovation. Especially the word "techno-" is likely to be associated with high-technology, and obscures the fact that innovation is more important. More usual term "innovative industrial district/complex" would be more appropriate. Secondly, it is crucial to recognise that the technopole strategy should be regional or local initiative since the innovation potential as suggested above, depends on the condition of each locality. For this reason, technopole strategy cannot be an alternative for national urban policy as it is the task of central government. Its regional development aspect is less relevant in this context. Technopole policy formulated at national level, has a potential danger to be disguised as regional development policy or urban development policy, as in the case of Technopolis programme. One must clearly distinguish it from these policies. However, the central government can assist regional and local governments' technopole building. Having recognised these points, the technopole concept and related policies implied by Castells and Hall (1994) and adopted approach in the Technopolis programme can be schematised as Figure 5.1. and alternative conceptual framework is suggested in Figure 5.2.

Figure 5.1: Technopole & Technopolis: concept and policies



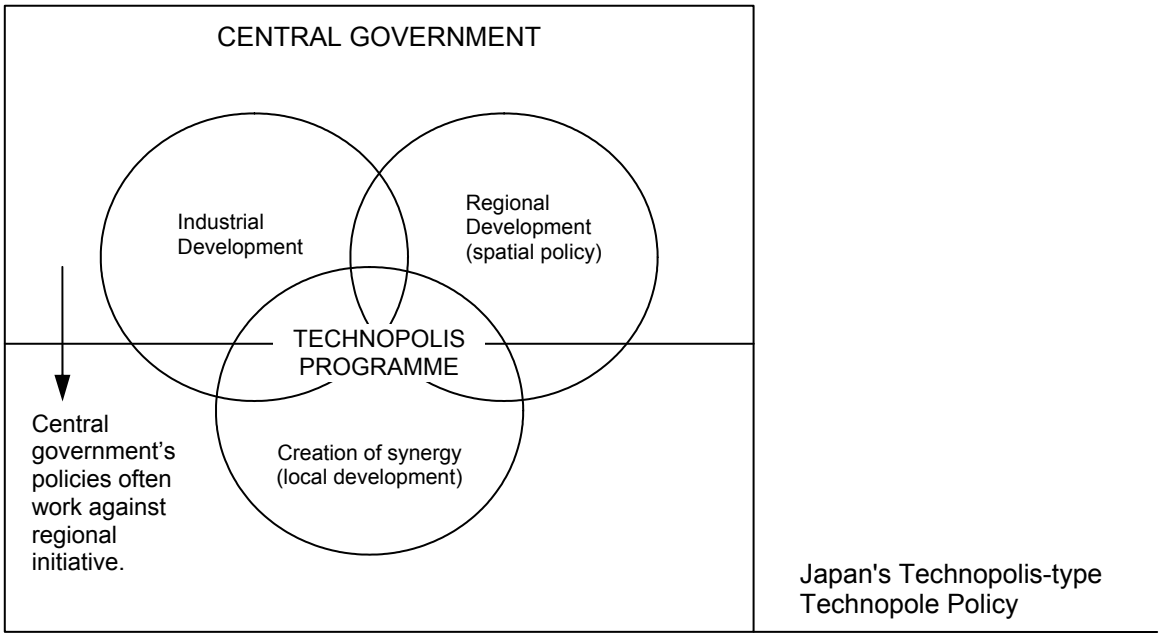
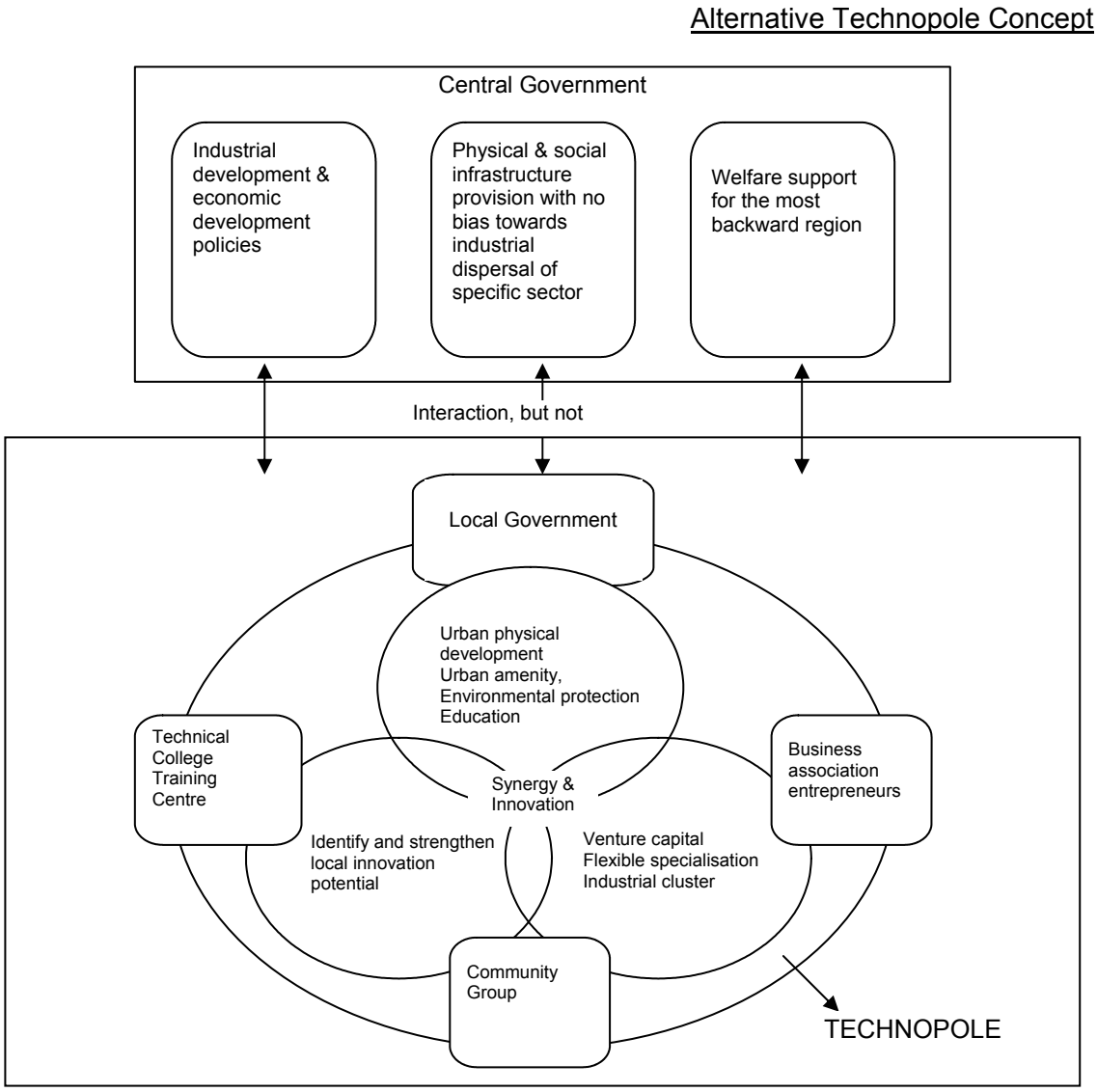


Figure 5.2: Alternative Technopole concept



5.3.2 The role of central government

Central government can help or hinder local development. Central government's implicit and explicit spatial strategies cannot direct the spatial pattern of economic and industrial development in a desired manner. Central government may have influence through technology and industrial policy, on which sector of industry should be encouraged to develop, which may have negative impacts on local innovation potential as shown in Japan's case. Central government may also have the power to decide the location of state research-based university and public R&D institution, but these are not significant contributors to local development as argued above. Thus, given that MITI-type industrial development strategy tend to pervade in developing countries, the central government intervention in the technopole strategy may not result in innovation-oriented technopole strategy, even if it is articulated as an objective, as shown in the case of Japan. Furthermore the effectiveness of the central state's targeting key sectors for development seem to have been declining as such key industries and the most suitable location for such industries is determined by market force in the global economy, and the condition changes so rapidly (Kosaka, 1992; Onuma, 1991).

As Gore (1984) and Gilbert (1992) argue, the spatial distribution of economic activity is not necessarily related to the distribution of income, or wealth. The distribution of wealth is determined by political and social structure. In this sense, the central government's ultimate tool to foster the spatial distribution of wealth, is the devolution of its political power, as well as fiscal responsibility, which enables subnational governments to act more flexibly to work with their own cities and communities. Another important role of the central government would be to link the peripheral areas with the outside world, that is, to provide transport network and information network. As shown in the case of Japan, these physical infrastructures had the strongest impact on the spatial distribution of industries. Although there is an argument that the improvement of these network will lead to further concentration of people and industries in metropolitan areas, it is not necessarily the case, provided that regional and local governments can create an attractive environment for people and economic activities, which in turn, depends on the degree of devolution from central government. These networks may contribute to create a network between surrounding regions if local and regional governments can provide an attractive environment and can create the organisational framework to exploit region- or local-specific innovation potential, which will lead in turn to further creative synergy.

5.3.3 The role of local government

As implied in the above argument, the role of local government as a technopole planner is critical. Local government could contribute to foster indigenous innovation potential through the creation of organisation to encourage the interaction between a variety of actors in a community; private sector, academic sector where available, community groups, etc. Although in the case of the Technopolis programme, this was tried in the form of "Technopolis organisation", its full potential could not be realised due to the negative impacts of MITI and the lack of financial resource, most of which was devoted to the attraction of high-tech R&D - an outsider which has had little contribution to local community. Thus devolution of political power is important as a precondition for the effective operation of such organisations.

When sufficient political power is given to the local authorities, these governments' focus on technopole building should be directed to the creation of incubator of innovation, under the initiative of non-profit organisation, possibly directed by the local government. for which various kind of actors are integrated under local governments' initiative. This kind of 'Third Sector' organisation should play a vital role in local development. This is much related to the concept of 'territorial development' introduced by Evangelinides and Arachovitou in Wilson (1995: 650) as "a strategy towards the satisfaction of basic needs, using purposeful community action based on decentralised participatory decision-making, small and medium-sized projects, labour intensive modes of production, appropriate technology and self-management, and the development of local small-scale enterprises aimed at providing basic (or social) needs."

However, as Wilson (ibid.) suggests, this approach also has a danger to divert from the true bottom-up approach: instead of civil society playing the lead role, local governments being the initiator of the action, the convenor of the participation, and largely a funder of the activities (often with national government assistance). Harrington and Warf (1995: 195) also argue that this type of 'post-Keynesian urban policy' "has led to a broad based shift in the priorities of local governments, which are increasingly less concerned with issues of social redistribution, compensation for negative externalities, provision of public services, and so forth, and more enthralled with the question of economic competitiveness, attracting investment capital, and the production of a favourable "business climate"." Thus, local governments always must be aware that the attraction of economic activity is not the central issue to promote their own city.

Viewed in this light, Wilson (1995)'s suggestion to add human development and ecological harmony in local development provides possible direction. To promote local development through indigenous innovation requires positive interaction of people who have the sense of community in the area. Thus, physical development of urban area and the creation of attractive living environment for people not for industry, becomes critical. The importance of urban amenity is quoted in many studies as an important element for urban development (Itou, 1994; Sakata, 1991; Yamazaki, 1991), in order to establish firm sense of community in the cities. This also applies to the cities in developing countries, since in the global economy, movement of industries in a space tend to be very quick. However, for any development efforts, the energy, skill and knowledge of people who share the common interest in their community's development, is essential. Thus the role of city authorities in urban management and urban physical planning would be more important in their role as a technopole promoter. On the other hand, the training facilities for local industries would also be a critical factor. In this sense, technical college, rather than research university, can be a source of indigenous technological innovation and capacity building.

6. CONCLUSION

This paper has examined the implications of the concept of technopole and the related case of Japan's Technopolis programme, for national urban policy in developing countries. The answers for the four objectives of the research set out in Section 1.2. have already been indicated in the above chapters. In the following, these findings are summarised.

First, the concept of the technopole is useful for developing countries as a means to promote local development based on indigenous innovation potential. It can be one of the strategies of local economic development. The technopole concept however, cannot provide the model which every city and region can adopt; technopole should be specialised industrial complex based on physical and social conditions specific to each locality.

Second, technopole cannot be a viable alternative for national urban policy in developing countries. Regional development objective of the technopole concept should be abolished. Once, technopole strategy is incorporated into national spatial strategy, it inevitably becomes the location policy for targeted sector, which has little impact on local innovation. furthermore in the global market, the movement of industries and production facilities are so rapid that even these central government policies aimed at the development of specific sector in the name of national interest at the cost of equitable distribution of wealth, may contribute little to national technological capacity building and hence economic development. Best the central government can do is to devolve its decision-making power to subnational level governments, and provide physical infrastructure network, connecting peripheral parts of the country. Precious resource should not be used to manipulate spatial distribution of industries.

Third, Japan's Technopolis experience indicates the difficulty in co-ordinated actions to achieve multi-objectives of the technopole-type strategy. In developmentalist state in which central state has strong control over national development strategy, co-ordination of different sectoral policies is difficult. there is always a danger that explicit spatial strategy is used as a rhetoric to legitimate the capital accumulation with social polarisation at the sacrifice of people in peripheral area, as Gore (1984) suggests. The difficulty in the co-ordination of policies is also related to the lack of co-ordination between responsible ministries. Ministries responsible for physical infrastructure should not be influenced by industrial location policy favouring specific area. Gradual and equitable expansion of the physical infrastructure network into peripheral area takes long time, but perhaps the most efficient way to promote 'redistribution with growth" in the long run. Ministries responsible for industrial development should not attempt to manipulate the distribution of industry. in this sense, 'industrial location policy' governed by short-term interest of relocating specific industry way of relocating industries policy may have significant negative impacts on local development efforts to build local technopoles.

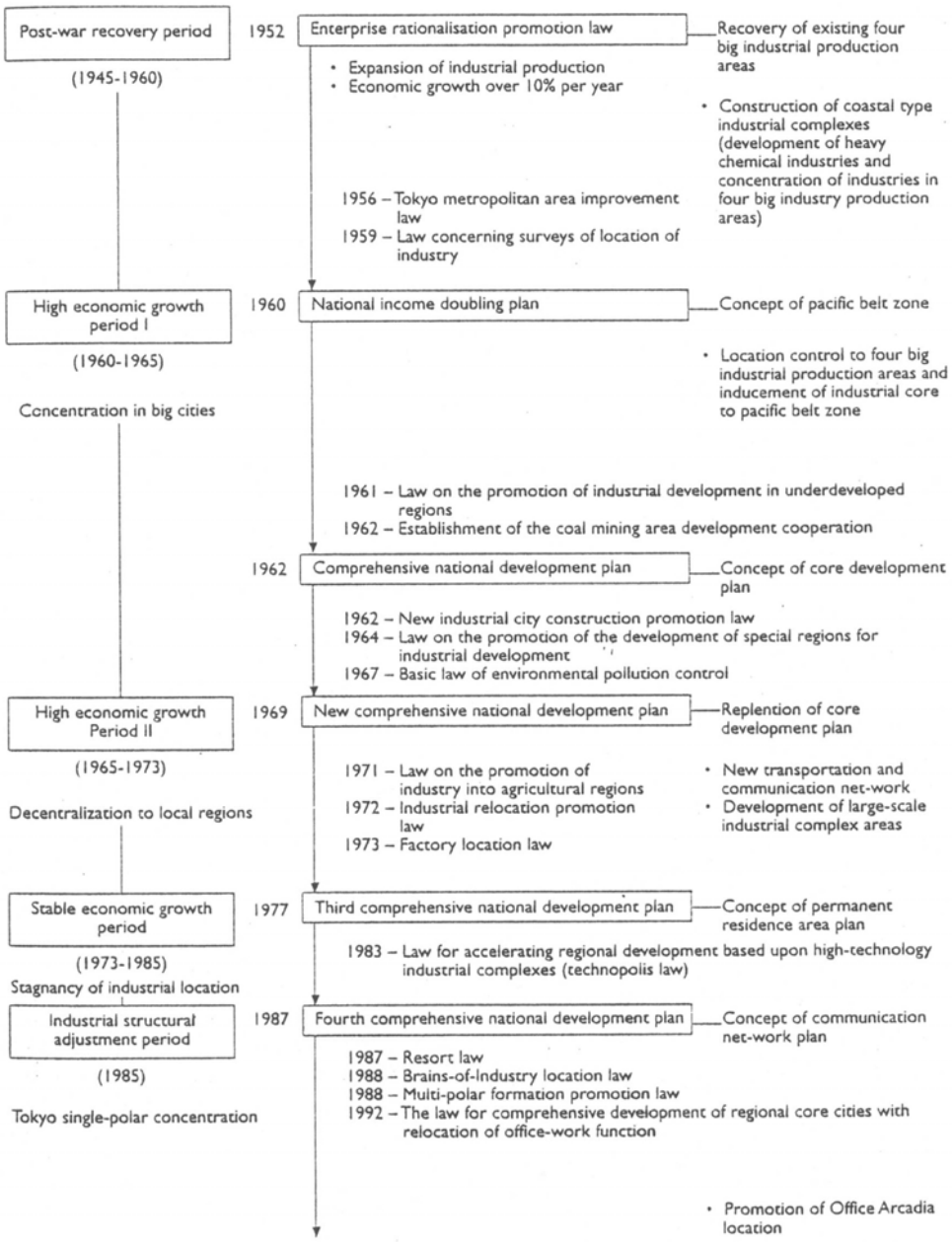
Fourthly, the important role of local government as a technopole planner should be emphasised. This perhaps falls into the task of urban management and urban planning. In this role, local governments should be well aware that technopole building is not just a matter of attracting industry from outside, but creating and upgrading industries which their city has particular strength in the market. City marketing approach may not be appropriate. However, it is also true that most of local governments lack in sufficient financial resource. Central government assistance in the form of competitive national urban policy such as city challenge in the UK, or technopolis programme in Japan, may not be appropriate as argued in Chapter 5 above. International aid agencies and international NGOs perhaps can play a role to assist local efforts.

Finally the limitation of the scope of this paper should be addressed. The discussion of the technopole concept encompasses many subjects ranging from post-Fordist production system and industrial districts, through various theories on technological innovation, industrial location theory,

to regional development and local development. Setting this debate into the context of national urban policy debate in developing countries further complicates the issue, and fuller in-depth analysis incorporating all these subjects is beyond the scope of this paper. Nonetheless some of the critical junctures between these debates have been identified, and this would be the starting point for further discussion.

Overall, the argument made here has highlighted the need not to confuse the technopole concept with national urban policy. While Castells and Hall (1994)'s policy guidelines strongly indicate the implications for national level location policy (i.e. spatial policy, or national urban policy in this context), their guidelines would be of little help to fully utilise the technopole concept for national development in developing countries. Technopole building would contribute to the realisation of "redistribution with growth" through local initiatives. In this sense, the wealth is *not distributed among localities*, but rather, *created* by each locality. To foster this positive movement, central government's first task would be to distribute *power*, but not industry or any other economic activities. Without realising this prerequisite, any attempts to achieve redistribution with growth would fail. Once this precondition is set, the technopole can be a useful tool for more equitable development as one of local development strategies, but not as a national strategy. Some developing countries, especially in Asia, have recently been trying to build high-tech industrial districts (NRI, 1996). "High-tech" still appears to attract development policy makers. Whether these planned districts in rapidly industrialising countries can contribute either to national technological development, or to innovation and spin-offs, is a possible topic for further empirical research.

7. APPENDIX INDUSTRIAL LOCATION POLICIES IN JAPAN



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