ELSEVIER

Research Policy 30 (2001) 805–817

research policy

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Development of national innovation policy in small developing countries: the case of Cyprus

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Received 24 April 1998; received in revised form 26 August 1998; accepted 7 June 2000

Abstract

This paper analyses the concept of national innovation policy (NIP) and puts forward arguments supporting the need for a NIP for small developing economies like Cyprus. A brief outline is given of the science/technology infrastructure and current innovation related policies in Cyprus while the attitudes of owners/managers of private manufacturing firms towards these policies, based on a research survey, are examined. The survey reveals an ambivalent attitude towards NIP, which is probably due to unrealistic expectations, as well as, inefficiency in design and implementation of innovation policy measures. Case research confirms these conclusions and highlights the importance of NIP for private firms despite the rhetoric of their managers against it. The formulation of a specific NIP for Cyprus is then considered, from which lessons for other developing countries are drawn.

Keywords: Cyprus; National innovation policy; Small countries

1. Introduction: the concept and role of NIP

The role of science and technology in economic development has only been really appreciated since the Second World War. Specific policies to harness science and technology have since been developed, initially in developed economies and later, though more gradually, in developing countries as well (Sagasti, 1989). But their application to very small developing economies like Cyprus has been almost non-existent till the late 1980s.

However, any effective policy, or set of policies, which aims to stimulate technological innovation must go beyond science and technology policy and incorporate other policy instruments such as regulation of markets, taxation, infrastructural development, etc. A national innovation policy (NIP), as it then becomes, has therefore to be wide-ranging, integrative and coherent if it is to be successful in promoting and supporting innovative activity.

Even within predominantly, non-interventionist, *laissez faire* economies, it seems that the majority of experts are in favour of an active NIP (Dahlman and Ross-Larson, 1987; Enos and Park, 1988; Lall, 1992; Stewart, 1992). Furthermore, NIPs are considered especially relevant for small developing economies as part of their adjustments to the changing international, economic and technological order as well as improvements to their own economic and technological situation (Davenport and Bibby, 1998; Pack, 1992). The main arguments for intervention, especially with

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0048-7333/01/$ – see front matter
PII: S0048-7333(00)00123-2

regard to small economies, are:

- *Market failure*: When private rates of return, due to high risk, uncertainty or 'externalities', may be sufficiently low to deter private investment in areas of crucial long-term national interest. This problem carries even more force for small developing countries where constraints to innovation (due to the small market size, the small size and number of firms, etc.) cannot be overcome by private firms without the intervention of the state.
- *Institutiona1/Infrastructural inadequacies*: The necessary supporting institutions (e.g. research facilities, etc.) may be absent, malfunctioning or not adequately linked to commercial activities within that particular economy.
- *International competitiveness*: Concern over international competitiveness of the national economy (or particular industrial sectors) increases pressure for intervention in supporting productivity improvements, manufacturing innovation, etc. (Ergas, 1987; Lall, 1992; Dodgson, 1993).
- *Empirical evidence*: Studies have documented the remarkable progress of Singapore, Taiwan, etc. and cited government innovation policies as a major factor in those successes (Kraemer et al., 1992).

The expected benefits of intervention have, of course, to be set against the risks of policy failure, its unplanned side effects, and possible market failure due to these measures. While the market failure argument follows the logic of the neoclassical economics approach, the other disbenefits can be viewed in an evolutionary economic perspective as systemic failures and issues of inadequate or uneven development of national innovation capabilities.

Some recent theoretical developments place NIP in a wider socio-economic context. The most important of these is the systems view of innovation. Several authors (Ergas, 1987; Andersen and Lundvall, 1988; Kogut, 1991; Nelson and Wright, 1992; Dahlman and Frischtak, 1993; Nelson, 1993) refer to 'National Innovation Systems' (NIS), emphasizing the fact that national firms are not isolated islands, but members of networks which, operating within the boundaries of a nation-state, have a particular importance for innovation. NIS has been defined as the 'network of agents and set of policies and institutions that affect the introduction of technology that is new to the economy' (Dahlman and Frischtak, 1993). Agents include private firms, technological intermediaries, universities, etc. This view does not deny the significance of other, trans-national networks and their role in technology transfer, but emphasizes that innovation is more often facilitated by sets of local relationships and linkages (Bianchi and Bellini, 1991; Hadjimanolis, 1997; Schibany, 1998).

In this paper, innovation activity in small developing countries, including all the above elements, is first considered, then Cyprus with its economic and technological environment is introduced. Cyprus serves as a 'structured' case study (Adeboye and Clark, 1996) for examining innovation-related policies in small countries. The attitudes to NIP of manufacturing firm owners and managers, based on the findings of a recent research survey, are then presented and several conclusions and suggestions for NIP formulation and implementation are offered.

2. Innovation in small developing countries

Early innovation theories developed in industrialized economics emphasized major innovations. The ensuing policies focused at least until recently (Rothwell and Dodgson, 1992) mainly on supply-side factors such as scientific research and development (R&D), the role of Government in R&D, and mechanisms for transferring R&D results to the private sector. However, innovation in developing countries was initially studied not by innovation theorists, but mainly by development economists (Dahlman and Ross-Larson, 1987; Lall, 1992; Stewart, 1992) with the consequence that the emphasis, in policy terms, was on technology transfer from developed to developing economies (Sagasti, 1989; Mowery and Oxley, 1997). It is, therefore, no coincidence that most of these studies refer to the newly industrialized countries, e.g. Korea, Taiwan, or large developing countries like India and Brazil (Dahlman and Ross-Larson, 1987; Enos and Park, 1988), which provide the most interesting, cases in terms of technology transfer.

But technological innovation is equally important for the *smaller* developing countries, although in this context a broader concept of innovation is needed to cover 'all types of search and improvement effort' (Lall, 1992). There are 83 countries with fewer than 5

million people (a usually accepted definition of a small country), most of which are developing countries. Several characteristics which set small developing countries apart from their larger counterparts are briefly summarized below (Streeten, 1993). It is significant that they also embrace some of the specific problems facing small national systems of innovation (Freeman and Lundvall, 1988; Davenport and Bibby, 1998).

- Small developing countries typically have limited markets, scarce physical resources, shortages of technical skills and a weak bargaining power for inter-state agreements.
- Government and the public sector play a dominant role in the economy, especially in scientific/technological affairs (Argenti et al., 1990). For example, the bulk of R&D is carried out by the public sector.
- Small and medium size firms are the predominant units of commercial activity in the economy. The predominance of small firms, and their dependence on external resources for innovation, affects the inter-firm linkages. For example, the complex subcontracting systems around large firms with first and second tier subcontractors as in Japan are largely absent in small developing economies, but there are, however, many formal and informal exchanges among more or less equal partners.
- Institutions essential for the promotion of technological innovation, such as technological intermediaries, research establishments and prototype testing facilities, are weak or underdeveloped (Argenti et al., 1990).
- The most important activity in the national innovation system of small economies (even industrialized ones) is often technology diffusion, in the form of absorption and adaptation of foreign technology (usually from industrialized countries), and not the indigenous development of new technology (Edquist and Lundvall, 1993). This applies even more so to small developing countries.
- The 'high tech' sector is invariably underdeveloped or non-existent and the main issue is the application of high technology in existing sectors (Lall, 1992).

In terms of NIP, many of the above characteristics suggest that attention should be turned to the analysis of mechanisms, institutions and policies for the acquisition and dissemination of foreign technology rather than to the expansion of relatively limited R&D activities within the small developing nation. Despite the similarities mentioned above, the many differences due to cultural, social and economic environments and the different historical paths of development should not be overlooked. There is today a move away from the top down approach to NIP and more emphasis on the involvement of all the stakeholders in the policy formulation. Private firms comprise one of the main stakeholders and 'users' of policy measures (Adeboye and Clark, 1996). It seems logical therefore, to look to their needs as defined by them so this present study attempts to clarify the attitudes of owners/managers towards NIP, check their awareness of innovation measures and evaluate the effects of NIP on their innovation decisions.

The proposition, which was investigated through the survey research, stated that the National Innovation Policy (NIP), particularly in the context of a small developing country, affects innovation at the level of the firm. The argument of the importance of the state and its policies in small countries is well founded in the literature (Freeman and Lundvall, 1988; Johnson, 1988; Argenti et al., 1990). The counter-argument of NIP being ineffective, or at worst that it may even have adverse effects on private innovation initiatives, leads to the need for empirical confirmation or rejection of the proposition.

3. Cyprus: its economic and technological activities

3.1. The economy

Cyprus is a small island state in the eastern Mediterranean with a population of about 0.7 million people. It has few mineral or other natural resources, apart from a sunny climate. Cyprus has a relatively high per capita GNP ($US 13,000 in 1997) coupled with sustained growth. Furthermore, inflation is modest (3% in 1996) and unemployment low (3% in 1996) (Anon, 1994–1997). Recently, Cyprus was no longer considered by the UN as a developing country, and although in terms of GNP this may be true, by other measures of industrial development Cyprus is certainly still a developing country. Anyway, it is classified as a 'high income' economy in the World Development Report 1997 (Anon, 1997).

Table 1
Distribution of value added in manufacturing by industry[a]

Industry	1995 (%)	1997 (%)
Food (F)	33	33.9
Textiles (T)	16	13.2
Wood (W)	10	10.2
Paper (P)	7	7.5
Chemicals (C)	10	10.2
Non metals (NM)	10	10.2
Metals (M)	12	12.6
Other (O)	2	2.2

[a] Source: Industrial Statistics, 1995, 1997, Department of Statistics (Anon, 1994–1997).

The Cyprus economy is heavily dependent on tourism and agriculture. Services, including tourism, constituted 71.4% of GDP in 1996, with manufacturing only contributing 12%. The manufacturing sector is, however, important in that manufactured products, comprise around 82% of domestic exports (Anon, 1994–1997). Table 1 illustrates the structure of the manufacturing industry and the predominance of traditional sectors like food.

Cypriot firms are generally very small with many micro-businesses: 88% of firms have less than 10 staff, while only 1.4% of firms have more than 50. The distribution of manufacturing firms by size is illustrated in Table 2. Exports of industrial products are primarily directed to EU countries (43% of total exports in 1997) and to Arab countries (33% of total exports in 1997) (Anon, 1994–1997).

The economy is now in a period of transition. Cyprus has a Customs Union Agreement with the European Union and has recently entered negotiations for full membership. The Customs Union Agreement has already brought about many changes in the economy such as dramatic reductions in import duties and other measures for trade liberalization, deregulation of the economy and adaptation to the Maastricht guidelines for economy management. The recent application of GATT agreements has added to the turmoil. At the same time labour costs have increased significantly in recent years while labour shortages have put additional pressures on enterprises not only to automate production processes but also to introduce higher quality products and search for new markets.

Table 2
Distribution of manufacturing establishments by size (number of employees)[a]

Size	1994 (no.)	1994 (%)	1996 (no.)	1996 (%)
Less than 1	347	4.4	346	4.4
1	2784	35.3	2775	35.3
2–4	2854	36.2	2809	35.8
5–9	966	2.2	975	12.4
10–29	690	8.7	697	8.9
30–49	141	1.7	145	1.8
50+	108	1.3	109	1.4
Total	7890	100	7856	100

[a] Source: Labour Statistics, 1994,1996, Department of Statistics (Anon, 1994–1997).

Cyprus in contrast to several other developing countries has achieved high and improving educational standards as shown in Table 3. With 2,803 tertiary level students per 100,000 people, Cyprus compares favourably on educational standards with such industrialized countries as the UK (2,646), Austria (2,893) and Italy (2,944) (Anon, 1992). Engineering, technology and sciences are among the popular subjects at schools and colleges, thereby significantly contributing to the establishment of a technically skilled workforce, a key input factor in manufacturing innovation.

3.2. Cypriot technology indicators

The first survey of the Science and Technology Potential in Cyprus was made fairly recently (Anon, 1992) from which the main R&D indicators for Cyprus are summarized in Table 4. Comparisons with other small countries on R&D expenditure and employment show that Cyprus has a very low level of R&D expenditure as a percentage of GNP (Table 5). In 1992 Cyprus's expenditure on R&D amounted to 0.2% of GNP, a very small percentage compared with small advanced European economies like Finland (2.3%), Denmark (1.9%) or even Slovenia (1.5%). Similarly, it is far behind Singapore (1.1%), New Zealand (1.1%), and even worse than Mauritius (0.4%). The average is about 0.65% in developing economies and 3% in developed countries (Anon, 1994). Cyprus also lags far behind the industrialized countries in R&D personnel per million people (Table 5). Furthermore, from Table 4 it can be seen that agriculture takes the lion's share of Cypriot research funds, while manufacturing has a very low research activity indeed.

Table 3
Education in Cyprus[a]

Education factors	1961	1975	1994	1996
Literacy rate (%)	82	90	94	94
Males	91	96	97	98
Females	73	85	90	90
Distribution of population by educational level (%)				
No formal education	25	13	5	5
Elementary	59	53	40	40
Secondary	15	25	38	38
Tertiary (Higher/University)	1	9	17	17
No. of students per 1000 Persons	N.A[b]	25	26.6	30.4
Public expenditure on education (as % of GNP[c])	2.6	4.3	4.5	4.6
Total expenditure on education (as % of GNP)	3.3	6.3	6.7	7
Education expenditure abroad (as % of GNP)	0.6	1.7	1.3	1.2

[a] Source: Educational Statistics, 1996, Department of Statistics (Anon, 1994–1997).
[b] N.A: Not available.
[c] GNP: Gross national product.

Table 4
Data on R&D in Cyprus[a]

Expenditure	Amount
Total expenditure in R&D (1992)	US$ 11.2 millions
Current expenditure	86.2%
Capital investment	13.8%
Public sector share of R&D expenditure	84.4%
Agriculture	60.5%
Health	20.3%
Manufacturing+others	19.2%
Private sector share in R&D	15.6%
People employed in R&D (1992) equal to 0.13% of people in total employment	366 (Full time equivalents)

[a] Source: R&D Statistics, 1991/1992 (Anon, 1993).

Cyprus has made considerable technological progress in fields such as construction, telecommunications, water resource development and agriculture (in the sense of rapid adoption of foreign technology). It is, however, acknowledged (Anon, 1988; Anon, 1995) that the manufacturing sector is in a relatively poor technological state with little support from local public research and over-reliance on imported technology in a 'packaged' form (purchase of machinery, licensing, etc.). The conclusion is that industrial research in Cyprus is virtually absent and, probably, due to its size only some industrial development work is realistically feasible.

Interestingly, Daniels (1993) ranks Cyprus in a comparatively intermediate position in comparison to other small countries with regard to its trade performance in 'technology-intensive' manufactures, which include chemicals, selected types of machinery, electronic equipment, instruments, etc. According to Daniels' data, Cyprus ranks far behind Ireland, Singapore, Hong-Kong or Israel as would be expected, but ranks above New Zealand, Iceland and Mauritius.

3.3. Industrial development policies in Cyprus

The recognition of the importance of 'path dependency', i.e. the impact of the initial conditions and history, on the development of a national innovation system and its associated institutions and policies, leads to the need to examine briefly the industrial policies of Cyprus in a historical perspective (Streeten, 1993).

Table 5
Personnel engaged in and expenditure on R&D (selected countries)[a]

Country	Year	R&D personnel per million people	Expenditure on R&D as % of GNP
Cyprus	1992	523	0.2
Denmark	1993	5303	1.9
Finland	1993	6035	2.3
Ireland	1992	N.A[b]	1.1
Iceland	1989	4527	N.A
Israel	1992	N.A	2.2
Malta	1988	128	0
Mauritius	1992	519	0.4
New Zealand	1993	2600	1.1
Norway	1993	5139	1.9
Slovenia	1992	5388	1.5
Singapore	1994	4036	1.1

[a] Sources: Research and Development Statistics 1991/1992 (Anon, 1993). World Development Indicators, 1998, World Bank (Anon, 1998).
[b] N.A: Not available.

Cyprus has a Planning Bureau, which prepares five-year development plans for the economy. These plans, which include industrial policies, serve as blueprints for government action. Cyprus industrial policy was following till the late 1980s the classical approach with encouragement of investment in machinery, mergers among local firms and formation of public companies. Then the Cyprus Government, in view of the impending implementation of the Customs Union Agreement with the European Community initiated a series of studies by consultants for a new Industrial Strategy and an integrated Science and Technology Policy (Anon, 1987). An Industrial Restructuring Council was formed in order to promote the suggestions of these studies and the indicative five-year development plans began to include the revised industrial policy. Thus, from around 1990, elements of a National Innovation Policy started to emerge.

The philosophy of the proposed changes was based on the 'flexible specialization' approach for Cypriot industry which was inspired by the achievements of the industrial districts notably in the 'Third Italy'. It was judged that Cyprus was well placed to embrace the principles of flexible specialization (Murray, 1992). The suggestions of the experts covered not only specific policies, but also institutional changes including the formation of new institutions for innovation and technology promotion.

The flexible specialization approach has come under severe criticism (in the case of Cyprus by O'Donnell and Nolan (1989)). They emphasize the dangers of production for market niches and question the capabilities of the very small Cypriot firms to compete in the European Union without some growth of their size, e.g. through mergers. Murray, himself admits that, flexible specialization was mainly developed by observing the organization of industrial districts. In his own words, "Much less experience of trying to implement an explicit strategy of flexible specialization ab initio was available" (Murray, 1992, p. 256).

Despite the objections to its theoretical approach, there is no doubt that many of Murray's suggestions were sound including the sectoral approach, the need for cooperation among firms, for technology upgrading, specialization, and attention to quality. Valuable also was the original idea of applying the same principles of flexible specialization to public administrative practices. Christodoulou agrees that the diagnosis and recommendations of the above team of experts were sound, although he considers their recommendations only feasible 'with extreme difficulty' (Christodoulou, 1992, p. 107)

In parallel with the industrial strategy, foreign experts at about the same period proposed an integrated technology strategy for all sectors of the economy as a core element of the industrial strategy. Their recommendations included the relevant coordination mechanisms and institutional support, e.g. the establishment of a technology culture, encouragement of greater technological intensity in the private sector, a policy on mechanisms for technology transfer and technology selection assistance to private firms.

What actually happened in the following years, was the implementation of some of the recommendations with substantial delay, while several others were just totally ignored. The strategy that was followed in practice was not coherent. The Government under political pressure made steps to the opposite direction, e.g. by allowing imports of foreign labour and taking reactive measures in response to particular crises (Anon, 1995).

Some efforts to promote cooperation among local firms on a sectoral basis were made with the help of foreign consultants in the early nineties, but the results

were far from spectacular. While specific examples of radical innovation are virtually non-existent, the survey research and the case studies mentioned below found several firms with a relatively good record of incremental innovation in terms of product innovation sometimes for export. There are also many successful examples of local modification and adaptation of imported machinery.

Design, which is important for the development of sectors like clothing and furniture, is licensed, assigned to foreign design firms or copied, but rarely developed locally. The tradition of Cyprus in trade rather than manufacturing has probably acted as a deterrent for the local development of original design and technological innovation.

3.4. Institutions

Innovation related institutions provide the infrastructure, which enables private firms to develop innovations. Institutions can be classified into technological, financial, labour-related and general infrastructure.

3.4.1. Technology-related

Intellectual property rights: In Cyprus till the beginning of the 1990s there was no patent office and inventors had to apply for a patent abroad (usually in the UK) at considerable cost. In 1991, legislation was introduced enabling Cypriots to apply through a local authority to the European Patent Office. Cyprus has also ratified the Convention on Protection of Industrial Property. Trademarks are registered with the department of the Registrar of Companies. Patent statistics in Cyprus is not a relevant innovation indicator, since foreign companies (mainly multinationals) file almost all applications for the registration of patents. The number of applications for patents by Cypriots in other countries (UK, etc.) is not known but probably very small (Hadjimanolis, 1997).

Public R&D in Cyprus is relatively limited as the data presented above indicates. The Agricultural Research Institute established in 1962, carries out applied agricultural research, finding solutions to problems of agriculture and animal husbandry whilst contributing to the technological upgrading of agriculture. It is an important regional research and training center employing 42 scientists. The Institute of Neurology and Genetics is a recently established research center in the health sector. A Cyprus Research Council to promote research in all fields and monitor the allocation of research funds has only recently been formed.

Higher education: Cyprus has one university established fairly recently (in 1992) which includes a school of physical sciences, but not yet one of engineering. The establishment of a school of engineering in the next 2–3 years is currently under study. Research is carried out according to the scientific interests of the academic personnel who have tried from the start to arouse the interest of local industry in their research. Although it is rather early to evaluate the results of their efforts, first impressions as expressed in interviews during the present research, were rather disappointing, at least concerning the response of the manufacturing sector. University level engineers and scientists are in ample supply even though they are graduates of foreign universities in Greece, UK, USA and many other countries. The Higher Technical Institute trains technician engineers in various fields of engineering to a relatively good standard while it also carries out some research of an applied nature mainly in the energy field.

Technological services: The Technology Foundation was created in cooperation with industrial employers' associations. It acts as a broker for technology resources (information, etc.) and promotes a 'Funded Consultancy Scheme', which allows local manufacturing firms to use the services of foreign and local consultants (accredited by the Technology Foundation) on a subsidized basis. The Technology Foundation in cooperation with the Development Bank has also helped to create consortia (networks of local firms), e.g. in the furniture industry (Anon, 1995). The Ministry of Industry and Commerce has an Industrial Extension Service initially designed for the provision of help in technological problems of the industry, but now acting more as a liaison with the major industrial sectors. The Cyprus Standards Institute is pursuing the introduction and monitoring of standards and quality management systems, while an Energy Unit in the same Ministry helps industry, as well as, other branches of the economy with the efficient use of energy.

Training providers include the long-established Productivity Centre and the Cyprus Training Authority. The latter carries out research for the training needs of industry and introduces suitable training programs for industrial workers and managers.

3.4.2. Financial institutions

Cyprus has several commercial banks (both local and subsidiaries of foreign banks). A stock exchange has also been recently created. The Cyprus Development Bank provides loans to manufacturing among other sectors. It has schemes for support of SME including management advice and participation in their share capital. There is no industrial bank specializing in the manufacturing sector and practically no venture capital firms.

3.4.3. Labour-related institutions

Labour-related institutions merit a few words also. There is a high level of labour unionization in Cyprus (around 80–90%). A tripartite agreement between Government, trade unions and industrial employers, formed in the mid-1970s to provide a framework for the settlement of industrial disputes has served the economy well.

3.4.4. General infrastructure

Telecommunication and transportation facilities are at a reasonably advanced level compared with those of industrialized countries and certainly in a much better state than those of many developing countries (Anon, 1995). Energy, however, which is mainly derived from imported oil is expensive, although electricity generation and supply is at a good technical level. Water is relatively scarce, but the water storage and distribution system is very well organized.

From the above brief summary of innovation-related institutions, it can be surmised that there was considerable institutional improvement in the last 15 years, which has considerably enhanced the innovation climate. Much more, however, remains to be done especially within the educational and financial systems.

4. National innovation policy in Cyprus

The industrial and the science and technology components of the National Innovation Policy have been briefly described above in their historical development. Any discussion of NIP in Cyprus must extend beyond the content of NIP (i.e. the mix of tools used to promote innovation) and include the context and process of innovation policy formulation.

4.1. The context of Cyprus NIP

The objective to join the European Union, linked with the current, relatively 'free market' economic approach of the government is shaping the internal context for a NIP and its development. Yet this internal context interacts with the external setting which includes international trends in technology development (e.g. the expanded growth of microelectronics and information technology), the globalization of industrial production, and the changing role of Cyprus within a major regional political and economic bloc (i.e. within an expanding European Union).

4.2. The process of NIP formulation

The public consultation process and the policy environment in Cyprus has a number of peculiarities in comparison with larger states (e.g. Korea, India) which are probably shared with several other small developing countries. For instance, in a small state like Cyprus powerful individuals and interest groups have more opportunities to use their influence during the process of policy formulation than in a larger state. Lobbying practices are also more informal, but no less effective.

To a greater extent than many of their counterparts in other developing countries, Cypriot state officials are well educated, competent and have the necessary management and coordination skills for effective policy formulation. The problem is, in the words of a disillusioned industrialist who participated in recent public/private committees for innovation promotion, that, "most government officials bring their own hidden agendas in meetings and try to promote, primarily their departments' and sometimes their own interests, rather than the stated objectives" (Hadjimanolis, 1997, p. 162). The consequence is inefficiency and delay rather than fast action, despite initial good intentions. Since innovation policy involves, by its very nature, many government departments, it frequently falls victim of power games and vested interests.

4.3. The NIP content

NIP tools can be classified into supply-side, demand-side and environmental measures, according to Rothwell's classification scheme (Rothwell and Zegveld, 1985). In Cyprus, supply-side measures have

been in place for several years now, such as incentives for new product development and investment in new high technology sectors. However, the tax basis of these incentives makes them rather weak due to the extent of tax evasion in the manufacturing sector.

Regarding demand-side measures, such as government purchasing policy for products or services, selection criteria have been based on the lowest possible cost, without even insisting on certain quality standards, let alone promoting the production of innovative products. An example from the paint sector illustrates this point well: — tenders were till fairly recently requested for paint without stating in detail the required specifications and were evaluated on a lowest price criterion only.

Environmental measures, such as the legal/fiscal framework within which industry operates (including for example, the patent system, health/safety legislation, anti-pollution measures) have been given more attention during the last few years, but in most cases the legislation has not yet been fully applied. The institutional framework, which was discussed above, can be considered as part of the environmental measures (although institutions are also frequently the channels of implementation of supply and demand side tools).

4.4. Evaluation of NIP

Evaluation of the effectiveness of currently existing NIP tools and institutions has not yet been attempted as it is probably too early to judge since their effects may take years to materialize. In view of the above description, the term NIP is probably a misnomer and a more accurate expression would be 'innovation-related government policies', because NIP may convey, wrongly, the impression that there is in place a well organized and functioning integrated National Innovation Policy. This is, as already explained *not* the case, neither in Cyprus, nor in several other small developing countries. There is an emergent innovation policy, but which is yet far from being an effective one.

The main problem with NIP in Cyprus seems to be that the current crisis in various export-based industrial sectors (e.g. clothing, footwear, etc.) has led to pressure from industrialists for short-term relief measures (e.g. low interest loans, export guarantees, etc.). These provisional measures could put into jeopardy or postpone the necessary long-term changes such as institutional development, etc.

Another problem is that almost all of the current measures are geared to existing firms, while support for establishment of new high technology, small firms is inadequate. There are also no specific measures for 'micro-firms' (under 10 employees), which form a very significant proportion of all manufacturing firms (88%) and deserve special attention as SMEs do in larger countries.

5. Methodology

A large, purposive sample of 140 Cypriot firms was compiled for a survey of owner/managers' attitudes towards NIP (Hadjimanolis, 1997). The sample was balanced across a variety of features such as size, innovative record, performance, sector, etc. The distribution of the sample firms reflects the structure of the Cyprus industrial enterprises in general and the sample is believed to be a fair representation of the population of manufacturing firms. The interviewees were owners wherever possible (100 respondents) or senior managers (general managers or production/technical managers) of the firms (40 respondents).

A cross-sectoral approach was used with five industrial sectors chosen in order to reflect a broad and representative range of business environments and technological innovation practices. These were: chemicals, plastics, food, clothing/textiles and metals. Together they represent over 70% of the total Cypriot manufacturing value added. Qualitative multiple case analysis was also employed to complement the survey research by providing richer explanations for the correlations found and to account for any unexpected findings. Twenty-five cases were studied, all being drawn from the 140 surveyed firms (Hadjimanolis, 1997, 1999).

6. Research findings

The hypothesis concerning the importance of NIP, could on the face of it, be tested by asking directly the owners/managers of firms whether NIP has influenced or not their innovation performance in the recent past, and which aspects of it are the most

Table 6
Government policy measures to support industry: percentage of respondents in favour of each measure

Policy measure	(%)
1. By being an important customer	22.9
2. By giving subsidies	17.7
3. By regulating prices	8.8
4. By setting standards (e.g. product & safety standards)	30.7
5. By import or export policies	32.1
6. By tax regulations	25.0
7. By industrial policy (e.g. specific plans to support your sector)	22.7
8. Other measures	3.2
9. No government interference	54.3

important for them. In addition, several questions on the questionnaire tested directly and indirectly the reaction of owners/managers to innovation related, government policies.

Some conflicting results were found in the survey. On the one hand, it appears that owner/managers do *not* consider NIP as an important factor affecting the innovativeness of their firms. For example on a multiple choice question, listing various measures of government influence versus non-intervention, the majority of owner/managers (54%) selected the latter as their main response (see Table 6).

The two most important policy measures mentioned by firms are:

- Import or export policy
- Standards (product, safety, etc.) setting

Innovation measures especially new product subsidies and technical guidance were rated as 'grossly inadequate' or 'inadequate' by the vast majority of owners/managers (83 and 74%, respectively) as noted in Table 7. Nevertheless, a few firms had suggestions for additional measures, including sectoral resource centres and technical information centres. Most managers (89%) consider that government policy measures had no effect on the relationships with other firms in their sector. Similarly the majority of managers (68%) do not think that government policy had an effect on the adoption of new technology by their firms. Those who answered that policy had such an effect mentioned that it was mainly due to subsidies or taxation considerations.

Table 7
Rating by respondents of government innovation support measures[a]

Support measures	Responses by owner/managers (%)				
	1	2	3	4	5
R&D subsidies	45.0	37.9	13.6	3.6	–
Tax reliefs	30.0	39.3	22.1	8.6	–
Low cost loans	43.6	27.1	24.3	5.0	–
Technical guidance	38.6	35.7	19.3	6.4	–

[a] Key: 1: Completely inadequate; 2: inadequate; 3: neutral; 4: adequate, 5: excellent.

The general impression from the survey is that Cypriot managers are very skeptical about the effectiveness of government industrial policies. They perceive 'government failure' (in terms of red tape, inefficiency, vested interests of civil servants, etc.) as a major constraint in the development of an effective industrial policy.

On the other hand, most owners/managers are pre-occupied with governmental, industrial and other innovation related policies and have many complaints against, and expectations of, these policies. They agree, for example, with the statements that 'government should support introduction of new manufacturing technology' and 'government should have sector specific strategies'. Regarding barriers to innovation, lack of government assistance is seen as a major barrier, but also governmental bureaucracy (Hadjimanolis, 1997).

The protected nature of the Cyprus economy (especially of the manufacturing sector) in the past has probably generated distorted expectations from government policies. Many industrialists still consider state protection against imports as the most desired feature of an industrial policy. Such views are of course untenable in the light of integration within the European Union.

The matter was further probed through the case study research, which allowed for a deeper investigation of perceptions, attitudes, and reasons for particular behaviour.

The case study material is especially revealing in this respect and suggests that the majority of owner/managers admit that governmental policies have a major impact on the success of their firms. Most probably, however, proactive innovators, according to the case studies evidence, although they take

Table 8
Types of required technical services not offered locally

Type of service	Owner/managers indicating need	
	Number	Percentage
Testing facilities	77	55.0
Calibration (of instruments etc.)	31	22.1
Contract research	17	18.5
Supply of spare parts	75	53.6
Machinery/equipment repair	76	54.3
Other services	1	4.0

advantage of NIP measures, do not rely on them or wait for them in order to go ahead with innovation. When investing in new technology their motives are much more related to their own cost structures and export expansion strategies. Reactive innovators and non-innovators tend to turn more to government for the solution of their problems.

Despite the ambivalent attitudes of the owners and managers of private firms, the conclusion is that NIP indeed matters and influences innovation both directly and indirectly. The direct influence, as mentioned above, is the use that innovators make of the available infrastructure and innovation measures. As examples, the services of the Technology Institute, new product or new investment tax allowances and industrial training, can be mentioned. Regarding the indirect influences, the macroeconomic policies for example, provide a stable investment climate, while the environmental and health protection policies push firms to introduce new technology and methods.

The results of the survey have highlighted a number of problems, which affect the innovativeness of private firms. These can be summarized as:

- Weak linkages among the elements of infrastructure, e.g. university and manufacturing industry (only 11% of firms cooperate with the local university and higher technology institute).
- Inadequate 'innovation specific' technical infrastructure. There is, for example, a relative lack of supply of technical services, as revealed by answers to the relevant question in the survey. The services, which are not offered locally and are in demand, are mainly testing and machinery/equipment repair (see Table 8).
- Relative lack of variety in technology transfer modes and over-dependence on suppliers for technological knowledge (45% of firms mention suppliers as the main mode of technology transfer).
- Low levels of cooperation among local firms of the same sector in new product development (less than 20% of firms cooperate with others) and production (around 30%).

The above constraints confirm for the case of Cyprus, the typical barriers to innovation in small developing countries, as described in Section 2. They suggest that, indeed, the nature of the business environment in a small developing country and the deficiencies of the innovation infrastructure affect the innovation climate and the innovation performance of the local firms.

7. Discussion and conclusions

The brief review of industrial policy in Cyprus has shown that it was fragmented and inconsistent over time. It has failed to pass on the message that the manufacturing sector has either to adapt to an open economic environment or shrink. A national innovation policy in the usual meaning of the term used in industrialized countries was essentially non-existent in Cyprus till the end of the 1980s, while an emergent NIP in the 1990s is not yet fully developed.

Small developing countries offer a rich variety in terms of culture, institutions, technological capabilities, etc. and comparisons cannot be easily made. They share, however, a number of important characteristics arising from their small size, their colonial heritage, and from recent development efforts under the guidance of international bodies such as the World Bank and IMF. These were summarized from the literature in Section 2, while several of them were confirmed by the research in the case of Cyprus, and can be seen as constraints in the development of manufacturing innovation. They have to be addressed by specific measures in the context of NIP as explained below.

Cyprus is an interesting case as a small country in an *intermediate* position between the newly industrialized small countries (Hong-Kong, Singapore, etc.), which have introduced various forms of NIP, and those at the early stages of industrialization, e.g. African small

countries, where NIP is still largely non-existent. The emergent NIP in Cyprus has some interesting lessons for other small developing countries. Firstly, good intentions aside, NIP formulation and implementation remains problematic. The selection of the 'proper mix of tools' is not the end of NIP (as some economists may tend to view it). It is even not just a matter of the capability or intentions of a government to apply some appropriate or even grandiose plans. It must be viewed as a comprehensive and iterative process. In Cyprus it is not a lack of ability on behalf of the civil servants, but rather a matter of conflicting, embedded interests and political considerations which put constraints on NIP implementation. The attitudes of the owners/managers of the private firms are the result of their inflated expectations, the inefficiency of the current NIP measures, as well as, the failure of the government to promote persuasively its proper role as facilitator rather than as 'life saver' or provider. However, it can be concluded that some state role, as catalyst and facilitator of the upgrading process of industry, is necessary in order to overcome the market or institutional inadequacies to which small developing countries are particularly prone.

In the light of the findings and discussion in this paper, some suggestions for policy formulation and implementation within small developing economies are possible. Firstly, the design of NIP has to take into account the following three sets of general guidelines:

- The international best practice as currently applied in the industrialized countries and summarized in the literature (for example in Sagasti, 1989; Nelson, 1993; Dodgson and Bessant, 1996).
- The peculiar conditions connected to smallness and the state of under-development, which favour a foreign technology diffusion orientation (rather than indigenous innovation development) (Andersen and Lundvall, 1988; Streeten, 1993; Hadjimanolis, 1999).
- The particular circumstances prevailing in the specific country as revealed by innovation research at the level of the firm (for example in Hadjimanolis, 1997).

Secondly, the overall aim should be an integrated, consistent and consensual NIP conforming to 'an articulated vision of the future' (Bezanson et al., 1999). Its success presupposes the active participation of industrial firms' owners/managers (through their associations) in all stages both in the formulation and implementation of NIP, and the agreement of all concerned on clear and feasible targets. One of the main targets should be to increase the technological capabilities of existing industrial firms, as a first step of improving their innovation capabilities as it has been often shown that firms with enhanced technological capabilities can better absorb foreign technology (Adeboye and Clark, 1996; Hadjimanolis, 1997). Technology transfer and absorption will remain the major influences on the innovative climate of small developing countries until indigenous innovative activity is established via an effective and balanced National Innovation Policy.

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