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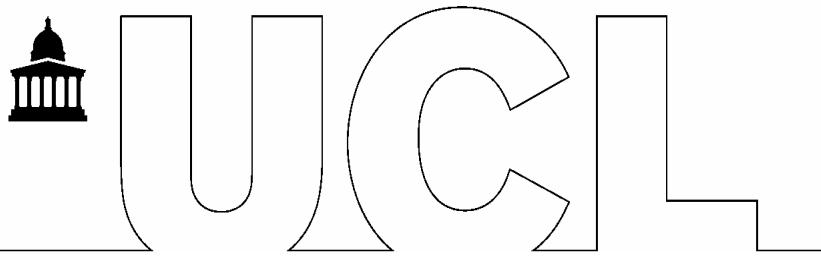

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BETWEEN VISION AND REALITY: PROMOTING INNOVATION THROUGH TECHNOPARKS IN KAZAKHSTAN

Slavo Radosevic* and Marat Myrzakhmet*

* Corresponding author: University College London, School of Slavonic and East European Studies, Gower Street, London, WC1 6BT, Email: s.radosevic@ssees.ucl.ac.uk
** Eurasian National University, Innovation Center, Munaitpasov Street, 010008 Astana, Kazakhstan, Email: mm.ic@emu.kz

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Centre for the Study of Economic and Social Change in Europe
UCL School of Slavonic and East European Studies
Gower Street
London, WC1E 6BT
Tel: +44 (0)20 7679 8519
Fax: +44 (0)20 7679 8777
Email: csesce@ssees.ucl.ac.uk

BETWEEN VISION AND REALITY:

PROMOTING INNOVATION THROUGH TECHNOPARKS IN KAZAKHSTAN[1]

Prof. Dr. Slavo Radosevic[2] and Dr. Marat Myrzakhmet[3]

Abstract

A common motivation for the technopark movement is the belief that technoparks promote innovation and economic growth at regional and/or national levels. The paper analyses the role of technoparks as instruments of innovation promotion in Kazakhstan using data from a firm survey and interviews. Our results suggest that, unlike what is assumed in the innovation policy literature, technoparks do not house firms dealing with the commercialisation of innovations that are ready for introduction to the market. Technopark firms are no more innovative than other firms. They are oriented largely towards the local market, and operate in traditional sectors; the frequency and intensity of their external links are more developed than are their internal links. The key motivations for relocating to a technopark seem to be lower rents and the possibility of accessing finance. Overall, Kazakh technoparks seem to be successful in terms of facilitating business incubation, but much les so in terms of innovation promotion and diversification of the economy. Currently, Kazakh industry does not make any demands for local R&D, and its sources of competitiveness lie in non-R&D activities. This suggests that innovation policy should focus on assisting companies to upgrade their technological capabilities to the level that they can articulate their R&D demands. Focusing on technoparks as the main mechanism to improve competitiveness and diversify the economy is an ineffective and uncertain a policy option at this stage of the country's economic development. However, there seems to be significant scope for supporting business incubation. These conclusions are of relevance to other emerging economies.

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[2] Corresponding author: University College London, School of Slavonic and East European Studies, Gower Street, London, WC1 6BT, Email: s.radosevic@ssees.ucl.ac.uk

[3] Eurasian National University, Innovation Center, Munaitpasov Street, 010008 Astana, Kazakhstan, Email: mm.ic@emu.kz

1. INTRODUCTION

A belief that technoparks promote economic growth resulted in the spread of their different forms in developed countries, particularly during the 1970s and 1980s. This was followed by a proliferation in the so called emerging economies during the 1990s. The original rationale for technoparks was that close physical proximity would create additional value for new technology based tenant-firms (NTBFs). Close daily interaction between tenant firms and providers of incubation and innovation services it was believed would add value to companies in terms of their faster establishment, the easing of initial teething problems, better infrastructure support, and better service provision including easier access to finance, and thus faster growth. In summary, it was believed that technoparks would generate value added by enhancing, in these specific ways, the ability of its tenants to survive and grow in technology-intensive business areas.

However, the development of the technopark movement has generated conflicting evidence regarding their effects. There is, in fact, a huge gap between policy makers' optimism regarding technoparks and their actual performance. There is no consensus on the effectiveness of technoparks, or the value added that they generate for technology based firms on their premises. In part, this is the result of the wide variety of types of technoparks, which range from business parks, through to incubators and science parks and industrial parks. In part, it is due to methodological problems in evaluating the contribution of technoparks to the local economy.

Attempts to copy the technopark model as a way to promote innovation, diversification and competitiveness of the economy are also widespread in the so called transition economies. Given the R&D heritage of these countries, commercialisation of their R&D results would seem logical and rewarding. The technopark movement in these economies was accompanied by programmes supporting different forms of S&T parks many of which were funded by international aid. With the recovery and high growth that occurred during the 2000s technoparks are increasingly being supported by domestic funds or, in the case of new EU member states, by EU structural funds.

Kazakhstan is an example of a fast growing transition economy which has been searching for ways to improve its competitiveness and diversify its economy, which is reliant on oil. The introduction of technoparks has been seen as a way to promote innovation and ensure growth based on local knowledge and innovation. In this respect, Kazakh innovation policy has tried to emulate the successes of technoparks in other countries. However, what is at issue is whether technoparks should be the key mechanisms for promoting innovation and structural change? If the answer is yes, then it is important to decide which model would be the most suitable for economies such as Kazakhstan? If not, then the question is what other support mechanisms should become the priority?

This paper analyses the role of technoparks as a mechanism for innovation promotion in Kazakhstan. Section 2 reviews the literature on technoparks. Section 3 analyses technoparks in conceptual terms, as instruments to promote innovation and

diversification in the Kazakhstan economy. Section 3 analyses Kazakh technoparks based on survey and interviews and Section 4 discusses policy options for innovation promotion and summarises the key points.

2. TECHNOPARKS IN INTERNATIONAL PERSPECTIVE: A REALIST'S OVERVIEW

A number of technopark models co-exist within individual countries, some having evolved from original models over time. The differences between them stem from differences in how they describe themselves, but also in the real differences underlying the technopark vision.

The literature is cluttered with a profusion of terms such as S&T parks, business incubators, technopark and technopoles. Different sources define these organisational forms differently; here we will use the generic term 'technopark', which is in common use in Kazakhstan.

A common rationalisation of the technopark movement is the belief that these institutions promote economic growth at regional and/or national levels. However, there seems to be a huge gap between the policy makers' optimism regarding technoparks and their actual outcomes.[4] Below, we briefly review the literature on this issue.

The Silicon Valley phenomenon is the origin of the technopark ideal. There is a large literature on the rise of Silicon Valley, much of which popularises the belief that it is the combination of a strong research university and entrepreneurship that lies at the root of this well-known area of technology dynamism. However, there are some academic studies whose assessments do not conform to these popular beliefs. In particular, there is a group of studies by British academics who, during the 1980s, analysed the emerging phenomenon of the science park.

In one of the systematic analyses of this phenomenon Markusen et al. (1986, p.177) conclude that: 'one of the most cherished myths of high-tech policy – that a strong research university is the key to high tech growth – seems to be without empirical foundation'. For Markusen et al. public funding of applied R&D coupled with demand from US defence firms, is at the root of the Silicon Valley phenomenon.

The idea that underpins popular beliefs about technoparks, and thus popular understanding about the growth of Silicon Valley, is the *linear innovation model* (ibid). The implicit argument in favour of technoparks is that universities/institutes as generators and repositories of scientific knowledge, and expertise, could transfer, through articulated mechanisms, at least part of this stock to companies. On the other hand, enterprises are not seen as sources of supply of technology, but only as sources of demand for technology.

In contrast to these popular perceptions, innovation studies have shown that firms

[4] For example, the conclusions from a benchmarking exercise on 79 US business incubators (US Department of Commerce, 2003) are that none of the assumed predictor variables appeared to be strongly related to primary performance outcomes (revenues, employment).

need a highly specific kind of knowledge in order to solve their problems (see Dosi, 1988 for an overview). Except where academic departments have developed areas of applied expertise, university knowledge outputs may be either too general or too theoretical and fundamental, and thus too long-term to be easily usable. The knowledge applied by commercial enterprises tends to be firm-specific and cumulative. The cost of assimilating knowledge and technologies from outside a firm in order to incorporate them within the firm is very high, and the idea that academic research is a pool of free knowledge which can be tapped into at limited cost is not sustainable. Where industrial enterprises do have links with academic research, these generally involve long-term relationships and financial support for the research, and are not dependent on close proximity between the firms and the academic institutions (Quintas et al., 1992).

This conceptual critique of the science park movement has been accompanied by its empirical critique. For example, analysis of another widely cited success story – the Cambridge Science Park – argues that 'a science park was not necessary for the growth of high technology firms in the Cambridge area. Such growth occurred through the parts of Cambridge area where no park existed, nurtured by defence and other large state R&D links' (Quintas, 1986a). The assessment of science parks in the UK by Massey et al. (1992) showed that science parks are not major sources of technology development. Detailed case studies suggest that, if anything, most science park firms are diffusing and applying new technologies in the economy in a modest way, rather than being technologically 'leading edge' (Quintas, 1986a, b).

Geographical proximity between a university and a science park seems to count for very little in the promotion of technology transfer. Empirical research suggests that the level of interaction between firms located in science parks and local universities is low, which is the core rationale for S&T parks (see Westhead and Storey, 1995; Vedovello, 1997). Science parks generally do not constitute a significant stimulus for technology transfer from universities to industry (Koenraad, 1991) and have generated only a modest direct contribution to employment (Storey and Tether, 1998).

There are few academic studies of technoparks which give them a positive evaluation. The parks milieu appears to have a positive impact on firm growth as measured in terms of *sales* and *jobs* despite the lack of a direct relationship between the science park location and *profitability* (Lofsten and Lindelof, 2001, 2001b). Westhead and Storey (1995) found that the probability of a firm surviving was higher if the firm had links with a university. Philimore (1999) found that the companies located in a science park usually form networks, and he considers this interaction to be important (see also Sarfraz, 1996).

Any attempt to draw a definite picture of the effectiveness of technoparks as a mechanism for innovation promotion encounters the problem of the huge variety of their forms and objectives. An assessment of French technopoles by Chorda (1996) points to several important departures from the original technopole model as well as two key under-achievements in the realisation of the technopole model – critical size and networking. An assessment of German innovation centres shows that, despite long-term support for these centres, their employment impact is small (Staudt, et al, 1999). The first comprehensive analysis of EU business incubators (EU, 2002) has shown that public support for them is critical. However, the analysis also concludes

that business incubators are a very cost-effective instrument for the promotion of public policy objectives.

Among the catch-up economies, an assessment of Malaysia's *Multimedia Super Corridor* (MSC) showed that it is a prominent initiative to transform the nation into a knowledge-based economy (Ramasamy et al, 2003). Assessment of the Taiwanese Hsinchu Science-based Industrial Park (HSIP) (Xue, 1997) demonstrates its extraordinary success, which can be understood only within the broader economic and technological context of Taiwan's modernisation.

No evaluation of technoparks in transition economies has yet been developed. In the majority of cases, technoparks have emerged as a result of the transformation of former R&D institutes or as local government initiatives. Only occasionally are they the product of private initiatives by individuals or creative groups that have spun-off from large organisations. Practice shows that Polish technology parks are too weak to encourage the reindustrialisation of depressed areas, and their economic weight is insignificant (EU, 2003). The creation of technoparks was implemented in Russia during the 1990s to commercialise its vast S&T potential. However, the high expectations have not been realised, primarily because of weak demand from large firms for the products and services of new technology-based firms (Kihlgren, 2003). Evaluation of a US programme of support of business incubators in *Ukraine* is fairly positive although such investments by the local economic development community would not have been possible, and it is questionable whether success can be sustained once foreign funding is removed (Shelton and Margenbhalter, 2002).

In conclusion, the international experience with support for different types of technoparks is of a few very successful cases, and a majority of cases with mixed success or no success in achieving their stated objectives. There is a huge gap between the enthusiasm of policy-makers for technoparks and actual results. The successful cases suggest that the model that underpins the true technopark is not the linear innovation model, but rather it is an interactive innovation model.[5] Science parks across the world do not operate as sources of ready-made innovations, but rather as places of technology transfer and knowledge support for companies. The success stories seem to arise out of several simultaneous and self reinforcing factors.

3. TECHNOPARKS AS MECHANISMS TO PROMOTE INNOVATION AND DIVERSIFY THE KAZAKHSTAN ECONOMY: A CONCEPTUAL ASSESSMENT

In this section we briefly analyse the role of technoparks as a mechanism for innovation promotion and diversification of the Kazakh economy.

The key difference between the Kazakh national system of innovation and the systems in developed countries is that the R&D capabilities of the former are still mainly located in public organisations rather than enterprises. Table 1 shows the institutional structure of Kazakhstan compared to the EU and North America in this regard.

[5] For example, Hsinchu Industrial Park depends very much on downstream R&D and manufacturing activities.

Table 1: Institutional structure of R&D systems in Kazakhstan, North America and the EU

	Kazakhstan, 2002	North America, 1995	European Union, 1995
Proportion of GERD performed by the Business Enterprise Sector	18.6	**59.3**	**52.5**
- in house business R&D *(zavodskaya nauka)*	4.4	-	-
- construction and design bureaus *(KTB)*	14.2	-	-
Proportion of GERD performed by the Higher Education Sector	22.2	15.6	20.8
Proportion of GERD performed by the Government sector	**57.2**	10.2	16.2
* GERD = gross expenditure on R&D			
Source: OECD, 2000, and Statistical Office of Kazakhstan			

The share of business R&D, which is three times lower in Kazakhstan compared to the developed countries, shows that Kazakhstan is lagging significantly. The share of the business enterprise sector in Kazakhstan in 2000 of 18.6% equates to the Korean situation in the early 1970s, which suggests a lag of around 30 years. During the 1990s, there was no sign of a shift towards R&D being undertaken within firms. In that sense, Kazakhstan has not yet started a transition towards an enterprise-based technology development system.

The underdevelopment of a firm-centred innovation system in Kazakhstan is a big disadvantage for the development of technoparks, as one of the keys to their growth – demand from domestic large firms – is missing.

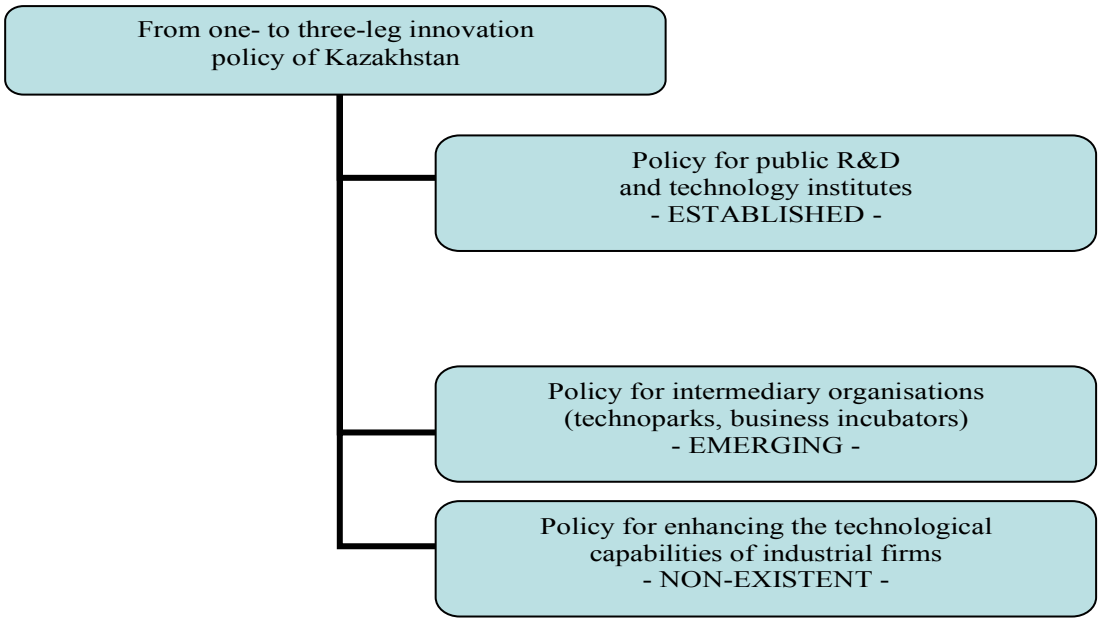
Kazakhstan has introduced some first institutional changes towards a structure of firm-centred innovation capabilities, from the situation when most S&T capabilities were located in public institutes. Policy has attempted to overcome the inherited gulf between R&D and industrial enterprises by bringing them together in National Science Centres, responsible for the implementation of goal-oriented S&T programmes. It is hoped that in this way a direct link will be established between S&T organisations and industrial enterprises. The focus on technoparks represents a continuation of this goal by enhancing *linkages* between R&D and enterprises.

However, Kazakh innovation policy is still predominantly preoccupied with the capabilities and resources of scientific, technological and training institutions that undertake technological activities *on behalf* of industrial firms. Policy measures designed to strengthen the technological activities of *firms* themselves are virtually non-existent. There are still no effective resource allocations or other mechanisms designed to increase firms' abilities to implement *their own* technological learning; strengthen *their own* design, engineering and other technology development capabilities; or undertake *their own* innovative activities.

Kazakhstan's innovation policy features a predominantly 'mono-structural' framework, centred largely on public institutions as the vehicles for implementing industrial technology development policies. Funding of innovation projects undertaken to solve the innovation problems of enterprises only started in 2001. The

government has not yet developed a comprehensive threefold structure of policy which, alongside its focus on the role of public institutions, and recently technoparks, would give similar emphasis to the role of firms as the creators of technology and the generators of underlying skills and capabilities. In conceptual terms we should see a shift from a one to a three-leg innovation policy (see figure 1).

Figure 1. From one-leg to three-leg innovation policy

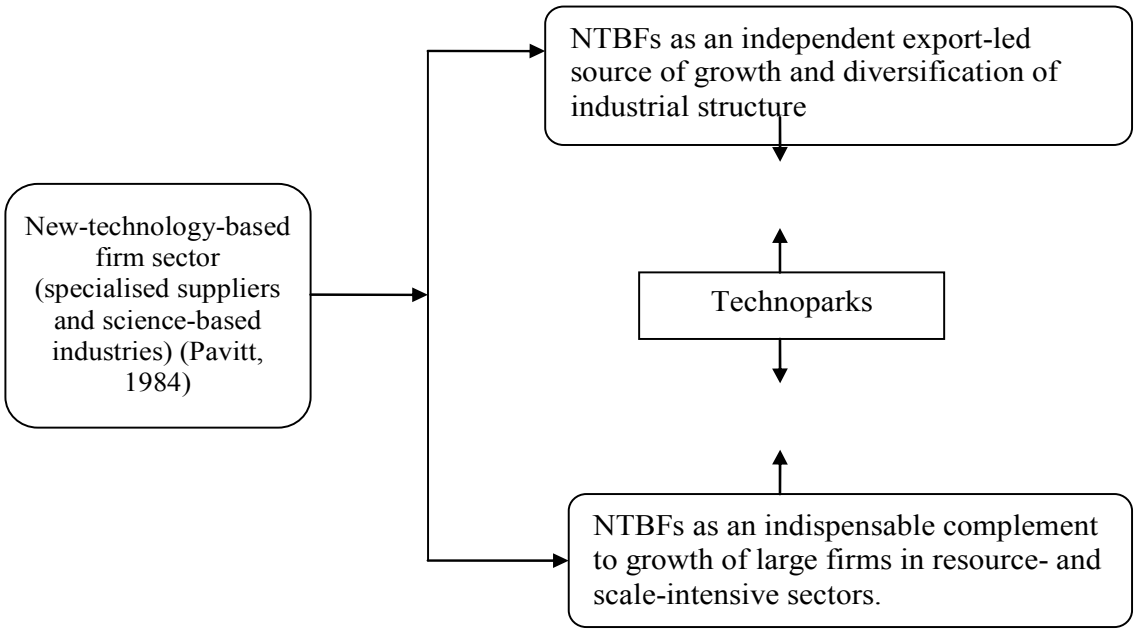


Technoparks and diversification of the Kazakhstan economy

In Kazakhstan, technoparks are expected to become the sources of diversification of the economic structure, which is overly dependent on oil and mineral -based sectors.

Figure 2 shows that NTBFs could operate as an independent export-led source of growth and diversification of the industrial structure (similar to the Indian software industry), or as a complement to large firm growth in resource- and scale-intensive sectors.

Figure 2: How new technology based firms impact on growth and restructuring



Barriers to the growth of NTBFs as independent export-led sources of growth and diversification are quite substantial. In order to appreciate the scale of these barriers, we can take the example of Russia, where a large S&T system has yet to generate any perceptible streams of knowledge-based revenues at the macro-level.[6] Intellectual property rights, standards and technical certifications, systems of guarantees and marketing barriers are some of the more important factors behind the inability of Kazakhstan to exploit its S&T potential internationally, as a source of growth (see Dyker, 2005). Several Kazakh research institutes have developed products with a technology content, such as accelerators and pharmaceutical products, but their further growth in terms of exporting, has been constrained by marketing and technical barriers.

There is an expectation that technoparks could create an environment that is different from the rest of the economy, which would be the source of growth and which would spread to the rest of the economy. Unfortunately, it seems that a range of factors (funding, linkages, knowledge, entrepreneurship, market access, etc) would have to be in place for such a process to take place.

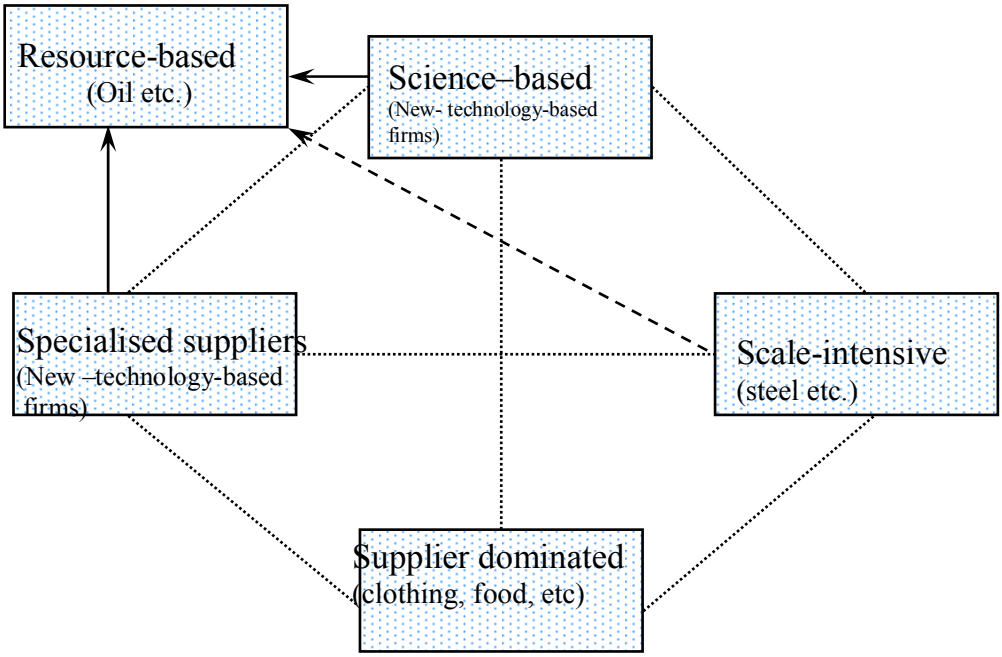
An alternative route is development of the NTBF sector as an indispensable *complement* to the growth of large firms in resource- and scale-intensive sectors (see Figures 2 and 3). The advantage of this route is that NTBFs do not face such high entry barriers, as demand is mainly domestic.
Domestic NTBFs could operate as:

- specialised suppliers for other industries, offering testing equipment, niche products, instruments ('hard' companies);
- consultants or 'knowledge brokers', facilitating adoption of new technologies ('soft' companies); and
- education/training organisations, offering methodologies and instrumentation services ('soft' companies).

In this scenario, the growth of NTBFs is dependent on the growth and restructuring of all four sectors (scale-intensive, supplier-dominated, science-based, specialised suppliers). Figure 3 illustrates why the generation of new sources of growth through NTBFs, and technoparks as mechanisms of support for NTBFs, faces such difficulties. There are limits to the potential for recovery and growth of NTBFs in the absence of demand from other sectors. In CIS countries, in particular, the capital goods sector, which partly overlaps the scale-intensive sector, has not yet recovered, and is, indeed, the least competitive sector. This leaves the resource-based sector as the only source of effective demand for NTBFs.

Figure 3: Sectors of potential demand for NTBF services and products[7]:

[6] The Russian software industry may be an emerging exception.
[7] This classification is based on Pavitt's (1984) taxonomy which here has been somewhat modified to take into account the role of the natural resources sector, which is important for Kazakhstan.



In summary, a lack of demand from other sectors for NTBFs' services and an externalized R&D sector poorly connected to local industrial firms, coupled with endemic lack of demand for local R&D pose constraints on technoparks operating as mechanisms of restructuring and innovation.

4. ANALYSIS OF CURRENTLY OPERATING TECHNOPARKS IN KAZAKHSTAN BASED ON QUESTIONNAIRES

Methodology

The fieldwork that forms the basis for this paper was undertaken between September and October, 2003; the data collection was conducted in 2004. Based on 21 interviews with entrepreneurs, and administrators and two questionnaires designed for technopark managers and tenant firms we have made an assessment of the state of techno-parks in Kazakhstan.

There are currently seven technoparks operating in Kazakhstan. These have emerged through the initiatives of entrepreneurs from public administration, primarily at the local level. Our sample consists of data from five major technoparks (see Table 2). We also collected data from 24 off-technopark firms, which serve as a reference group for some indicators.

Results

Table 2: Identity card of Kazakh technoparks

	Almaty Business Incubator (ABI)	Almaty Technopark (ATP)	Karaganda (KGP)	Petropavlovsk (PPV)	Kostanai (KST)
Year of establishment	1999	2003	1999	2000	2000
Founders	Akimat Almaty	Akimat Almaty	Akimat of Karaganda region	Akimat of North Kazakhstan	Private Enterprises and Individual Entrepreneurs (18)
Legal status	State commercial enterprise	State commercial enterprise	Communal state enterprise	State commercial enterprise	Business Association
Sources of finance	Rents	Rents, services of technopark	Regional budget	Local government, rent	Own funds (100%)
Tenants at establishment	8	27	4	16	1
Tenants as of 2004	30	27	16	46	26
Rate of survival	100	85%		100%	
Utilisation of estate (%)	100%	53%	n.a.	54%	70%
% of commercially active tenants	100%	30%	n.a	n.a.	50%
Joint services	Computer related services, conference hall, restaurant	Restaurant, conference hall	n.a.	Office services, business plan and consulting services	Mortgage and tendering assistance
Estimated turnover of tenant firms	n.a.	n.a.	$88K (2002)	n.a.	$66K (2003)
Estimated value added of TP (scale 1-5)	2.5	2	3.5	3	2

Source: Questionnaire to technopark managers

Kazakh technoparks are relatively young and small endeavours, housing between 16 and 46 enterprises not all of which are commercially active (Table 2). They employ some 200 to over 300 people (Table 3). Based on data for two technoparks we estimate that the average rate of turnover per enterprise is around $5000.

Table 3: Age and working experience of entrepreneurs inside/outside technoparks (TP)

	Age of entrepreneur		Years of working experience in area of venture	
	inside TP	outside TP	inside TP	outside TP
average	43	46	13	15
median	43	48	10	12
max	56	63	35	40
min	28	33	2	1

Source: Questionnaire

Entrepreneurs inside and outside technoparks are post-socialist, i.e. their years of working experience in the area of venture (13 and 15 respectively) coincide with the start of transition. There is no significant difference in the age and working experience in the area of venture between entrepreneurs inside technoparks and the sample of other firms (table 3).

Table 4: Employment and age of firms inside four Kazakh technoparks and outside technoparks

	ABI	**ATP**	**KGP**	**PPV**	**- in technoparks**	**- outside technoparks**
Employment	254	335	337	191	1117	1781
- Median	7	8	7	3	9	32
- Average	11	13	11	4	12	61
- Max	34	50	43	12	50	250
Age - average	7	3	2	n.a	5	14
Age - median	6	3	2	n.a	4	9

Source: Questionnaire
Legend: see Table 1

Firms inside parks are on average much smaller and younger than firms outside parks (Table 4). The average employment in firms inside technoparks is 12 and outside it is 61 (table 4). Also, firms outside technoparks are much older with on average of 14 vs. 3 years. This contrasts sharply with the very similar number of years of experience in business (13 vs 15 years) and similar average ages (43 vs 46 years) of entrepreneurs in firms inside and outside technoparks.

Table 5: Firms inside/outside technoparks by type of activity

	Firms inside technoparks							
	ABI	**ATP**	**KGP**	**PPV**	**Total**	**Shares**	**Firms outside technoparks**	**Shares**
Manufacturing	9	5	12	45	71	55%	30	91%

Services	3	7	3	45	58	45%	3	9%
Total	12	12	15	90	129	100%	33	100%

Source: Questionnaire
Legend: see Table 1

Almost half of firms inside technoparks (45%) are service oriented while our sample of firms outside technoparks mainly includes manufacturing or product oriented firms (Table 5). This partly explains the big differences in the average sizes of the two groups of enterprises (Table 4). This manufacturing–service structure is in line with the situation in technoparks in the US and Europe, where a large proportion of tenant-firms are service providers. This structure undermines the original idea of technoparks as places where the key activity is commercialisation of new technologies and their transformation into new products. A specific feature of Kazakh parks is that they are also inhabited by low-tech firms active in traditional areas (Table 6). In terms of activities, and excluding pharmaceuticals/medical services and IT services, traditional products and services dominate.

Table 6: Activities of tenant-firms in four technoparks

Furniture production and repairs	21	Transport services	4
Pharmaceuticals and medical services	11	Printing and copying services	4
Souvenirs and musical instruments	8	Advertising services	3
Sewing services/clothing	7	Training services	2
Technical and electric services	7	Legal services	2
IT services	6	Other products	6
Metal parts	5	Other services	6
Trading services	4	Not classified	10
Catering services	4	**Total**	110

Source: Questionnaire

Technopark firms are largely oriented towards the local market. On average, 90% of their sales are destined for the local market and only 9% for the national market (table 7). This pattern was fairly similarly for three technoparks for which we have data.

Table 7: Destination of sales of firms in technoparks across markets

	Local	**National**	**Foreign**	
Average	90	9	1	100
ABI	67	29	4	100
ATP	100	0	0	100
KGP	98	2	0	100

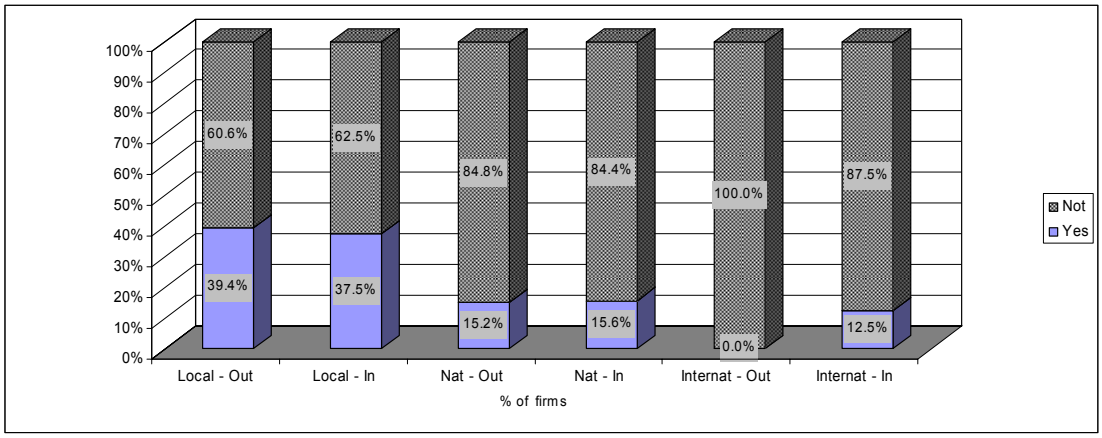
Source: Questionnaire, 36 replies
Legend: see table 3

We collected data on product novelty from firms inside and outside technoparks in

different markets (local, national and international). Figure 4 shows that 39.4% technopark firms are local innovators, and 15.2% are national innovators. Interestingly, among small number of firms oriented towards the foreign market 12.5% are international innovators. However, apart from a few producers of Kazakh national souvenirs and musical instruments, which do represent innovation in the world market, there were no technology innovators.

A comparison of innovativeness between firms inside and outside technoparks (ignoring the above mentioned marginal number of souvenir and musical instrument producers) shows that they are very similar (figure 4). Thus, technopark firms are no more frequent innovators than firms outside technoparks.

Figure 4: Novelty of products of firms inside and outside technoparks on local, national and international markets



Source: Questionnaire

Firms are quite realistic about why they choose to relocate to a technopark. Lower rent and better image rank highest (4.1. and 4.0 respectively). Although firms do not expect that location in a technopark will significantly improve their access to finance (average importance is 2.9) they have expectation in terms of appropriate business services. The frequency of these factors varies across firms as seen by number of firms that responded positively to individual factors. Rent is relevant for only 50% of firms (Table 8), but for these 50% it is a very important factor. The difference between the importance ascribed to an individual factor and the share of firms for which it is relevant suggests that the firms surveyed are in very different situations. For some, cash flow and thus rent is the most important while for others it is image and through this possible access to external finance that matters.

For firms outside technoparks, rent does not rank as an important cost. Only 7 out of the 24 firms (36%) outside technoparks that we surveyed indicated rent to be an important cost. This may reflect the larger size and greater maturity of off-technopark firms, and possibly a higher degree of business success, which in some way adds force to the argument for hosting firms in technoparks to reduce start-up costs. However, lower rents are probably not a good enough justification for investment in technoparks, as this problem could be solved simply by subsidising firms' rents, no matter where they are located.

Table 8: Importance and frequency of motives for relocation to technopark

(scale 1-5)

No of firms = 34	Rent	Finance	Location	Infrastructure	Services	Image
Average	4.1	3.0	3.7	3.8	3.9	4.0
ABI	4.3	3.0	3.1	3.9	4.1	4.1
ATP	3.9	2.5	4.2	3.6	3.8	4.4
KGP	-	3.3	4.0	4.0	3.9	3.8
No of firms	19	26	21	21	30	26
Share of respondents	50.0%	68.4%	55.3%	55.3%	78.9%	68.4%

Source: Questionnaire

Access to finance and access to technology were indicated by 87% and 79% of firms respectively as the key barriers to growth (Table 9). Access to foreign markets and infrastructure were not seen as important. As technopark firms are predominantly local market oriented this latter result is not surprising. The small share of firms reporting infrastructure services as a major barrier (38%) suggests that the services that are available to them in technoparks are not essential to their growth.

Table 9: Importance and frequency of barriers to growth of firms in technoparks (Scale 1- 5)

No of firms = 34	**Finance**	**Technology**	**Infrastructure**	**Access to foreign market**
Average	3.8	3.3	3.1	2.9
ABI	4.6	3.3	3.2	3.1
ATP	3.1	2.7	3.0	2.6
KGP	3.5	3.6		
No of firms	34	31	15	14
Share of respondents	87%	79%	38%	36%

Source: Questionnaire

For firms outside technoparks finance and access to foreign markets are the most important factors affecting growth (Table 10). This is to be expected given that these are larger firms, the majority of which are in manufacturing.

Table 10: Importance of barriers to growth of firms in and outside technoparks (scale 1- 5)

	Finance	**Technology**	**Infrastructure**	**Access to foreign market**
- in TP	3.8	3.3	3.1	2.9
- out TP	4.8	3.0	1.0	4.4
No firms out TP	14	5	1	5

Source: Questionnaire

Technoparks generate added value, to the extent that they enhance the ability of their tenants to survive and grow in business. Responses from technopark firms point to a

favourable perception of the value added from location in a technopark (average rating 3.5) (see Table 11). The perception of value added from technoparks for firms outside technoparks is very similar (3.6). However, the perception of technopark directors is somewhat lower ranging between 2 and 3 (see Table 1). This may point to there being a much greater potential for creating value added for firms than is actually realised.

Table 11: Assessment of value added by technoparks (TP) of entrepreneurs in and out of TP (scale 1- 5)

	In TP	Out TP
No firms	24	23
average	3.5	3.6

Source: Questionnaire

Data on use of services from firms in two technoparks show very different rates of use. Almost all of the 16 Karaganda technopark firms have used the various services available, while only 20% of Almaty technopark firms have done so (table 12).

Table 12: Number of firms' users of services of technoparks

	Consultation	Business Plan	Office Services	Finance	Other
ABI (30 firms)	6	3	6	1	1
KGP (16 firms)	15	15	15	11	0

Source: Questionnaire
Legend: see table 3

Linkages among firms within technoparks are part of the value added offered to tenants is. Table 13 ranks the frequency and perception of intensity of linkages with firms inside the technopark, as well as linkages with firms outside the technopark. In our sample 46 firms claimed to have links with firms outside the technopark, 31 with firms inside the technopark and 23 with higher education institutions. The presence of several pharmaceuticals firms increases the importance of links with higher educational institutions and research institutes. The greatest intensity of linkages is with firms outside the technopark. Links are very strong in terms of both joint development and production, most often materials purchase The frequency and intensity of linkages among firms outside the technopark with other firms, are stronger than the links among technopark firms. In addition, the intensity of linkages of firms outside technoparks with higher education institutions is surprisingly strong when compared to technopark firms (Table 13).

Table 13: Links with firms inside and outside technoparks: frequency and intensity (scale 1-5)

		Firms inside TP (n=25)		Firms outside TP (n=25)	
		No of firms	Average intensity	No of firms	Average intensity
Other TP firms	Joint Production	16	3.5		
	Joint Development	12	3.0		

	Other	3	1.7		
	Total	31	-		
Higher Education	Joint Production	9	2.7		
	Joint Development	10	2.5	5	4.6
	Other	4	1.3	8	4.3
	Total	23	-	13	-
External Firms	Joint Production	19	4.5	23	5.0
	Joint Development	23	4.1	4	
	Other (purchase)	4	2.5	11	5.0
	Total	46	-	38	-

Source: Questionnaire

A higher ranking for linkages with Kazakh firms outside rather than inside a technopark is compatible with the results in the international literature, which has shown that the linkages among firms within S&T parks are weak.

In summary, the data, although based on a limited sample, confirm our intuition based on interviews with tenant-firms and technopark managers. Technoparks have roughly equal numbers of firms involved in production or service provision. They operate mainly in traditional activities, and, except for a few pharmaceutical SMEs, do not match the image of technoparks as places for the commercialisation of new technologies. Firms within technoparks are not more innovative than firms outside technoparks. Technopark firms have stronger with firms outside technoparks than inside. Firms outside technoparks have stronger links with higher education institutions than firms inside technoparks. Technopark firms are younger than firms outside technoparks. Many are hampered by cash flow problems and see lower rents as an important benefit. Those firms that are better of in terms of cash flow see image as the key benefit possibly indirectly facilitating their access to external finance. The scope of technopark services offered and used differs widely across technoparks. Overall, Kazakh technoparks operate as business incubators for locally oriented firms in traditional sectors, rather than centres of innovation promotion and diversification of the economy.

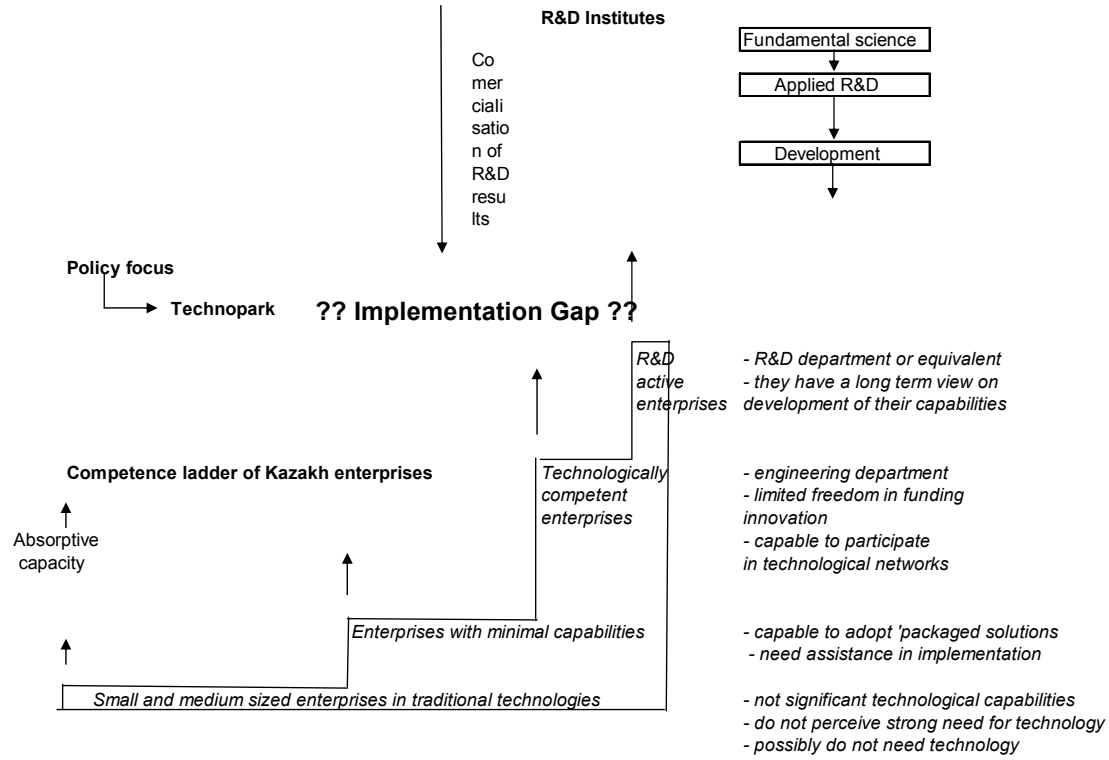
4. POLICY ISSUES AND CONCLUSIONS

Kazakhstan has embarked on the transition from a public R&D driven to a firm based innovation system. This transition can neither be understood nor successfully implemented within the logic of the linear innovation model, which is the basis for current Kazakhstan innovation policy. The strong emphasis on technoparks is understandable within the logic of the linear model. We consider this policy foundation to be serious weakness, as it does not reflect the needs of the actual innovation process.

Figure 7 depicts the nature of the problem by highlighting the implementation gap between the capabilities of Kazakhstan enterprises and the nature of 'supply' from R&D institutes. The majority of Kazakhstan's enterprises are either SMEs in traditional technologies, many of which are located in Kazakhstan's technoparks, or enterprises with minimal capabilities. Only a very small number of enterprises are

technologically competent, and only a few enterprises are conducting R&D. The number of people in enterprises that are engaged exclusively in R&D is only 378, or 2.5% of the total number of R&D workers in Kazakhstan (Kembaev et al. 2001, Table 14, p. 30). In addition, R&D institutes are rarely able to provide R&D results in a form that would be useful to industrial firms, especially given the latter's limited absorptive capabilities. There is a belief that technoparks should be able to bridge the gap between the limited absorptive capability of enterprises and the research outputs of the R&D sector.

Figure 7: The linear innovation model logic that underpins the innovation policy of Kazakhstan and its problems[8]



In practice, the size and nature of the implementation gap remains a huge problem within this policy framework (Figure 7). The *'Catalogue of innovation developments recommended for introduction'*, published by the Ministry of Education and Science (2003) illustrates the problem. This catalogue collects the most promising commercial developments from the Kazakhstan R&D system (Table 14).

Table 14: Catalogue of innovations developed within the public R&D system of Kazakhstan

	Number	Share
Developments ready for introduction	41	20.0%
Developments that have passed industrial pilot stage	50	24.4%
Developments that have passed experimental stage	46	22.4%
Developments at the technical documentation or patent stage	68	33.2%
Total	205	100.0%

[8] A competence ladder section is based on Arnold et al (2000).

The catalogue data show that only 20% of developments (41 out of 205) are ready for introduction from a technical point of view. Our interviews with local specialists who are familiar with Kazakhstan's technology market suggest that only one or two R&D results from this list are of interest commercially. Of course, this is very imperfect and possibly very partial assessment, but it nevertheless given an indication of the nature of the problem, and again raises the question of whether the lack of innovation in the Kazakhstan economy can be resolved within the logic of the linear innovation model. How far can R&D institutes be pushed to substitute for firms by commercialising the results of their R&D? Could the solution lie in re-framing the problem and orienting policy more firmly towards innovativeness within industrial firms?

Supporting the emergence of new-technology-based businesses via the formation of new organisations (cf. technoparks) is a quite risky and not the most effective strategy to promote innovation in emerging economies. Very often, the bulk of the money going into technoparks is invested in buildings, while other tasks – generating synergies among firms, bringing in innovative projects and developing incubation services – are awarded secondary status or not supported at all.

The key point is to distinguish between support for technopark *activities* (cooperation with R&D and higher education institutions, active management of technology transfer, support for technology-intensive activities) and support for technoparks as *organisations.* Rather than being focused on technoparks as organisations, policy must focus and prioritise its support first, on innovation projects (grants), second, on the people who will be involved in managing innovation projects (skills), and, third on supporting technoparks as organisations.

Technoparks are not places that facilitate commercialisation of innovations ready for the market. There is danger that policy may be driven by simplistic models rather than an in-depth understanding of local needs and conditions. As Quintas et al. (1992: 18) point out: 'Bridging between academic research and commercial activity is unlikely to be easy or costless, and constructing buildings is unlikely to provide an adequate mechanism. Property development gives the impression that linkage is happening when in fact it is not'.

The record of business incubation by Kazakh's technoparks seems better than that of support for innovation via new technology-based firms. In fact, Kazakh technoparks are generally operating as business parks with large scope for improvements in terms of business incubation services. Support for business incubation would be justified in Kazakhstan under present conditions, followed by a gradual introduction of support for new-technology-based firms. Only exceptionally, where the conditions for a genuine technopark are met, i.e. in those cases that can gather a critical mass of new-technology-based firms (usually attached to a research institute or university) could support for technoparks be justified.

It is unrealistic to expect that the growth generated within technoparks will spread to neighbouring regions, or that technoparks alone can become sources of diversification of the economy and innovation promotion. The major difference between the situation in Kazakhstan and the majority of successful examples of technoparks is the (non)existence of domestic demand for R&D and technology-based activities. Currently, Kazakhstan industry does not have a demand for R&D, and its sources of

competitiveness lie in non-R&D activities. This suggests that innovation policy should assist companies in upgrading their technological capabilities to the level that they can articulate their demand for R&D. Without this step, focusing on technoparks as a mechanism to improve competitiveness and diversify the economy may be far too expensive and uncertain a policy option at this stage of economic development.

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