Barriers to innovation for SMEs in a small less developed country (Cyprus)

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Abstract

The present research, conducted in Cyprus, a small less developed country, concentrates on the barriers approach to innovation. The importance of barriers, as perceived by the firms' owners/managers was, rather surprisingly, not statistically correlated either to innovativeness, economic performance or the extent of the horizontal networking. The study of barriers offers, nevertheless, some interesting clues to the innovation practice in small less developed countries. Some similarities with barriers in industrialized countries (e.g. in supply of finance and skilled labour) were found, but many differences as well, as expected from the peculiar environment of a less technologically developed country. The role of Government policies is of particular importance. © 1999 Elsevier Science Ltd. All rights reserved.

1. Introduction

While firms in less developed countries, in the recent past, were operating within a relatively protected environment, they must now face the global forces of competition. The globalization of the markets requires the adaptation of firms in order to survive. Even small firms have to introduce new products of higher quality and take advantage of new technology. Innovation is a difficult undertaking, especially for firms with little experience and limited resources.

Small firms in less developed countries have to face in addition to the liability of their size, the limitations of an inadequate infrastructure. The study of innovation, including the obstacles to its successful implementation, while relatively well researched in the industrialized countries is rather neglected in less developed countries (Bell and Pavitt, 1992).

The present research was conducted in Cyprus, a small less developed country. It is located in the eastern end of the Mediterranean Sea and has an open and relatively well-developed economy with a high per capita

income (US$13 000 in 1997). It is classified as a "high income economy" in the World Development Report of 1997.

The next section introduces the barriers approach to innovation. The methodology is then presented, followed by the results of the study. The findings are compared with those of the literature and the last section presents some conclusions and recommendations for policy makers and managers.

2. The barriers approach to innovation

One of the several different approaches to innovation concentrates on the main barriers, i.e. obstacles, to innovation usually as perceived by the top managers of the firms. This approach is sometimes extended to include factors motivating innovation, i.e. facilitators. The aim of the research on barriers is initially to find out about their nature, origin, and importance. It attempts then to identify their point of impact in the innovation process and to measure their effects or consequences. The measurement of effects is the really difficult part.

Barriers can be classified in various ways, a usual one differentiates between external to the firm or exogenous

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and internal or endogenous ones (Piatier, 1984). *External* can be further subdivided into supply, demand and environment related. Supply barriers include difficulties in obtaining technological information, raw materials, and finance. Demand barriers have to do with customer needs, their perception of the risk of innovation, and domestic or foreign market limitations. Environmental ones include various government regulations, antitrust measures, and policy actions.

Internal barriers can be further subdivided into resource related, e.g. lack of internal funds, technical expertise or management time, culture and systems related, e.g. out-of date accountancy systems (Rush and Bessant, 1992), and human nature related, e.g. attitude of top manager to risk or employee resistance to innovation.

Barriers may act on one or more points of the innovation process. If this process is visualized as a simplified linear sequence of stages from the adoption of innovation through implementation, the effect of a barrier is probably higher in one stage rather than another. For example lack of finance will probably have a greater effect on the implementation stage.

The assumption behind the barriers approach is that once inhibitors of innovation are identified, their effect is understood and action is taken to eliminate them, then the natural flow of innovation will be re-established. Innovation, however, demands motivation, extraordinary effort and risk acceptance to proceed (Tidd et al., 1997). It is not an automatic or spontaneous process. Barriers may even act as innovation stimulants in some cases rather than inhibitors.

Successful innovation has been associated with subsequent growth and therefore performance of the firm (Freeman, 1982). It is expected then that barriers to innovation will also affect negatively the economic performance of a firm. The reservation for their possible positive effect on the success of innovation in some cases makes, however, the direction of association between barriers and performance inconclusive.

Small and Medium Enterprises (SMEs), even in industrialized countries, are expected to face relatively more barriers to innovation than large firms due to inadequate internal resources and expertise. This is why more emphasis has been given to SMEs in studying their barriers to innovation. SMEs need, therefore, to obtain technology and resources from external sources through strategic networks and as a consequence the interactive character of innovation in their case is even more intense than in large firms (Rothwell, 1991). It is assumed that the higher the importance attached to barriers, the higher the networking propensity. In less developed countries SMEs face, apart from the above-mentioned problems, the inadequate technological and policy infrastructure. Studies on barriers to innovation in such contexts are relatively rare. There are, however some studies on barriers to growth (e.g. Levy, 1993) and technology development (Lall et al., 1994) which are of some relevance.

A major study in the literature following the barriers approach, in industrialized countries, is that of Piatier (1984) which, although rather dated by now, is still valuable as a reference. It is briefly reviewed below in order to use it later as a comparison yardstick to the findings of the present research. Cyprus already has a Customs Union and has applied for full membership of the European Union. It also has strong cultural and trade links with Europe; therefore a comparison with its trading partners is appropriate.

The "Piatier" study, carried out for the Commission of European Communities, under the title "Barriers to innovation in SME" includes work done by several researchers in eight countries of the European Economic Community. A consolidation of the individual national reports, despite its problems (due to differences among countries in industrial structure, complexity of innovation operations and the sheer variety of barriers and their perception) identifies some major barriers to innovation common among the countries involved. These include the effect of education and training upon employment in enterprises, the effect of action by banks upon the financing of the innovation, the effect of action by venture-capital companies upon the financing of innovation and norms and standards-product controls-effect upon the manufacturing of new products.

The report has also investigated the origin and impact of barriers. The origin of barriers is mainly attributed to: (a) general legislation and bureaucracy, (b) norms and standards, (c) corporate culture attached to the role of the head of the enterprise, (d) information on science, technology and patents. Impacts are mainly on finance, manufacture and manpower. General government action, which is estimated to cause about half of the difficulties experienced, has its strongest negative impact upon the downstream end of the innovation process (i.e., distribution and exports). On the basis of these results the report recommends an innovation strategy and detailed measures for support of innovation in SMEs.

It is interesting to note the effect of problems caused by government action at the marketing end in the above report and their policy repercussions. Innovation policies usually concentrate upon the initial stages of the innovation process and fail to consider barriers during the commercialization stage, which may prove the critical one.

The present study concentrates on the identification of barriers and their ranking in terms of importance by managers. It tries to identify factors underlying the perceived barriers and tests differences in factor scores across sectors and size groups of firms. An attempt is made to go beyond the mere listing of barriers and test some hypotheses. The impact of barriers, a complicated issue, is not further considered here.

Firms are embedded in socioeconomic networks (Granovetter, 1985), consisting of enduring webs of relationships with customers, suppliers, financiers, trade associations etc. The inter-organizational linkages, the "building blocks", of networks can be *vertical* (exchanges between firms at different stages of production), horizontal (between firms of the same sector producing similar products) or *lateral* (between production-wise unrelated firms). Vertical linkages, especially with foreign suppliers, are certainly very important for overcoming barriers to innovation for firms in a small less developed country. The importance of horizontal linkages, i.e. formal and informal cooperation in product development, exchange of knowledge and information, is more controversial. Empirical studies on innovation in networks (Biemans, 1992) and on the importance of cooperative or competitive behaviour for innovation (Dickson et al., 1993) have produced mixed results on the existence and importance of horizontal links. Therefore only the relationship of barriers to horizontal networking is considered here.

From the above discussion the following hypotheses can then be formulated:

H1: The higher the importance of the external barriers as perceived by the owner/manager, the lower the innovativeness of the firm.
H2: The higher the importance of the external barriers as perceived by the owner/manager, the higher the horizontal networking intensity of the firm.
H3: The higher the importance of the external barriers as perceived by the owner/manager, the lower the economic performance of the firm.

3. Methodology

In the small island economy of Cyprus small firms, strictly speaking, are those under 10 employees. Since the aim of the survey was to study firms with important innovation efforts the concentration on micro-businesses would not serve this purpose. For our purposes small are those with 10-50 employees and medium between 51 and 100. Even medium firms in Cyprus are small by European standards. According to the definition adopted by the European Union (as of January 1995) small firms are those with up to 50 employees and medium 51-250). A number of micro-businesses (below 10 employees) and "large" firms (over 100 employees) was also included for comparison purposes and in order to have a fuller picture of the Cyprus economy as a whole.

A random sample is the ideal for a research project, but in this case it was difficult (if not impossible) to achieve for a number of reasons: (a) access to firms was important for completion of a long and detailed questionnaire, (b) a balance was also aimed in terms of innovative/less innovative firms in the sample (or at least the inclusion of several truly innovative firms, which are a rather rare species in the Cypriot context). Information from industry experts (e.g. from the Industrial Extension Unit of the Ministry of Trade and Industry and other sources) was used for the inclusion of innovative firms. Kim et al. (1993) give a similar argument, i.e. the low level of technological capability/innovation of small firms in Korea as a reason why a probability sampling plan would result in the inclusion of too few innovative firms.

A large (140 firms), carefully balanced, judgemental (purposive) sample was then used. Balance was aimed 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 fairly representative of the population of manufacturing firms.

A cross-sectoral approach was used to determine any variations in innovation performance and characteristics caused by industrial sector specific factors. Five industrial sectors were chosen in order to reflect a broad and representative range of business environments and technological innovation practices. These are: chemicals, plastics, food, clothing/textiles and metal. They represent together over 70% of the manufacturing value added.

A questionnaire of 20 pages was constructed and pretested with 12 firms. It was then adjusted, corrected and re-worded according to the results of the pilot testing. This procedure aimed to increase the content validity of the questionnaire. The results of pilot testing were *not* incorporated in the survey data.

The interviews for the questionnaire completion were face-to-face, since it was felt (rightly as was later realized) that the response rate with a postal questionnaire of such length and complexity would be unacceptably low. The interviewees were owners wherever possible (100) or senior managers (general managers or production/technical managers) of the firms (40).

The study included many variables, but in the limited space of this article only those related to barriers are mentioned. Such variables are the innovativeness, performance, and the measure of external barriers, as well as a scale measuring the horizontal networking. The innovativeness (NPDIN) scale has been adapted from Deshpande et al. (1993). It measures aspects of the innovation strategy of the firm and indirectly the novelty of the firm's products. The manager is asked how often the firm, in new product introduction, is: (a) first-to-market with new product, (b) later entrant in established, but still growing markets, (c) entrant in mature, stable markets, (d) at the cutting edge of technological innovation. A summated scale is thus constructed with scores for the third item reversed. The scale, although subjective, avo-

ids problems of measuring e.g. product innovativeness across different sectors. Its validity was tested by confirming that it is significantly correlated to separately constructed product and process innovativeness indicators.

The scale for performance was adapted from the same source as above. It is a summated scale based on the subjective evaluation of the owner/manager of the firm's position against the largest competitor in terms of profitability, size, market share and growth (BENCHSUM). The scales for barriers and networking were specially constructed for this research (Hadjimanolis, 1997).

The summated scale for the perceived importance of barriers (EXBARSUM) was based on a large number (25) of them as reported in the literature (Table 7 in Appendix A). The measure for horizontal networking is based on the importance attached to relations with various types of firms (local in the same area, other Cypriot, or foreign), but all in the same sector.

4. Results

4.1. External barriers

4.1.1. Hypothesis testing

The hypothesis that the higher the importance of the external barriers as perceived by the owner/manager, the lower is the innovativeness, is tested by calculating the correlation of variables: Innovativeness (NPDIN) and Importance of Barriers (EXBARSUM) ($r = 0.12$, $p = 0.085$). The coefficient r is low and not statistically significant, therefore H1 is *rejected*.

The reason may be that innovative firms although facing important barriers tend to find ways to overcome them, while non-innovative firms which do not make serious efforts to innovate tend to underestimate (or not be aware of) the pitfalls/problems associated with innovation in the Cyprus context. Similarly Garsombke and Garsombke (1989), report that low technology firms in their sample saw fewer barriers to technology, while high technology users were more cognizant of external and internal barriers.

The importance of barriers does not seem to induce firms to develop their networking relationships, at least the horizontal ones (H2). No correlation was found between the corresponding variables ($r = 0.05$, $p = 0.289$). The literature suggests that firms facing barriers to innovation, especially SME, tend to use network relationships to overcome these barriers, for example Malerba and Torrisi (1992) and Biemans (1992). In Cyprus firms are probably using mainly their vertical network relationships, e.g. with suppliers and customers,

rather than horizontal ones with firms in their own sector, in order to alleviate the adverse effects of barriers.

The perceived importance of external barriers is not correlated to the performance of the firms as per H3 ($r = 0.01$, $p = 0.452$). The reasons are probably similar to those mentioned in the case of innovativeness above.

4.1.2. Descriptive data

4.1.2.1. External barriers in the adoption/development of innovations
The five most important external barriers to innovation as viewed by firms (percentages below show "important" and "very important categories" combined) are shown in Table 1.

It is interesting to note that two of the top five external barriers as ranked by the Cypriot owners/managers (i.e. financing of innovation by banks and shortage of skilled labour) are broadly similar to two of the top five barriers as summarized by Piatier (1984) for a study that covered eight industrialized countries of the then European Economic Community (Table 1). The role of government is also common, although in the EEC it was mainly the regulation aspects (norms and standards) that were emphasized. For a proper comparison it should be noted that in Cyprus venture capital companies are practically absent. In a small country like Cyprus innovation is largely incremental and therefore "too easy to copy". There is therefore a major issue of "the appropriability of returns to innovation" (Teece, 1986) i.e. the extent to which innovations can be protected from competition. Fast introduction of new products to markets and secrecy are some of the ways of protection against innovation copying.

Inadequate financing as a problem, especially for new product development, is a common complaint due to the attitude of commercial banks, which insist on collateral for their loans. This is not the case for new machinery, which is used as collateral, although it is also a barrier for the improvement of old machines or the local construction of machinery.

Some of the top barriers in the present research are similar to those found by Lall et al. (1994) in a study in Ghana, a developing country. They were investigating barriers to the development of technological capability of firms, which is related to innovation capability. Barriers included financial constraints, lack of managerial skills, shortage of skilled technicians and lack of local linkages.

4.1.3. Attitudes to government policies

Several questions in the survey probed the attitudes of SME owners/managers towards government policies and relevant action (or inaction) to support industry. Government policies have a central place in the managerial preoccupations. There is, however, an ambivalent attitude towards government action. The findings have to be interpreted bearing in mind the high expectations

Table 1
External innovation barriers

Top five barriers in INNOCYP research	Top five barriers in EEC Piatier (1984)
1 Innovation too easy to copy (83.6%)	Effect of education and training upon employment in enterprises
2 Governmental bureaucracy (76.5%)	Effect of action by banks upon the financing of innovation
3 Lack of government assistance (72.9%)	Effect of action by venture capital companies upon the financing of innovation
4 Shortage of skilled labour (71.4%)	Norms and standards—product controls—effect upon the manufacture of new products
5 Bank policies on credit (71.4%)	Norms and standards—product controls–in other Community countries; action on exports to those countries

of Cypriot firms from government, reflecting their experience of the protected local market of the recent past.

Over 50% of the firms do not feel any government supportive measures and the majority consider the current innovation measures as inadequate. Most firms (68%) mentioned that Government Industrial Policy did not affect their decision to adopt new technology. These results differ from the results of the STRATOS project (STRATOS Group, 1990), (a study of European small businesses) which reports that 54.9% of the SME perceive government interference, in a supporting sense, (against 45.7% in our sample). Giving incentives was the most important role of Government in STRATOS research, while for Cypriot firms it was the import/export policy, the latter refers mainly to import protection.

4.1.4. Factor analysis of the external barrier perceptions of owner/managers (25 items)

This analysis seeks to find factors related to external barriers to innovation as perceived by the owner/manager.

4.1.4.1. Assumptions of factor analysis
(a) Bartlett test of sphericity: 1163.9607. Significance = 0.00000. Correlations significant at 0.0001 significance level. (b) Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.70809 in the acceptable range (well above 0.50) (Hair et al., 1995). Therefore the assumptions for carrying out factor analysis are met.

Eight factors were extracted in the unrotated factor solution with eigenvalues (latent roots) over 1. These eight factors explain 65.3% of the variance. Two of the items were rejected (Exbar 5 and Exbar 24) due to their low communalities in the first rotated solution to improve the factor analysis. A more parsimonious solution was then sought by inspecting the factor scree plot. Four factors were retained and the factor analysis was repeated. These four factors explain 48.2% of the variance, which is still an acceptable percentage. The compromise is worthwhile because the factor solution is easier to interpret.

A varimax rotation was applied which converged in 6 iterations. According to the accepted guidelines for identifying significant factor loadings (Hair et al., 1995) 0.30 was accepted as the cut-off point for interpretation purposes. The factors with the highest loadings are first taken into account in naming the factors (Tables 2–5 Appendix A).

Four factors were therefore identified as the main dimensions underlying the perceptions of the owners/managers about the external barriers to innovation. The reliabilities of factors (for the items loading on each factor) are shown in Table 6 in Appendix A. The factors are:

> *FACTOR 1*: government market regulation policies
> *FACTOR 2*: problems with inputs (especially physical ones, labour, and finance)
> *FACTOR 3*: access to technology providers
> *FACTOR 4*: government's environment, labour, and consumer protection policies

These underlying constructs have remarkable similarities to the top ranking barriers. The factor scores were used in further analysis in order to determine whether there are significant differences in scores across sectors and firm size groups.

For each factor a scale was calculated with a mean of zero and a standard deviation of 1 (Anderson-Rubin factor scores). Then for each scale an F test was calculated to test whether there is a significant difference in the mean scores across the groups of interest.

4.1.4.2. Factor scores across sectors
Factor 1 (government market regulation policies) has a significant difference across sectors ($F = 0.03$). Sector 1 (Mean $m = 0.41$), Sector 2 ($m = -0.16$), Sector 3 ($m = 0.18$), Sector 4 ($m = -0.33$), and Sector 5 ($m = -0.20$). Similarly factor 4 (government environment, labour and consumer protection policies) has a significant difference across sectors ($F = 0.004$). Factors 2 and 3 are not significantly different across sectors. The above analysis tends to suggest that firm owners in different sectors perceive government policies differently as barriers to innovation. In contrast to that, perceptions of the other factors are similar.

It is possible that government market regulation policies (factor 1) and protection policies for the environ-

ment, labour, etc. (factor 4) have a different impact on the innovation efforts of firms in different sectors. Policies on wages, for example, have a greater effect on the labour intensive sectors as clothing/textiles, while policies on patents and licenses have a greater effect on the chemical sector. Similarly the government's environmental policy affects to a greater extent the chemical sector. In contrast to the above, factor 2 related to inputs, and factor 3 related to access to technology providers, affect the economic environment of the various sectors in a rather similar manner.

4.1.4.3. Factor scores across firm size groups Only factor 3 (access to technology providers) is significantly different ($F = 0.044$) [Group 1 (micro-firms) Mean: $m = -0.39$, Group 2, $m = -0.10$. Group 3, $m = 0.02$, Group 4, $m = 0.22$ and Group 5 (large firms), $m = 0.41$]. The analysis implies that only barriers related to the access to technology providers are perceived differently by firms in different size groups, while the other factors including government policy related are considered similar. It is possible that only firms of a certain size and above, which have a basic level of internal technological capability, can obtain benefit and therefore develop relationships with external technology providers.

4.2. Internal barriers

The three most important *internal* barriers to innovation (Table 8) are:

- "Lack of time (e.g. one man responsible for many tasks)" (60%)
- "Inadequate R and D, design and testing within the firm" (51.4%)
- "Inadequate financial means" (44.6%)

Lack of time was the top ranking internal barrier, followed by inadequate R and D and related facilities within the firm and inadequate financial means. Cypriot owners/managers try to carry out as many tasks as possible within the firm themselves. This is understandable for micro-businesses and small firms, but it becomes a problem when the firm grows e.g. beyond the limit of 50 employees. Fire-fighting and routine work then drives out planning for the future and concentration on future-related activities including innovation.

From answers to other questions related to internal barriers it is concluded that only the more technologically sophisticated firms realize the importance of having adequate testing equipment for both quality control and research and development for new products.

5. Conclusions and recommendations

The importance of barriers, as perceived by the owners/managers of manufacturing firms, is not statistically correlated to innovativeness. This is a rather counter-intuitive finding, but a possible explanation was offered and other researchers have found something similar. No correlation was also found to economic performance. Perhaps the high performing firms find ways, sometimes innovative, round the barriers.

The importance of barriers is also not correlated to horizontal networking. This is also a surprising finding against the accepted wisdom. Some justification based on the nature of small less developed countries was proposed. This nature includes, for example, features like lack of indigenous technology (forcing firms to turn to foreign suppliers), limited subcontracting, and low complementarity of resources, especially knowledge related ones, between firms. Barriers show some similarities to those identified in industrialized countries, but also significant differences. The latter are probably due to the deficiencies in resources and technology of the business environment in Cyprus. The incremental type of innovation in such environments makes imitability a major barrier, and government policies an important consideration.

Two of the factors, as identified in factor analysis, are related to government policies and these are the only ones which are significantly different across the sectors. The factor, which relates to the access to technology providers, differs significantly across the size groups. Larger firms, as expected, are more concerned with access to technology providers.

The research has revealed a number of barriers to innovation as perceived by the managers. It has also highlighted the fact that only the few more advanced firms are aware of such barriers. Action is then needed, at state level, first for helping firms to become aware of the importance of innovation, and second for becoming alert to possible barriers. Specific measures are then required for the removal of these barriers. Further research is probably required to examine barriers in more detail. Policy makers frequently concentrate on "objective" barriers as reported in the literature for other countries, or as perceived by them, rather than by managers in the Cyprus business environment.

The research has also revealed some weaknesses in the socioeconomic context; for example the problem of financing new product development or local construction of machinery, the shortage of specialized technical labour, and weaknesses in the supply of technical services.

Some suggestions for elimination or alleviation of important barriers, at the level of national innovation policy, include the reduction of bureaucracy and an industrial bank specializing in the manufacturing sector. Reorganization of the technical education and seminars

on time management for owners/managers are other significant measures. More attention on the most important barriers, as revealed in the present research, and open communication with the private firms' managers can lead to more effective joint action for innovation promotion. The joint action presupposes a deeper understanding of the perceptions and preoccupations of the private sector managers by the government officials.

Strategies to overcome barriers at the level of the firm could involve reorganization, better time management

and a search for technology and resources outside the firm. The barriers in other small less developed countries, which share with Cyprus the problem of an inadequate technological infrastructure, are probably similar to those identified above. More research in such countries will corroborate and extend the present findings.

Appendix A

Factors related to external barriers to innovation

Table 2
Factor 1: government market regulation policies

Item	Loading	Description of item
3	0. 77	Wages policy
2	0. 69	Social insurance policy
4	0. 69	Policy on patents and licenses
14	0. 64	Government policies on competition
21	0. 58	Consumer protection policy
9	0. 52	Effect of technical standards on new products
18	0. 44	Short-term economic, monetary and financial policies
8	0. 42	Policy on public contracts and government purchasing
25	− 0. 41	Innovation too easy to copy
10	0. 36	Government Policy to assist small firms

Note: The negative sign of the loading (− 0.41) of the item "innovation too easy to copy" means that it moves to the opposite direction than the other items. It is negatively correlated to factor 1 "government market regulation policies". This is logical, as with stricter intellectual property protection measures (i.e. increase in market regulation), ease of copying innovation from others would decrease.

Table 3
Factor 2: problems with inputs (especially physical ones, labour and finance)

Item	Loading	Description of item
7	0. 68	Problems with inputs (raw materials and components)
12	0. 68	Inadequate technical training of employees
6	0. 67	Lack of government assistance
15	0. 61	Bank policies on credit
11	0. 59	Inadequate university education of employees
22	0. 51	Lack of venture capital
18	0. 41	Short-term economic, monetary and financial policies
10	0. 40	Government policy to assist small firms
25	0. 37	Innovation too easy to copy
13	0. 35	Foreign Trade Policy (import tariffs)
1	0. 33	Shortage of skilled labour

Table 4
Factor 3: access to technology providers

Item	Loading	Description of item
17	0. 85	Limited access to research institutions
23	0. 74	Lack of opportunities for cooperation with other firms and technological institutions
16	0. 67	Lack of testing institutions
18	0. 31	Short-term economic, monetary and financial policies
10	− 0.32	Government policy to assist small firms

Table 5
Factor 4: government's environment, labour and consumer protection policies

Item	Loading	Description of item
19	0. 72	Government's health and safety policies
20	0. 64	Government's environmental policy
22	0. 42	Lack of venture capital
21	0. 38	Consumer protection policy
15	0. 36	Bank policies on credit
1	− 0. 34	Shortage of skilled labour
8	0. 33	Policy on public contracts and government purchasing
25	0. 30	Innovation too easy to copy

Table 6
Reliabilities of factors

Factors	Cronbach's alpha values
Factor 1	$a = 0.75$
Factor 2	$a = 0.76$
Factor 3	$a = 0.61$
Factor 4	$a = 0.58$

N.B. The reliabilities of the first two factors are good (above 0.7, Bryman and Cramer, 1990), while those of the last two are fair, but still acceptable.

Table 7
Importance of external barriers to innovation

External barrier		Not applicable 1	Of little importance 2	Important 3	Very important 4
a.	Shortage of skilled labour	5.0%	23.6%	50.0%	21.4%
b.	Social insurance policy	64.3%	25.7%	7.9%	1.4%
c.	Wages policy	45.7%	27.9%	20.0%	5.7%
d.	Policy on patents and licenses	54.3%	27.9%	8.6%	9.3%
e.	Governmental bureaucracy	2.9%	20.7%	58.6%	17.9%
f.	Lack of government assistance	0.7%	25.7%	43.6%	29.3%
g.	Problems with inputs (raw materials and components)	5.0%	48.6%	32.1%	14.3%
h.	Policy on public contracts and government purchasing	27.9%	33.6%	26.4%	12.1%
i.	Effect of technical standards on new products	27.1%	43.6%	20.7%	8. 6%
j.	Government policy to assist small firms	4.3%	40.7%	37.9%	17.1%
k.	Inadequate university education of employees	34.3%	40.0%	19.3%	6.4%
l.	Inadequate technical training of employees	6.4%	27.1%	50.0%	16.4%
m.	Foreign trade policy (import tariffs)	10.7%	30.7%	33.6%	24.3%
n.	Government policies on competition	25.0%	52.9%	12.9%	9.3%
o.	Bank policies on credit	2.9%	25.7%	50.7%	20.7%
p.	Lack of testing institutions	7.1%	22.1%	47.9%	22.9%
q.	Limited access to research institutions	16.4%	32.9%	34.3%	16.4%
r.	Short-term economic, monetary and financial policies	6.4%	61.4%	22.9%	9.3%
s.	Government's health and safety policies	10.7%	38.6%	42.9%	7.9%
t.	Government's environmental policy	16.4%	41.4%	30.0%	12.1%
u.	Consumer protection policy	37.9%	44.3%	12.1%	5.7%
v.	Lack of venture capital companies	15.0%	57.1%	20.7%	7.1%
w.	Lack of opportunities for co-operation with other firms and technological institutions	9.3%	44.3%	37.1%	9.3%
x.	Lack of customer responsiveness to new products and processes	6.4%	35.7%	47.1%	10.7%
y.	Innovation too easy to copy	4.3%	11.4%	45.0%	38.6%

Table 8
Internal (within the firm) barriers to innovation

Internal barrier	Count	Percentage%
Lack of time (e.g. one man responsible for many tasks)	84	60.0%
Lack of qualified managerial/technical personnel in your firm	35	25.0%
Inadequate financial means	58	44.6%
Resistance to change in the enterprise	12	18.8%
Inadequate R and D, design, testing and other technical facilities within the firm	72	51.4%
Lack of a clear technology strategy	8	13.8%
Lack of motivation (e.g. high profitability with current product mix)	10	16.1%
Lack of technological experience necessary for development of specific innovations	34	24.3%
Lack of information on markets	17	25.8%
Pay-off period of innovation too long	38	41.3%
Excessive perceived risk of innovation	19	27.1%
Innovation costs hard to control	13	32.5%
Other (please specify)	1	—

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