Innovation surveys in developing countries: what can we learn from it for public innovation policies?

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Measuring innovation output has been an important preoccupation in the literature. Owing to considerable disenchantment with the conventional indicators of measuring innovation, it is now measured using a variety of new indicators the most prominent of which is the innovation survey. Although it was developed in the context of European countries, the concept of an innovation survey is fast diffusing to developing countries as well. Innovation surveys provide with a variety of indicators that is more comprehensive top measure the health of the National System of Innovation of a country. But both in the developed and developing country contexts, the output of these surveys have hardly been used to design innovation policy instruments. The paper analyses this problem and suggest some solutions from the perspective of improving the quality of decision-making with respect to impacting on the process of generation of innovation and diffusion in developing countries.

Introduction

The economic growth of developing countries requires the acquisition of technological capabilities. In countries at the world technological frontier, such capabilities refer to cutting edge skills to innovate entirely new products. In developing countries, the requisite technological capabilities are broader, and include production engineering, project execution and incremental innovation to make borrowed technology work (Amsden, 2007).

Innovation and developing countries do not usually go together. This is because, even now, most developing countries assemble technologies, which are generated in the North. This is especially so when innovation is narrowly interpreted as a linear process resulting from the performance of R&D and leading to the release of new products and processes. However increasingly the linear view of innovations is discarded and the belief that innovation is the sole creation of R&D has few takers. The literature has taken a much more broad view of innovations and modifications of existing products and processes too are taken as incremental innovations. Developing countries and incremental innovations is not an odd pair. With the rapid diffusion of innovation surveys, innovation is no longer treated as the outcome only resulting from the performance of R&D, but there is widespread consensus that a variety of non R&D activities and expenditures do result in the creation of innovations. In the context, the purpose of this paper is to marshal the

available empirical data on what can be said about innovative activity in developing countries during the most recent period taking a much broader view of innovations.

The paper is structured into three sections. Section 1 maps out the nature of innovations occurring in developing countries using some conventional indicators such as R&D expenditure and patents granted. Section 2 on the other hand assembles some new indicators of innovation based essentially on the results of innovation surveys. In specific terms I try to see if there are any countrywide variations in the type of expenditures that together constitute innovation expenditures, the source of information on innovation and the barriers to innovation The discussion here with specific reference to the results of the innovation surveys obtained from three countries, Brazil, Malaysia and South Africa. The third and final section identifies four critical issues regarding innovation surveys from the policy point of view.

i. Nature and extent of innovations in developing countries- Conventional indicators

Although there are over 150 countries that come under the label of developing countries only handful of them are reporting as having performed any innovations. This can be seen if we analyse the two most often used indicators of technology generation namely patents and R&D expenditures.

Despite its limitations as a measure of local technology generating efforts or innovations, there is now much consensus on the fact that patents are a good and convenient indicator of this activity. If one analyses the distribution of patents granted in the U.S. it is seen that the share of developing countries have been increasing. Based on this fact, one could argue that the potential for generating new technologies by developing country assignees have shown some dramatic increases (Figure 1). But a closer analysis of this picture shows that this innovative performance of developing countries is restricted only to just 11 countries, namely Argentina, Brazil and Mexico from Latin America, South Africa from the whole of the African continent, India, China, Hong Kong, Singapore, Malaysia, Taiwan and South Korea from Asia. Even within these better performing countries (with the possible exception of Korea and Taiwan), innovative efforts are restricted to a small number of domestic firms. Majority of developing countries are not involved in any local technology generating efforts despite the fact that given the location specificity of technologies, even imported technologies will have to be adapted to local conditions. This adaptation is, very often, accomplished through investments in R&D activities. Thus the management of imported technology from abroad does entail local R&D efforts as well. In short, although, some developing countries have become potential creators of new technologies, majority of them are still mere assemblers of imported technologies. Moving up the ladder of technological development is an incremental effort. Studies have shown that even to process imported technologies effectively firms in all sorts of developing countries, potential creators of new technologies and assemblers of imported technologies, will have to invest in local R&D efforts. And in order to encourage firms in doing so, governments have designed a variety of financial instruments.

However very few developing countries have reported R&D expenditures (Table 1). Even for those, which have reported this usual measure of R&D intensity measured by the GERD to GDP, ratio rarely exceeds 1 per cent. Another important dimension is that even in these countries which report R&D expenditure much of the R&D is financed and performed by either the government by itself through its research institutes or by the higher education sector, which too in many cases is completely owned and managed by the government itself. Business enterprises which actually uses they results of these R&D does not necessarily perform any R&D at all although some countries such as Korea, China and Singapore have actually made conscious policy attempts to reverse the normally observed trend. In these countries much of the R&D is actually performed by the business enterprise sector itself and it is hypothesized that this to a certain extent explains their recent technological performance. But for a majority of developing countries there is actually a divorce between R&D and production.

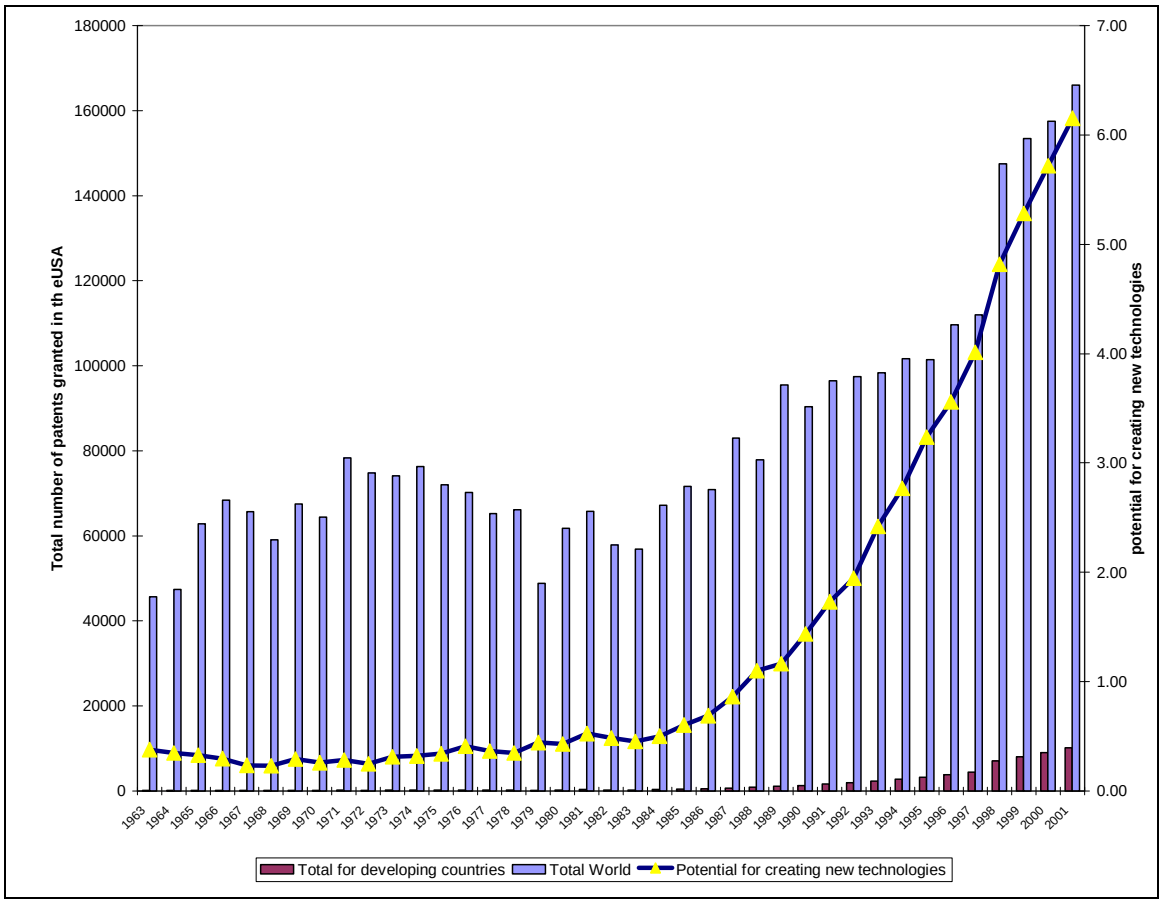

Figure 1: Trends in the potential for creating new innovation by enterprises, 1963-2001
Source: Computed from United States Patent and Trade Mark Officehttp://www.uspto.gov/web/offices/ac/ido/oeip/taf/h_at.htm#PartA1_1a (accessed on November 22 2006)

Table 1: Research Intensity across developing countries, 1996-2002
(GERD to GDP ratio in percentage terms)

	Argentina	Brazil	China	India	Malaysia	Mexico	South Africa	Thailand	Korea
1996	0.42	0.77	0.60	0.55	0.22	0.31		0.12	2.42
1997	0.42		0.68	0.70		0.34		0.10	2.48
1998	0.41		0.70	0.74	0.40	0.38	0.56		2.34
1999	0.45	0.87	0.83	0.78		0.43		0.22	2.25
2000	0.44	1.04	1.00	0.85	0.49	0.37		0.25	2.39
2001	0.42		1.07			0.39	0.76	0.24	2.59
2002	0.39		1.22		0.69		0.67	0.24	2.53

World Bank (2005)

Table 2: Structure of R&D performance across developing countries c 2002

	Business enterprise	Government	Higher education	Private non-profit
Argentina	26.1%	37.2%	33.9%	2.8%
Brazil*	45.5%	11.0%	43.5%	...
Chile	36.8%	10.6%	38.7%	13.9%
China	61.2%	28.7%	10.1%	
Colombia***	18.0%	8.0%	60.0%	14.0%
Costa Rica**	23.3%	19.5%	36.2%	...
India**	23.0%	74.7%	2.4%	...
Indonesia***	14.3%	81.1%	4.6%	...
Korea (Republic of)	74.9%	13.4%	10.4%	1.3%
Malaysia	65.3%	20.3%	14.4%	
Mexico	29.8%	41.4%	28.6%	0.3%
Pakistan	...	79.8%	20.2%	
Saudi Arabia	...	...	...	...
Singapore	61.4%	13.2%	12.6%	12.8%
South Africa	53.7%	20.0%	25.3%	0.9%
Thailand	38.8%	...	...	...
Uruguay	49.0%	19.4%	31.6%	
Note: *1996, **2000,and ***2001				

Source: UNESCO institute of Statistics (2007)

ii. **Innovations in developing countries as seen through innovation surveys**

For a very long time until the early 1990s, measurement of innovation even in developed countries was in the form of conventional indicators. The growth of innovation indicators has progressed exponentially (Table 2). These conventional indicators include the following: R&D expenditure and intensity; Patent applications, grants and citations; bibliometric data (scientific publication and citation). With the jettisoning of the linear view of innovation and the embracing of the "chain linked" conceptualization of innovation, new indicators were developed to measure innovative activity. The most prominent of these are innovation surveys. Innovation surveys are of two types:

(i) Those that focus on firm-level innovation activity, asking about general innovation inputs (both R&D and non R&D) and outputs (usually of product

innovations). This is sometimes referred to as the subject approach since it focuses on the innovating agent; and

(ii) (ii) Those that focus on significant technological innovations (usually identified through expert appraisal, or through new product announcements in trade journals or other literature). This is referred to as the object approach since it focuses on the objective output of the innovation process.

The subject approach includes small scale, incremental changes while the object approach tends to focus on significantly new products. By new indicators we mean only the subject approach.

Table 2: Exponential growth of innovation indicators

Decades	**50s and 60s**	**70s**	**80s**	**90s**
Main indicators used →	R&D	R&D	R&D	R&D
		Patents	Patents	Patents
		Technological balance of payments	Technological balance of payments	Technological balance of payments
			High-tech products and sectors	High-tech products and sectors
			Bibliometrics	Bibliometrics
			Human resources	Human resources
			Innovation surveys	Innovation surveys
				Innovations mentioned in technical literature
				Surveys of production technologies
				Government support to industrial technology
				Intangible investment
				Indicators of information and communication technologies
				Input-Output matrixes *
				Productivity *
				Venture capital *
				Mergers and acquisitions *

Innovation surveys have joined the list in 1980s and have diffused somewhat cautiously across the developing world through the 1990s. The idea of an innovation survey is inherently appealing to developing countries as it is based on the premise that firms do not always innovate through the performance of R&D. In fact a whole host of innovation generating non R&D routes are used, for instance by acquiring machinery, purchasing

innovative outputs from outside, training of personnel etc. In fact firms in developing countries are more prone to using these non-R&D routes. The data on GERD to GDP ratio and patents presented above shows that even with low levels of R&D investments some of these developing countries are able to continuously improve their respective patenting records.

Innovation surveys were first done in Europe popularly known as the Community Innovation Surveys (CIS). The CIS contains quantitative, dichotomous and polychotomous variables. The CIS has been carried out for the first time in 1992 using the first edition of the "Oslo Manual". CIS2 took place in 1996 and CIS3 in 2001, CIS 4 in 2005. The fifth CIS is in the field in early 2007, and planning for the sixth CIS, which will implement the recommendations of the 3rd edition of the Oslo manual, is already underway (Arundel, 2006). Data gathering and analysis has been supported under the various Community RTD Framework Programmes. Since 2000, the CIS has become a major data source of the "European Innovation Scoreboard". Arundel (2006) has argued that very little of the results of these innovation surveys have found expression as innovation policy instruments even in the European context.

Measurement of innovation through innovation surveys has actually diffused across various types of developing countries (Table 3). Its extent of diffusion has been the highest in Latin America and the least in Africa. The two large countries,, China and India both are in the process of launching a large nation-wide innovation survey.

Table 3: Diffusion of innovation surveys across developing countries

Country	Methodological Basis	Questionnaire Reference	Period	Activities
Argentina (Sengunda Encuesta Nacional Innovation y Conducta Tecnologica de las empresas Argentinas 1998-2001)	Oslo Manual and Bogota Manual	CIS3 (major adaptation)	1998-2001	Manufacturing
Brazil PINTEC 2000 (Pesquisa Industrial-Innovacao Tecnologica 2000)	Oslo Manual	CIS3 (minor adaptation)	1998-2000	Manufacturing and Mining and quarrying
Malaysia NIS-3 (Third National Survey of Innovation)	Oslo Manual	CIS3 (minor adaptation)	2000-2001	Manufacturing
Mexico (Sengunda Encuesta Nacional de Innovation en los sectores manufacturero y de Servicios 2001)	Oslo Manual	CIS3 (minor adaptation)	1999-2000	Manufacturing

South Africa 2001	Oslo Manual	CIS2 (major adaptation)	1998-2000	Manufacturing and Services (merged)
2005 (First official innovation survey)	Oslo Manual	CIS 4	2002-2004	do

Source: Adapted from Viotti and Baessa (2005)

The country experiences

It is seen that about ten developing countries have conducted at least one innovation survey. Almost all of them have based on their surveys on the methodology prescribed in the various versions of the Oslo Manual. Consequently the results obtained by these surveys are eminently comparable with each other but also with those obtained by various rounds of CIS. In the context, the purpose of this section is to copare the results obtained by various developing countries with view to looking for regularities if any in the following:

i. the rate of innovation;
ii. innovation activities and expenditures;
iii. source of information on innovation;
iv. factors hampering innovation; and
v. effects of innovation on specific dimensions of performance.

In order to discuss these I have selected three developing countries, namely Brazil from Latin America, South Africa from Africa and Malaysia from Asia. Although these countries may not be representative of the continents to which they belong to, all of them have conducted at least two innovation surveys referring either to the late 1990s or the early 2000 period. I discuss each of these three cases separately with respect to the above five dimensions and then present a comparative picture of the three. I begin with the Brazil case.

Brazil

I discuss the Brazilian case using he data obtained from the results of the 2000 Industrial Survey – Technological Innovation (PINTEC), carried out for the first time by IBGE in partnership with Financiadora de Estudos e Projetos-FINEP (Research and Projects Financing Agency), of the Ministry of Science and Technology. A second innovation survey was conducted in 2003 and the results of these were published in 2005. However due to data availability my discussion of the Brazil case is entirely restricted to the first one which covered the period 1998 and 2000.

Response rate

The Brazilian survey covered all manufacturing enterprises employing 10 or more persons. The first Brazilian survey had a realized sample of 72, 000. But the actual

sample is not indicated. So the response rate could not be worked out. This realized sample increased to 84, 000 firms in the second survey.

i. **Rate of innovations**

Between 1998 and 2000, 22,700 companies implemented a technologically new product and/or process for the company itself or the domestic market. Among the 72,000 enterprises, 6.3% innovated in their products, 13.9% in production processes and 11.3% in products and processes. This means that about 31.5 per cent of the Brazilian firms introduced some technological innovation between 1998 and 2000 and this increased slightly to 33.3 per cent in 2003.These firms invested, in 2000, 3.8% of their sales revenue on technological innovations, which amounts to over R$22 billion. According to PINTEC, among the enterprises that created new products (17.6% of the sample), only one fourth of them (4.13% of the sample) presented a new product to the domestic market. The innovation rate increased according to the size of the enterprises, ranging from 26.6% for the smaller sized companies investigated (10 to 49 persons employed) to 75.6% for the largest ones (500 people employed and over). Three inferences could be drawn:

- Rate of innovation works out to about 31 per cent in 2000;
- About three quarters of the innovating firms are large firms employing 500 employees and above; and
- Most of the innovations are of an incremental in nature.

Innovation rates were high (defined as 60 per cent and above) only in high technology industries such as, for instance, the manufacture of office and computer equipment (68.5%), basic electronic apparatus (62.9%), communication machines and equipment (62.1%). The lowest rates of innovation were observed in the group of extractive activities where, with the notable exception of two industries namely the manufacture of pulp and other pastes (51.8%) and petroleum refining (39.4%). .

When compared with European countries, the Brazilian enterprises present a rate of innovation similar to that of Spain: 31.5 per cent of the Brazilian enterprises innovate and devote 3.8 per cent of their sales revenue to innovation activities. In Spain, 34.8 per cent of the enterprises that carry out innovations spend 1.86% of their sales recenue on innovations.

The comparison between the two countries may be done also regarding the structure of the expenditure, which are concentrated mostly on Purchase of machines and equipment (41.28% in Spain and 52.22% in Brazil) and Research and Development (30.81% in Spain and 16.75% in Brazil). Despite the similar structure, we notice, however, the priority given by Spanish companies to R&D, which get proportionally more investments.

i. Innovation activities and expenditures

Purchase of machines and equipment was the main innovation activity of the industrial sector as a whole (mentioned as being of the greatest importance by 76.63 per cent of the enterprises and consuming over 50% of the total expenditure on innovation), with decreasing importance according to the size of the enterprise. The second most important activity was Training of personnel, followed by Industrial project and other technical preparations, explained by the acquisition of new machines that demand training of operators and structural adaptation of facilities. Research and development (R&D) was at the second place in terms of expenditure. The larger the company, the greater the investment and the commitment to R&D. In 2000, 90 per cent of the total expenditure on R&D was recorded for enterprises that routinely engage and not only occasionally. The enterprises that invest on R&D expend a total of over R$3.7 billion in that activity, equivalent to 0.64 per cent of the receipt in 2000. Once again most of the firms expending R&D could be found only in the high tech industries.

The findings above are quite significant because it confirms the view that firms raely innovate through essentially the R&D route. Acquiring newer vintages of capital goods through the explicit intention of introducing modified products or processes was far more important. And this finding has important policy implications.

iii. Source of information on innovation

Another important finding is that most of the innovations are introduced by the innovating company itself (71.4 per cent). But this is not the case with process innovation where the similar percentage is only 10.6 per cent. However in terms of importance (66.1 per cent), suppliers and equipment providers is the most important source of information on innovation to the innovating firms. The next important source (59.5 per cent) is clients and consumers followed by other competing firms (47.8 per cent). What is striking about this result is the fact that universities and research instates are hardly a source of information on innovation. This finding is quite significant as seen above the Brazilian universities alone perform about 45 per cent of the R&D in the country. The results of these R&D efforts are not finding expression interms of innovations in manufacturing enterprises.

iv. Impact of innovation

As to the impact of the innovations implemented, over 7o per cent of the enterprises admit that they carry out these projects either to keep their share of the market (80 per cent), to expand it (71.02 per cent) or to improve the quality of their products (78.27 per cent).The economic importance of the innovation may be measured by the participation of new products in the total sales revenue. For 21.2% of the enterprises, the innovation of products weighs up to 10% in the receipt. For 48.9% of the enterprises, the new product represents between 10% and 40% of the receipt and for close to 30% of the enterprises the weight of the product is more than 40%. In this case, in the small companies new products, fruit of innovation, represent a greater participation in the receipt, reflecting the greater diversity of products in the largest enterprises, where new products have a lower weight in sales.

v. Factors hampering innovation

The reasons indicated by the large majority (55.6%) of the 46 thousand enterprises that did not innovate were market conditions themselves, which did not demand or not allow innovations, while 11.6% claimed having done recent innovations. Among the remaining companies (32.7%), the intention of innovating has been contained by difficulties such as the high cost (84.5%), risks (73.3%) and the lack of adequate sources of funding for the innovation (57.2%).

The South African Case[1]

The first official innovation survey in the country was conducted in 2005 and referred to the period 2002-2004 and reports data for 2004. The methodology followed is exactly the same as CIS 4. India, which is planning its innovation survey in 2007, referring to the period 2005-06 has adopted the South African and indeed the CIS4 methodology. The survey included both manufacturing and service enterprises.

Response rate

The highlights of the survey (Department of Science and Technology, 2007) on which this analysis is based does not make clear the response rate. However I understand that it is of the order of about 31 per cent. The unofficial survey done in 2001(covering the period 1998-2000) had a very low response rate of about 8 per cent. In this sense the response rate registered by the present survey is quite high and makes generalizations more possible in a safe manner.

i. Rate of Innovations

The innovation rate is estimated to be 52 per cent, as high as those recoded in Denmark, but much higher than in France. According the earlier South African (unofficial) survey this was around 44 per cent in 1998-2000. This means that the innovation rate has risen to such impressive levels to the extent one out of every two firms surveyed reported as being innovative. The precise reasons for this increase in the innovativeness of South African firms, notwithstanding their lackluster performance needs some explanation.

ii. Innovation activities and expenditures

According to the Department of Science and Technology (2007) , the South African enterprises spent a total of R27.8 billion on innovation activities in 2004. This represents about 2.4 percent of the total turnover of all surveyed enterprises in both the industrial and service sectors. About 20 percent of expenditure on innovation was devoted to intramural R&D and a further 7.8 per cent was spent on outsourced R&D. The R5.7 billion spent on intramural R&D in 2004 accords well with the amount of R5.9 billion recorded for the equivalent sectors in the 2004-05 R&D Survey. The most important innovation expenditure (65 per cent) was devoted to the acquisition of

[1] The discussion is based on Department of Science and Technology (2007).

new machinery, equipment and software. Acquisition of other external knowledge accounted for about 6.5 per cent of innovation expenditure. Once again we see that innovations are effected by acquiring capital goods from abroad. Further the intensity of innovation expenditure intensity (2.7 per cenT is much higher than intramural R&D expenditure (less than a per cent).

iii. Source of information on innovation

The majority (51 per cent) of innovations were produced within enterprises themselves but this was more common in the manufacturing enterprises (70 per cent) than in the services-oriented enterprises (35 percent). Clients or customers provided highly important sources of information for 35 percent of innovative enterprises, followed by suppliers (24 per cent) and competitors (13 per cent. Universities and technikons (polytechnics) were rated as highly important by 5 percent of enterprises and public research institutions, including science councils, were acknowledged as highly important sources of information by just over 3 percent of innovative enterprises. Another similar issue is that most important collaborative partnerships for innovation were between enterprises and their clients or customers and these comprised 46 per cent of innovative collaborations. This was closely followed by collaboration with suppliers (45 per cent) indicating that innovative South African enterprises are well attuned to both the demand and supply aspects of the market. Competitors (or enterprises operating in the same sector) were important collaboration partners for innovation for 38 per cent of innovators. Universities and technikons and public research institutes were rated as highly important partners for collaboration in innovation activities by 17 per cent and 14 per cent of innovative enterprises respectively On this issue too the South African finding is very similar to the Brazilian case.

iv. Impact of innovation

The most often cited highly important effect of innovation was improved quality of goods or services (45 per cent of innovative enterprises). The majority of EU countries also cited this effect as the most highly important in response to this question. It was also important for innovative enterprises in South Africa to increase the range of goods or services (33 per cent) and to enter new markets or increase market share (23 per cent). About 21 per cent of innovative enterprises cited the meeting of government regulatory requirements as a highly important effect of innovation. Surprisingly reducing labour costs and reducing resources per unit output appeared to be relatively unimportant for the majority of innovative enterprises.

v. Factors hampering innovation

More than a quarter (26 per cent) of all enterprises indicated that the development of innovative activities within their enterprises were hampered or restrained because the market was already dominated by established enterprises. Lack of funds within the enterprise or enterprise group and innovation costs being too high were cited as highly important in hampering innovation activities by 25 per cent and 20 per cent of

enterprises, respectively. Lack of qualified personnel was seen as a highly important factor by 17 per cent of enterprises. However these results appear to be contradictory on three grounds. First, the innovating enterprises found competition as one of the factors that drove them to innovate. Second, financing of innovation is found to be another contradiction when the country has three main research grant schemes. Third, although the country has a shortage of scientists and engineers, the firms have not found this as a constraint.

An interesting finding is that on all the five issues the finding from South Africa is almost exactly similar to that found in Brazil.

The Malaysian Case

Malaysia has done three innovation surveys so far, with reference periods 1994, 1997-1999 and the latest one in 2000-2001. The methodology adopted for the latest survey is the same as that of CIS3 (Malaysian Science and Technology Information Centre, MASTIC , 2003).

Response rate

The latest survey had a response rate of about 19 per cent, as the realized sample is 749 out of a total sample of 4000 firms. This raises some serious questions about the generality of the conclusions reached.

i. Innovation rate: About 35 per cent of the firms have self reported them as innovative similar to the Brazilian one. In fact the rate of innovation increased by 14 per centage points between the second and the third survey. The high innovators (defined as those having an innovation rate of more than 50 per cent) are publishing and printing, electrical machinery, textiles, medical and precision instruments, motor vehicles, radio, television and communication equipments. In other words most of the innovative firms belonged to high and medium technologies. The least innovative firms belonged to three industries, namely machinery and equipment, wood products and leather products.

ii. Innovation activities and expenditures: Acquiring R&D, machinery and equipment, training, purchase of designs turned out to be the four most important innovation activities.

On all the other matters, findings obtained in the Malaysian survey are more or less similar to that obtained in the previous two cases.

Table 4 summarises our findings with respect to these three cases.

Table 4: Dimensions of Innovations across Brazil, Malaysia and South Africa

	Brazil	Malaysia	South Africa
Survey period	1998-2000	2000-2001	2002-2004
Response rate 9in per cent)	Not clearly indicated	19	31 (?)
Scope	Manufacturing and services	Manufacturing only	Manufacturing and services
Innovation rate (in per cent	31	35	52
Most important innovation activity	Acquisition of capital goods	Acquisition of R&D	Acquisition of capital goods
Intensity of innovation expenditures	Greater than unity	Greater than unity	Greater than unity
Importance of intramural R&D	Not very important- less than one-third	Not very important- less than one-third	Not very important- less than one-third
Source of information on innovation and partnership for effecting innovations	Customers and suppliers	Customers and suppliers	Customers and suppliers
Importance of universities and research instates as a source of information on innovation	Not very important	Not very important	Not very important
Factors hampering innovation	Innovation costs	Innovation costs	Competition from established firms and innovation costs

Importance of governmental sources of financing innovation	Not important	Not important	Ambiguous

Source: Own compilation

iii. The Four critical issues in innovation survey from the policy point of view

Every one accepts the fact innovation surveys are largely born in Europe and there are no other regions of the world which has accumulated such rich experience and indeed data on innovation through innovation surveys as the Europeans. Most developing countries, which have conducted some form of innovation survey, have always invoked the "Oslo Manual" (Table 3 above) for conducting these surveys. But as Arundel (2006) has very convincingly argued that even in Europe, the results of the innovation surveys have had very little influence in designing innovation policy targets and instruments as the following quotation from him would indicate:

"With data available from several consecutive CIS surveys, one would think that the European policy community would be actively using CIS indicators to assess the ability of national innovation systems to respond to the challenges of the knowledge economy. Unfortunately, this hasn't happened anywhere near the extent that one would have expected in 1996. The results of a series of in-depth interviews by UNU-MERIT with European policy analysts a review of major European white papers on innovation shows that the European policy community still relies on long established indicators for R&D and patents. The effect of the CIS is largely diffuse, influencing general perspectives rather than the development of concrete policy actions. There are of course exceptions, such as the use of CIS data on collaboration in the evaluation of relevant policies in the Netherlands".

Here I discuss four major difficulties that considerably reduce the policy designing impact of innovation surveys.

(i) The definition of the term innovation and measurement errors due to self-reporting. This is especially severe when the economy is dominated by the services sector where even the output is not tangible;

(ii) Low response rates and missing values and the consequent problems in generalising the results for the entire universe;

(iii) Poor quality of data on the six or seven items of innovation activities and expenditures and the difficulties in interpreting these results

(iv) Use of innovation surveys: more for academic publications (?) rather than for designing public policy instruments for impacting on the rate of innovations in the economy.

I discuss each of these seriatim

- **Definition of innovation:** Normally in most innovation surveys the definition followed is as follows: something, which is new to the firm even when it is not new to the universe in which the firm is located. The term innovation is very culturally sensitive. What one considers as innovation in one kind of culture may not qualify for being termed as innovative in a different culture. This inherent lack of uniformity in the understanding of the term innovation can lead to different firms in the same industry in a specific country reporting a specific product or process as innovative or not innovative. This will make aggregation of the number of firms that are innovative in a specific industry extremely difficult. Further, in a typical innovation survey context, firms self select as being innovative. In developing country context this self-selection can lead to serious measurement errors as firms, which are not innovative, can also report themselves as innovative and this is indeed the case in a number of developing countries that have conducted innovation surveys. Consequently the number of innovative firms in these countries are very high (ranging from 30 to 50 per cent) and in those countries, like for instance in Argentina and Malaysia, which have conducted more than one survey, the share of innovative firms have shown sharp inter temporal increases. Such increases without any concomitant increases in any of the other known innovation indicators such as R&D expenditure, patents granted, high tech content of manufactured exports etc makes one wonder whether the increase in the number of innovative firms is a mere statistical artifact.

- **Low response rates**: The response rate in the case of innovation surveys is defined as the percentage share of realised sample in the actual sample [(Actual Sample/Realised Sample)*100]. Even in the case of European CIS, the response rates vary considerably across the participating countries. Germany has very low response rates of about 8 per cent even in CIS3. Response rates are of course very high in those countries (like France and Portugal) where the innovation survey is part of some other compulsory surveys such as the annual survey of industries. Low response rates make generalizations extremely difficult and this reduces the

public policy input potential of innovation surveys. In addition, there are missing values. A firm may have responded to the survey, but has failed to answer a number of crucial questions. An area where missing values are most severe is in the case of the seven activities that constitute the total innovation expenditures. The low response rates are compounded by the lack of information on the population itself. The statistical authorities in a number of countries do not even have a list of all the industrial firms in their economy. This makes the task of increasing the response rates even more difficult. A still another but less highlighted difficulty arises as to who has filled in the survey questionnaire. The filling of the questionnaire is time consuming and requires considerable co-operation across different divisions of a company. This increases the probability of serious measurement errors as the respondent may be forced to resort to a sort of guess when faced with the lack of availability of questionnaire data. All these makes the data generated by the innovation surveys less useful for defining public innovation policies designed to stimulate the very process of innovations.

- **Poor quality of data**: I have already alluded to this problem above. Firms rarely maintain data on innovation expenditures according to what is required in an innovation survey. Even in the case of CIS this item has been patchy. An item that ranks one in terms of importance is acquisition of machinery, equipment and software. There can be severe measurement errors for this item. This is because although the survey questionnaire clearly asks for only the expenditure on capital goods that are required for the introduction of new or significantly improved products or processes, most enterprises are prone to reporting their total expenditure on capital goods without making any clear distinction of the purpose for which these equipments or software is acquired Further in the final tabulations, no distinction is also made between new firms and existing firms. New firms acquire capital goods for their very existence and this may not be termed as innovation expenditures. In short if one were to design an instrument for increasing innovation activity, if the innovation surveys are to be believed, is to enable companies to purchase capital goods In the post WTO regimes, this is tantamount to encouraging firms to import their capital good requirements.

- **Results of innovation surveys are used more for academic publications than to design policy instruments for stimulating innovations**

I had already presented the views of Arundel (2006) that even in the case of the European Union very little of the information provided by the successive CIS have been used for designing policy instruments for stimulating innovations. As Smith, Keith (2004), argues that the results of innovation surveys are mainly leading to academic publications. In fact deigning public policy instruments according to survey results can lead to policy conflicts. For instance, all the surveys done in both developed and developing countries have shown that the most important activity that leads to the creation of innovations is the acquisition of capital goods. This means that if a country wants to promote innovations it must enable its manufacturing enterprises to acquire the latest vintage of capital goods. Such a policy in the post

WTO era is tantamount to subsidising the importation of capital goods from abroad. If the country in question has a large enough domestic capital goods sector as is the case in Brazil, China, India and South Africa, such a policy of encouraging the importation of capital goods will have deleterious effects on the domestic capital goods industry. This argument is based on the reality that in most countries domestically produced capital goods are mostly than comparable quality imported ones. Moreover the importers are able to provide the capital goods users better terms and conditions of purchase like deferred credit facility etc.

Conclusions

Innovation surveys do contain a whole lot of innovation about the actual functioning of a country's national system of innovation than mere R&D surveys. However the results provided by these surveys have not been used for policy purposes. Following is a list of specific suggestions that may be implemented to make the output of these surveys more useful for policy purposes:

- There is need to increase response rates to at least 50 per cent. Combining the innovation survey as part of other mandatory surveys may do the trick as in the case of France, Norway and Portugal for instance;
- Care needs to be placed while tabulating and interpreting the data on innovation activity expenditures. Age of the unit need to be taken into explicit account
- Results of innovation surveys must feed into public policy making. Systemic failures must be detected
- Time series data on innovation activity and expenditure must be developed.

One only hopes that the conduct of innovation surveys do not become an empty annual ritual from the policy point of view.

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