Innovation and education policy in SMEs: a Czech perspective

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Abstract

After considering the various dimensions of innovation policy, this paper reviews the experiences of the Czech Republic (CR) in implementing such policies in the post-1990 transition period. Particular attention is paid to the contribution of small and medium-sized enterprises (SMEs) in innovation activities and to the various direct and indirect measures used by the CR in their support. The paper also focuses on the education and training issues and policy prescriptions deemed most appropriate to medium-term goal setting in the CR. It is noted that in order for such education and training policies to be effective, they must be informed by a number of well-established patterns and trends within globalised, knowledge-based economies as well as by the particular circumstances faced by the CR or other transition economies.

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Introduction

Innovation is a somewhat elusive concept, often loosely associated with new or improved products and processes. More rigorous definitions focus on radical departure rather than incremental change, as with Mintzberg's (1983) definition of innovation as "the means to break away from established patterns". Schmookler (1996) links innovation explicitly to technical change: "The first enterprise to make a given technical change is an innovator. Its action is innovation." In fact growth theorists (see, for example Maddison, 1987; Solow, 1955) have for some time seen technical change and innovation as inextricably linked, together helping account for the observed and positive discrepancy ("residual") between rates of change of GDP and rates of change of factor input (capital, labour) in time series analysis.

Schumpeter (1942) took a similar stance, seeing innovation as part of the trilogy of activities subsumed within the process of technological change: namely invention, innovation and diffusion. Invention is the creation of new ideas or of technological knowledge; innovation the process by which the idea or knowledge is converted into marketable products or productive techniques; and diffusion the routes and time profile by which the innovation is adopted by others. Schumpeter regarded technological innovation as the source behind the long wave (50 year) cycles identified by Kondratief in 1925.

Schumpeter saw the market mechanism as fostering innovation by rewarding, via enhanced profits, those entrepreneurs who initiate innovation, whether in terms of new products, processes, markets, sources of raw material or types of industrial organisation. However imitation would progressively reduce the return to innovators, competing away any excess profits until some new "wave" or cluster of economic activities emerges to reinvigorate the innovative process. Indeed Schumpeter believed that larger firms would have a competitive advantage over SMEs in terms of innovation precisely because they would be better able to erect entry barriers to deter such "imitation". Any "excess" profits from earlier innovations could then be preserved over longer time periods by larger firms, serving as an attractive source of internal finance for reinvestment in

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ongoing R&D and other innovative activities. Galbraith (1952) concurred with this view, believing innovation to be so costly that only larger firms with significant resources could effectively engage in this activity.

Vossen (1998) usefully reviews the arguments for and against the existence of substantial scale economies in innovative activities. Indeed the countervailing perspective would seem to be gathering strength, namely that SMEs are disproportionately responsible for significant innovations. Acs and Audretsch (1990, 1991) found that small firms in the USA contributed some 2.4 times more innovations per employee than larger firms and in their 1991 study concluded that " ... empirical evidence suggests that decreasing returns to R&D expenditure in producing innovative output exists".

These findings are in line with the work of Rothwell (1985, 1989) and Rothwell and Dodgson (1994). Rothwell (1985) had concluded that " ... the relative strengths of large businesses are predominantly material ... while those of small firms are mostly behavioural (entrepreneurial dynamism, flexibility, efficiency, proximity to the market, motivation)." Vossen (1996) broadly agrees, finding smaller firms to be more profit/cost efficient in innovation. Zenger (1994) takes a more balanced perspective, seeing neither small nor large firms as better innovators *per se*, rather acknowledging that different sized firms may be better suited to certain types of innovation. For example small firms are likely to have a competitive advantage in innovations which depend on flexibility and proximity to market demand, which involve "spillover" applications of knowledge breakthroughs derived from larger firm R&D activities and which can be utilised in small scale commercial applications.

Of course from a policy perspective, a key issue is whether innovative activities, whatever their particular form and the size of firm from which they originate, must be regarded as random events or whether they are capable of being induced proactively by governmental intervention. Drucker (1985) certainly adhered to the latter view, seeing innovation as " ... capable of being presented as a discipline, capable of being learned and capable of being practised".

It is now widely recognised that government policies can influence the incentives and opportunities for innovative activity in a wide variety of ways. Such governmental influence may be to some extent indirect (though no less important), as in establishing the education and skills base, the macroeconomic context or the legal, proprietary framework. On the other hand direct innovation policy may take the form of governments seeking to increase the stock of knowledge, as in the case of R&D assistance or incentives, or to improve the effectiveness of its application and dissemination, as in the case of policies seeking to improve the transfer and diffusion of technology.

This paper seeks to review lessons learned in the field of innovatory policy from the experience of the Czech Republic. Particular attention will be paid to the transition period post 1990, to the role of SMEs within the innovative process and to the education and training policies best suited to supporting that role.

SMEs and innovation policies in the Czech Republic

The importance of SMEs within the industrial sector of the Czech Republic (CR) is indicated in Table I, with some 56 per cent of workers in firms with less than 500 employees, contributing around 46 per cent of total turnover. Whilst indicative, Table I is not strictly comparable with the more usual EU definition of SMEs as having less than 250 employees. In addition Table I captures only industrial production and faces the problem, at least as regards turnover data, that many of the outputs of smaller firms occur within the "informal economy", thereby understating their true turnover and GDP contribution. Expert assessments within the Czech Republic suggest that enterprises with fewer than 250 employees account for between 50-60 per cent of total employment across all sectors and produce some 45-55 per cent of GDP (Benacek, 2001).

Nevertheless concern has been expressed that the positioning of SMEs in the Czech Republic during the early years of the transition period has inhibited their contribution to the innovative process. Muller (2001) points out that a large proportion of Czech SMEs are still dependent on the somewhat precarious existence of vestigial large-scale enterprises from the command

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Table I Industrial production by size of firm (current prices (1998) and number of employers (%))

Size of firm by employees	Sales CZKbn	Sales Index 1998/1997	Sales Share (%)	Average number of employee Thous. persons	Average number of employee Index 1998/1997	Average number of employee Share (%)	Average monthly wage CZK	Average monthly wage Index 1998/1997
Up to 19	198.1	106.0	10.6	164	104.8	11.2	9,747	108.3
20-99	225.6	108.6	12.1	250	106.0	17.1	10,401	108.1
100-499	430.7	110.9	23.0	400	99.3	27.6	11,106	110.5
500-999	222.1	107.8	11.9	175	93.7	12.0	11,810	110.7
1,000-1,999	305.9	108.6	16.4	184	96.1	12.6	12,313	112.6
2,000-4,999	195.8	103.6	10.5	136	94.9	9.3	12,511	112.0
5,000+	289.1	105.4	15.5	149	92.5	10.2	15,231	112.6
Total industry	1,867.3	107.7	100.0	1,458	98.6	100.0	11,623	110.2

Source: Czech Statistical Office (2000)

economy period. Even those SMEs established during the liberalised post-1990 reform period in response to perceived deficiencies in the ability of the planned economy to meet local and regional demands, have faced an insecure future. In a liberalised and globalised environment their competitive advantages have often been rapidly eroded by both domestic and transnational firms. Nor has their plight been eased by governmental supports in the form of subsidies and reliefs: for example Benacek (2001) estimated that SMEs received only 25 million CZK in state support during the 1990s as compared with 400 million CZK received by larger firms, despite SMEs being responsible for a broadly equivalent proportion of GDP.

In the latter part of the 1990s the government has, however, sought to implement policies aimed at both increasing support for SMEs and enhancing their role in the innovative process.

Industrial zones

Greater attention and support has been given to the establishment of industrial zones throughout the economy since 1998. In the early 1990s such zones had been established in only a few sites, geographically adjacent to the major markets of Austria and Germany – frontier regions notoriously short of qualified manpower given the attraction of these foreign labour markets. Now up to 60 per cent of the costs involved in the construction of the infrastructure for such industrial zones is available to municipal authorities throughout the Republic, with a variety of additional state subsidies and reliefs provided in support of private firms and public bodies operating in those zones. Table II outlines some of the characteristics and the estimated impacts of these industrial zones over the period 1998-2000.

Table II Development of industrial zones in the CR

Sum of the announced direct investments into production	47,863/1,367
Number of announced new jobs	12,856
Support from state budget	602/17.2
Support from municipal funds	638/18.2
Utilisation rate of industrial zones (%)	41.0

Notes: (1998-2000, million of CZK/EURO)

Source: CzechInvest (www.czechinvest.org)

Over the period 2000-2005 a further 2,700 million CZK (77 million Euro) has been budgeted for industrial zone support, the intention being to increase the modest 41 per cent utilisation rate shown in Table II for established zones whilst also developing new zone locations.

New business start ups

Historically there would seem to be a broadly favourable environment for new business start-ups in the Czech Republic. Some 13.9 per cent of total businesses were designated "start ups" in 1998 (Muller, 2001), a much higher proportion than that recorded for most other transition economies. Whilst admittedly attracting inward foreign direct investment (FDI), industrial zones are also intended to support and encourage new business start-ups by indigenous firms. A wide variety of governmental subsidies and reliefs from both Czech and EU sources to encourage entrepreneurship and new business start-ups are reviewed in Table III. As well as the private banks and the Czech-Moravian Guarantee and Development Bank, well-focused investments in SMEs have been sourced from venture capital providers,

Table III Main initiatives taken in favour of start-ups

Organisation	Objectives	Target audience	Type of funding
Czech-Moravian Guarantee and Development Bank	Programs "Start", "Region"	Enterprising projects for metallurgy sector, lagging regions	Subsidies (repayable), Lower interest rates
Czech-Moravian Guarantee and Development Bank	Program "Market"	SMEs	Subsidies (repayable) or 50 per cent of costs for attainment of ISO
Ministry of Industry and Trade	Establishment of industrial zones	Municipal authorities	Subsidy for construction of infrastructure
Czech Innovation Relay Centre	Improve competitiveness, domestic and foreign technology transfer and domestic R&D results	BIC, SMEs, R&D organisations	EU funds, domestic funds
Ministry of Industry and Trade	Development of industrial zones	Municipalities of city and region, private firms (developers)	State subsidy, EU funds
Funds for Risk Capital (Foundation for Development of Regions)	Support of start-ups of SMEs by venture capital	SMEs	Investors: Ministry of Regional Development, EU delegation (Phare funds)
Czech Venture Partners	Support of start-ups with dynamic growth and clear pattern of governance	Domestic firms	Investors: Ministry of Regional Development, private banks

especially Czech Venture Partners and the Fund for Risk Capital, using Czech government and EU monies.

Even when it has been the foreign owned firms that have taken advantage of these government initiatives, the innovative potential of Czech firms may still have been enhanced. Biegelbauer *et al.* (2000) point to considerable spillover effects of inward FDI in favour of training, R&D activities and product development in associated domestic firms and local labour markets.

Inter-firm co-operation

Innovative activity by SMEs is being fostered by governmental programmes to support sub-contracting and other methods of inter-firm co-operation. The initiatives involved include measures to support:

- technological upgrading of product and processes in SMEs delivering products, components and services to larger (Czech and foreign owned) firms;
- information exchange, the formation of databases on available suppliers in the CR, and the provision of standardised schemes to support employee training and sales/marketing initiatives.

Reorientation of R&D policy

SMEs and larger firms in the CR have benefited from the changing focus of government R&D policy since the mid 1990s. In the first half of the 1990s the broadly "science push" R&D model ensured that 95 per cent of state R&D funds were allocated directly to research activity and its associated infrastructure in the various publicly funded institutes and universities, with only 5 per cent used in support of new product development within the business enterprise sector (BES). In the latter part of the 1990s an increasing proportion of these state R&D funds have been allocated to activities at the interface between R&D activity itself and the industrial/commercial sector. Indeed applications for R&D grants are increasingly assessed in terms of the relevance of the particular research oriented project for industrial/commercial application (patents, new products, new processes etc.).

This increasingly innovation directed funding is to occur within an expanding R&D budget. For example Resolution No. 249 in 1999 was extended to cover the years 2000-2002, with public R&D funding budgeted to grow from 0.6 per cent of GDP in 2000 to 0.7 per cent of GDP in 2002 (having averaged only 0.5 per cent of GDP over the years 1997-1999).

Table IV reviews a variety of government-funded agencies, their responsibilities and activities in the R&D related area.

Table V provides more detail on the major government-funded programmes to support innovation in the CR.

Table IV Government funded agencies

Organisation	Status	Responsibilities	Assessment
Council of Government of CR for Research & Development	Executive body	Coordination of R&D funded by state	Advisory body, improving coordination of R&D funded by state
Grant Agency (GA) of CR	Public body	Distribution of public (state) R&D funds	Quality control of R&D by excellence
Academy of Science (AS)	Public body	Promotion of basic research in (28) selected areas via GA or AS	Promotion of research in key science disciplines
Ministry of Education, Youth and Sports	Executive body	1 articulation of concepts of state R&D policy; 2 coordination of international R&D cooperation; 3 promotion of R&D at HE via specific programs	Responsible for a part of academic science which is carried out at faculties of HE
Ministry of Industry and Trade	Executive body	Various programs[a]: "Export", "Centres", "Technos", "Stratech"	
Other ministries	Executive bodies	Specific GAs or R&D programs	Important R&D capacities are supported by Ministry of Agriculture, Ministry of Health and Ministry for Environment

Note: [a] See Table V

Table V Major government funded programmes and initiatives in favour of innovation

Name of programme	Responsible body	Objective	Sources of funding
EXPORT	Ministry of Industry & Trade	Support of competitive capacities of domestic industries	50 per cent – public (subsidy/five-year loan); 50 per cent – BES
STRATECH	Ministry of Industry & Trade	Support of development and diffusion of key technologies in the field of defence & state security technologies	50 per cent – public (subsidy/five-year loan); 50 per cent – BES
CENTRES	Ministry of Industry & Trade	Support of competitive products and technologies	50 per cent – public (subsidy/five-year loan); 50 per cent – BES
TECHNOS	Ministry of Industry & Trade	Support of SMEs and their technological capacities	50 per cent – public (subsidy/ loan – max. 9 mil. Kè for five years); 50 per cent BES
PARK	Ministry of Industry & Trade	Foundation, operation and development of Scientific and Technological Parks	25-50 per cent public (subsidy) loan – max. 9 mil. CZK

Education and training initiatives

Some of these have already been mentioned above. However a particular focus has been the development of innovation management technique (IMT) courses explicitly directed towards engendering more entrepreneurial approaches in the CR. IMT courses have been introduced explicitly into the curricula of leading universities, especially their economic engineering and technological faculties. Table VI outlines some of the initiatives used in support of human resource development for innovation.

Attempts are also being made to raise the general awareness of contemporary management practices in SMEs as well as in larger firms. For example progress is being made in terms of the diffusion of total quality management (TQM) techniques with over 2,000 Czech firms having been awarded ISO certificates.

The implications of an increasingly globalised and knowledge-based international framework for education and training initiatives in the Czech Republic are reviewed further at the end of this paper.

Macroeconomic context

It is widely recognised that the prospects for innovation amongst SMEs and larger firms alike are closely correlated with the macroeconomic environment in which these firms operate. A variety of government decrees and acts have sought to stimulate activity within the economy as a whole, including inward FDI. For example the

Table VI Main initiatives taken in favour of human resources development for innovation

Responsible organisation	Objectives	Target	Funding
Ministry of Industry and Trade	Resolution of Government No. 562, 9.6 1999 for support of SMEs	Training and education of entrepreneurs of SMEs in innovation	Public, Phare (EU)
Ministry of Education, Youth and Sport	White book – national program of education	Primary, secondary, tertiary education; adult education	Public
Government	Resolution of Government No. 418, 5.5 1999, National Plan of Employment	Unemployed	Public, Phare (EU), Private

January 2000 Act offered a number of broad based investment and FDI incentives:

- *Corporate tax relief of ten years for new companies and five years for existing companies seeking to expand.* New enterprises will be able to receive a full corporate tax discount for ten years from the start of production and existing enterprises seeking to expand will be able to receive a partial corporate tax relief for five years.
- *Financial support for creation of new jobs.* In regions with a high unemployment rate, job creation grants are to be offered. The grants differ according to the unemployment rate in the specific region and can reach up to CZK 200,000 (approximately US$5,500) per each new job created.
- *Financial support for training employees (up to 35 per cent of total training costs).* Training and retraining grants are to be offered in regions with high unemployment rates which may cover up to 35 per cent of the total training costs in those regions experiencing the highest rates of unemployment.
- *Location incentives.* The provision of low-cost land as well as subsidies for the development of infrastructure on sites where production is to be located.

Fostering innovative activities

A number of mechanisms and policies for increasing innovative activities in the CR, especially in the SME context, would suggest themselves from this review.

Innovation may be best supported by indirect measures in the form of additional grants, subsidies and tax reliefs being made available to SMEs and especially technology based SMEs. The focus should increasingly be on the interface between R&D and the business economic sector, rather than "directly" on the R&D activity itself. Indeed firms and institutions seeking R&D grants and other government reliefs and subsidies should be assessed primarily in terms of the relevance of the particular research oriented project for industrial/commercial application, as evidenced by outcomes such as patents, new products, new processes, etc.

SMEs and the majority of CR firms must ultimately depend on the market mechanism for creating both the opportunities and threats underpinning innovative activities. Whilst the work of the Revitalisation Agency has been important in restructuring the ten or so largest and most heavily indebted CR companies over the period 1999-2002, the prospects for SMEs are more closely connected with prospective changes in the legal and regulatory framework. For example it has been suggested (OECD, 2000a) that the most important boost to entrepreneurial and innovatory activity could lie in reforming the statutes and enforcement provisions surrounding bankruptcy legislation in the CR. Currently creditor rights are poorly protected, contributing to the growing reluctance of private banks to provide new loans to companies seeking to expand. New laws are being enacted to curtail the ability of debtors to asset-strip during bankruptcy proceedings and to provide greater opportunities for both creditors and debtors to engage in corporate restructuring ("workout bankruptcies") alongside any ongoing court procedures.

The legal and regulatory framework might also be adjusted to simplify and encourage more start-up activity in the CR. Greater regulatory stability would be particularly helpful in this respect: e.g. the Tax Law was amended four times in 1999 and the Business Code no less than six times in 2000. Such uncertainty invariably has an adverse effect on

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innovatory activities. Adjustment to CR domestic accounting standards may also help stimulate R&D activity. Currently R&D results are treated as a fixed asset which, given the long time span between outlay and effect, has resulted in firms funding their R&D and innovation from profit. Appropriate adjustments to the CR regulatory and accounting frameworks can help obviate this problem.

Specific programmes (e.g. "Technos", "Park") supporting innovative activities in SMEs, with clearly defined short and medium term objectives, would seem to be having positive results, as are similar programmes aimed at fostering research and innovative applications in larger firms ("Stratech", "Centres"). Of particular importance has been the sub-contracting programme organised by CzechInvest (Ministry of Industry and Trade) and running since 1999. Enhanced networks from such programmes have helped support inward FDI and the upgrading of products and processes in domestic (CR) suppliers.

Closer linkages with foreign firms have been widely advocated as a key factor in supporting domestic CR innovations. For example a study of the manufacturing sector over the 1993-96 period found that enterprises in which foreign stakeholders were in the majority had productivity levels twice those of domestic firms, invested five times more per employee, exported one-third more and were more profitable (Zemplinerova, 1998).

This shift towards a more strategic approach to supporting innovation and enterprise in SMEs within the CR is usefully exemplified by the "Resolution in support of enterprise in SMEs" [No. 562, 1999], which sought to make explicit the short and medium term goals to 2002 and the ways in which these could be attained. Short-term goals focused on the improved access of SMEs to venture capital and credits, protection against unfair competition, simplification of accounting standards and conventions, the more favourable tax treatment of innovations and the creation of new industrial zones. Medium-term goals included improvements to education and training policies, to the legal framework, to statistical surveying (e.g. adoption of standardised statistical approaches to innovative activities, as with the OECD Frascati Manual on R&D) and the preparation of SMEs for EU entry (Politika, 2000). This more strategic and policy oriented approach to supporting innovative activities in the important SME sector arguably gives a more credible context for growth in innovation-related activities in the CR.

The final section of this paper reviews the implementation of one such medium-term goal directed towards innovative activity in the Czech Republic – namely education and training policy.

Education, training and innovative activity in the Czech Republic

A number of policy initiatives aimed at aligning education/training policies with innovative activities have already been outlined. Table IV outlines various programmes and initiatives supporting R&D in the various publicly funded institutes and universities. Such funding was to take a higher proportion of GDP and to be progressively directed towards projects with clearly identified commercial outputs, such as patents, new products and new processes. In addition a variety of educational initiatives at lower levels of educational attainment were reviewed in Table VI, including courses explicitly directed towards fostering more entrepreneurial approaches within SMEs in the Czech Republic.

However whilst targeted goal setting has obvious attractions, for such targets to be effective they must be constructed in the broader context of a globalised, interdependent economic framework as well as that of the Czech Republic itself. For example some recent major reports (*World Economic Outlook*, 2001; *World Employment Report*, 2001) have identified the increasing importance of information, communication and telecommunications (ICT) technologies to innovation, economic growth and employment patterns in modern economies. A number of labour market impacts of ICT within increasingly knowledge-based societies were identified by these reports as having important implications for education and training policies.

- A change in the patterns of employment with ICT developments increasing the demand for highly skilled workers who can push forward the technological frontier and make the new technology

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accessible to the rest of the workforce. Less skilled, repetitive occupations in both manufacturing and service sectors (e.g. offices) tend to be replaced by ICT, with fewer, more highly skilled workers remaining.

- A greater geographical dispersion of employment as work becomes progressively less dependent on specific locational factors (e.g. increased "outsourcing" of work to lower labour cost economies, growth in work from home).
- A shift in employment towards smaller, less established firms and new entrants via "leapfrogging", which in this context refers to the opportunities inherent in the new ICT technologies for SMEs and new entrants to bypass extensive earlier investments by rivals in terms of the time or cost of innovative developments.
- A more highly skilled and better-educated workforce required within economies which now depend less on physical inputs than on knowledge.
- A shift in the focus of education and training to foster generic skills, with individuals no longer seen as passive recipients of facts but as active, lifelong learners. The ability at all levels of expertise to learn new approaches and transform existing knowledge into new knowledge becomes still more important in work environments that rely increasingly on rapid innovation and on the interpersonal exchange and creation of knowledge.

Forray and Lundvall (1996) propose a classification of "types" of knowledge which is particularly useful when reviewing education/training goals in knowledge-based societies:

- *knowing what*: procedural knowledge which involves the transfer of codified knowledge into facts;
- *knowing why*: cognitive knowledge involving an understanding of basic principles, rules and ideas;
- *knowing how*: knowledge that derives from direct experience or "know how";
- *knowing who*: knowledge that involves the ability to communicate and work in teams.

The World Employment Report (2001) suggested that procedural knowledge, i.e. knowledge about facts, is becoming progressively less important in the modern, information-rich economies. The emphasis is switching towards knowing why and understanding the basic principles which can then be applied flexibly to a range of new situations. The increased importance given to such cognitive knowledge and to the skills needed for its acquisition, are placing education and lifelong learning at the centre of governmental policy initiatives in modern economies. As the World Employment Report observes, increased emphasis must now be placed on " . . . a variety of foundation skills, such as the ability to learn, to communicate and to analyse and solve problems, all of which are essential to work environments that rely on rapid innovation, and the interpersonal exchange and creation of knowledge" (*World Employment Report*, 2001, p. 10).

Any attempt to overly prescribe educational and training policies for individual countries is, of course, fraught with dangers. Nevertheless Luthans *et al.* (2000) firmly advocate the need for formal entrepreneurial training and educational opportunities to be provided in the transition economies. Such a proactive stance by governments is seen as a means of supporting and directing a range of intentional entrepreneurial experiences involving purposive and volitional goal-bound activities toward entrepreneurial development. They note that, if executed successfully, these experiences will lead to an increase in entrepreneurial self-efficacy and help avoid an excessive dependence on external and often non-intentional attributions (e.g. having the right connections). Social cognitive theory suggests that reliance on such external attributions is far less likely to translate into higher self-efficacy (Stajkovic and Sommer, 2000).

What, then, are the elements that might be considered for inclusion in a proactive education and training policy by transition economies seeking to position themselves to take full advantage of the opportunities provided by an increasingly knowledge-based global society?

Broad-based literacy initiatives

A well-educated workforce has been shown to be a prerequisite for harnessing the use of ICT technologies in developing countries such as India, the Philippines and elsewhere. However many of the statistical relationships

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established often identify broad-based initial levels of educational attainment as the key independent variable. For example differences in school enrolment (per cent of school-age children actually attending school) are closely correlated with various indicators of ICT usage. A major report of the International Labour Office (2000) found a close and positive correlation ($r = 0.77$) between the percentage of school enrolment and the number of Internet hosts per 1,000 population.

A survey of OECD and Central European Countries (Hudson, 2001) found that, in 14 out of 20 countries surveyed, at least 15 per cent of adults had only "literary skills at the most rudimentary level, making it difficult to cope with the rising demands of the information age". In the countries surveyed, from one-quarter to an astonishing three-quarters of the adult population failed even to meet the literacy standard of Level 3, defined as the minimum for coping with the demands of modern life and work, i.e. capable of participating fully in the knowledge and information society.

Curriculum content

Throughout the curriculum attention needs to be given to the acquisition of the more cognitive skills of knowing why and how to learn, rather than fact based procedural knowledge. Transition economies must clearly seek to bring the types of knowledge conveyed explicitly and implicitly throughout the curriculum and at all educational levels into line with the needs of modern knowledge-based societies.

Overcoming the digital divide

Access to ICT technologies at home and work remains restricted to the more educated and higher income groups in most countries, whether developed or in transition. For example households with a "head of household" possessing a university degree in Canada were more than twice as likely to regularly use a computer than in cases where the head of household had only completed secondary education (OECD, 2000b). Although by no means a panacea, increasing Internet connectivity in schools, colleges and community centres has been an important policy mechanism for overcoming this digital divide in developed and transition economies. Estonia achieved 100 per cent connectivity in its school system in 2000, with Chile meeting the same criterion in 2001 for its secondary schools, though primary schools lag behind at around 50 per cent. Of course Internet connectivity *per se* is an imperfect indicator! For example although all Portuguese schools have been connected to the Internet with the help of EU funding since 1998, actual access is restricted by the high number of students per computer (around 40 students per computer in 1998 for secondary schools and over 100 students per computer for primary schools).

Skills training and lifelong learning

It has been pointed out that by 2010, over 80 per cent of the workforce in the EU will have received their formal education and training at least a decade earlier. In a rapidly evolving ICT context, the ability of workers to find and retain a job will increasingly depend on their possessing appropriate "foundation skills" that are transferable in terms of job flexibility and which can be regularly updated. These "foundation skills" must, of necessity, extend beyond those required in the ICT sector itself, which employs less than 5 per cent of the workforce across most OECD countries. Clearly a key policy focus must entail the provision of adequate numbers of those with these skills, which include the ability to learn, to communicate and to analyse and solve problems.

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