

REGULATORY REFORM AND INNOVATION

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

FOREWORD

Government regulations can have both positive and negative effects on the innovation process. Among other goals, regulatory reform in the OECD countries is intended to enhance the positive regulatory effects on innovation. Reforms should help ensure that regulations in all spheres of activity are fully responsive to changes in the economic, social and technical conditions surrounding them. The regulatory process must take into account the effects of regulation on innovation as well as the implications of technical change for the rationale and design of regulation. The regulation/innovation interface is mutual and dynamic; an understanding of this interface is crucial to regulatory reform efforts.

The OECD Directorate for Science, Technology and Industry (DSTI) is currently exploring the diverse and complicated links between regulation and innovation. Regulation and regulatory reform can affect technological development in sectors ranging from biotechnology to banking, and can influence the innovation process from research through technology diffusion.

This report presents an overview of the relationship between regulatory reform and innovation. It is an interim report which presents some preliminary findings of ongoing DSTI research in this area. This work will contribute to the OECD horizontal programme on regulatory reform and to the work programme of the Committee for Scientific and Technological Policy (CSTP).

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SUMMARY

Regulation directly affects the innovative process, while innovation and technical change have significant impacts on regulation. To be successful, regulatory reform efforts must take into account the linkages between regulation and innovation. A three-fold typology of regulation is used here for illustrative purposes. *Economic regulation* is intended to improve the efficiency of markets in delivering goods and services – which influences the innovative process. *Social regulation* protects the environment and the safety and health of society at large – its design can encourage or discourage innovation. *Administrative regulation* governs the practical functioning of the public and private sectors –setting some basic conditions for technological advance.

Regulatory reform is directed to making sure that these regulations are fully responsive to changes in the economic, social and technical conditions surrounding them. Many reforms are stimulated by technology developments which have changed the underlying cost and competitive structure in industries ranging from telecommunications to banking to biotechnology. At the same time, regulatory reform is a powerful stimulus to further innovation. Competition-enhancing reforms in both the manufacturing and service sectors have been essential to the development and diffusion of new technologies, such as the Internet, automatic teller machines and optical scanners in supermarkets. The redesign of approaches to environmental, safety and health regulation has increased the flexibility of firms in developing innovative solutions to social problems with an emphasis on prevention rather than mere control. The streamlining of administrative regulations has reduced the cumulative burden on business, freeing up resources for research and technology development. But as these reforms have unleashed a new round of technical change, unforeseen side-effects and different technology impacts have emerged to again underline the need for regulatory revisions.

This review of the *regulation/innovation interface* leads to several general conclusions on how to improve the positive regulatory effects on innovation without jeopardising the original regulatory objectives:

- ◇ *Understand regulation/technology linkages.* The regulatory process – whether in the economic, social or administrative spheres – must be ever vigilant to the effects of technical change.
- ◇ *Introduce competition.* In all economic sectors, a certain degree of competition among firms is essential to the innovative process.
- ◇ *Streamline regulations.* In the interest of economic efficiency and innovation, regulatory reform should seek to remove duplicative, onerous and inefficient regulations, particularly to aid small and medium-sized enterprises.
- ◇ *Use technology-driving approaches.* Maximum use should be made of regulatory approaches or alternatives which are technology-friendly, such as economic instruments, voluntary agreements and performance rather than design standards.
- ◇ *Harmonize internationally.* Countries should pursue greater compatibility among their regulations to remove uncertainties, inefficiencies and market barriers which can slow innovation.

BACKGROUND

A. TYPES OF REGULATIONS

Regulation can be said to generally refer to policies where the government acts as a referee to oversee market activity and the behaviour of private actors in the economy. Such government intervention in the marketplace is usually justified on the basis of market failures and the need to ensure societal well-being. For illustrative purposes, this report discusses three general types of regulation, all of which have effects on innovation (see Box 1). *Economic regulation* is intended to ensure the efficiency of markets, partly through promoting adequate competition among actors in the market-place. *Social regulation* is intended to promote the internalisation of all relevant costs by these actors. *Administrative regulation* can be said to aim at ensuring the smooth functioning of public- and private-sector operations.

Regulatory reform is directed to making sure that these regulations remain fully responsive to changes in the economic, social and technical conditions surrounding them. Regulatory reform can take many forms. With regard to economic regulation, reform can mean deregulation, privatisation or opening up a market to increased competition. In the case of social regulation, reform generally means improving the flexibility and cost-effectiveness of regulations. With regard to administrative regulation, reform is usually directed to streamlining and improving the efficiency of regulations. In some cases, regulatory reform can mean increased rather than decreased levels of regulation or government surveillance.

In all domains, regulatory reform should yield benefits in terms of reducing costs, enhancing efficiency and stimulating innovation. However, this must be done without sacrificing or jeopardising the original regulatory objectives – whether this be ensuring fair market transactions, protecting the environment or maintaining government oversight of private sector activities. Regulatory reform often incurs some short-term costs of adjustment; thus, the assessment of overall effects must take a long-term view. Regulatory reform is also controversial in re-distributing the costs of public policies among economic actors and altering established systems of protection, whether for industry or consumers. Establishing the right degree and form of regulation is a difficult challenge for governments and has important implications for the processes of innovation and technological progress.

Box 1
TYPES OF REGULATIONS

Economic regulation – Economic regulation is generally intended to improve the efficiency of markets in delivering goods and services. It can include government-imposed restrictions on firm decisions over prices, quantity, service and entry and exit.

Social regulation – Social regulation is intended to protect the well-being and rights of society at large. It can include protection of the environment, health and safety in the workplace, protection of the rights of workers, and protection of buyers from fraudulent or incompetent behaviour by sellers.

Administrative regulation – Administrative regulation relates to general government management of the operation of the public and private sectors. It can include regulations relating to taxes, business operations, distribution systems, health care administration and intellectual property rights.

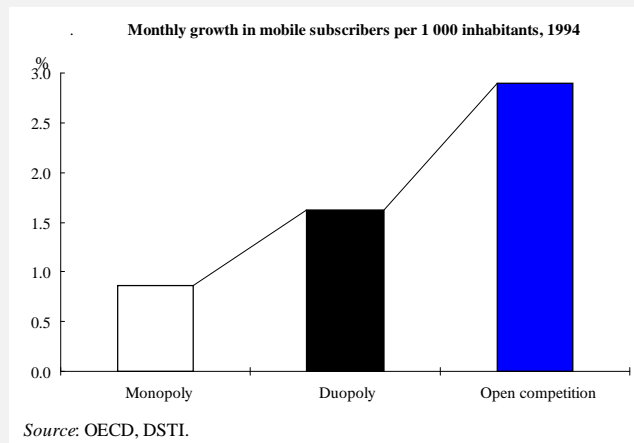
B. REGULATORY EFFECTS ON INNOVATION

Regulations have numerous types of effects on innovation, both positive and negative. In the economic sphere, regulations can maintain a certain level of openness or competition in product markets which provides the necessary conditions for research and innovation. In the social sphere, regulations can place technical demands on industries and act as focusing devices for their research efforts. Regulations have also spawned the creation of new industries and products as in the case of the “environment industry” (OECD, 1996*c*). Administrative regulation ensures there are fair “ground rules” for all economic actors in the innovative process, as in the case of intellectual property right protection.

However, regulations can also erect barriers to the development of new, improved products and production processes. They can encourage or discourage research efforts by firms. They can distort the choice of technologies that are explored and adopted. They can create barriers to innovation by increasing the uncertainty and costs of the development process. And they can affect technology diffusion (see Box 2). A 1994 survey by the Union of Industrial and Employers' Confederations of Europe of more than 2 500 European companies asked them to assess whether regulations made it easier or more difficult to realise six of the principal determinants of successful innovation. According to the companies surveyed, regulations make it more difficult (or much more difficult) for companies to: *i*) minimise costs (75 per cent of companies surveyed); *ii*) organise in a flexible way (59 per cent); *iii*) reduce time to market (54 per cent); and *iv*) reduce uncertainty (49 per cent) (UNICE, 1995). Regulatory reform is intended to address the deficiencies in regulation which negatively affect the innovative process from research to diffusion, while still achieving the benefits of regulation.

Box 2
REGULATION AND TECHNOLOGY DIFFUSION

The effects of insufficient competition in impeding technology diffusion is visible in the telecommunications sector, which remains under monopoly control in many countries. Of the 27 OECD Member countries, only eight allow competition in the underlying telecommunications infrastructure. Data show that use of the Internet (*i.e.* penetration rate for Internet hosts) is five times higher in competitive than in monopoly markets. Similarly, the diffusion rate for mobile (cellular) phones is directly related to the national regulatory regime. In monopolies, the monthly growth in subscribers per 1 000 inhabitants is less than 1 per cent, rising to 1.7 per cent in duopolies and to almost 3 per cent in markets with open competition (OECD, 1996a).



C. TECHNOLOGY EFFECTS ON REGULATION

Not only do regulation and regulatory reform affect innovation and technology development, but technology can also have a powerful effect on regulation (see Box 3). This is most often the case when technical change makes certain regulations obsolete or inefficient. Industries considered natural monopolies due to the nature of existing technology and regulated as such can find themselves undermined by technological developments. For example, telecommunications, electric utilities and transport were long regulated by governments as monopoly structures, partly for considerations of public service and national security. But over time, the technologies underlying these sectors changed, lessening their monopoly character by lowering costs and introducing potential new actors.

The effect of changing technology on regulation is demonstrated powerfully in the *telecommunications industry*, where the development of digital technology and other advances continue to revolutionise the sector. Here, outdated regulations are governing products and services which didn't even exist when the rules were formulated. Technology has blurred the boundaries between different service providers – local telephone companies, long-distance companies, international carriers, satellite transmitters, radio broadcasters, cable television companies, cellular carriers, fibre-optics access providers, wireless cable operators, specialised radio services, etc. Innovation is leading to new multimedia products and a gradual merger of telecommunications with broadcasting, computing and entertainment. Still, in many countries, regulations continue to govern these suppliers and products based on the old technological regime.

Information technologies, in particular, can alter the operations of a sector and bring into question the structure of regulation. In financial services, the costs of transactions have been lowered and their ease facilitated by electronic networks, leading to pressures for regulatory change. The prospects of electronic money or digital cash and electronic data interchange are further transforming financial markets at the national as well as international level. In areas of social regulation as well, the development of new products and processes may outpace the regulatory regimes in place. This is seen in the case of genetic engineering and the development of new biotechnology-based food and medicinal products.

Box 3

THE TECHNOLOGY/REGULATION INTERFACE

When it comes to competition, the technology/regulation interface is often a two-way street. Technical advance can not only dismantle monopolies but also favour more concentrated markets.

This is seen particularly in sectors which are heavy users of information and communications technologies, which can have “*network effects*”. Here, the emergence of a new product can lead to a “*de facto*” standard for the industry. In the airline industry, for example, computerised reservation systems may favour incumbent airlines, allow price discrimination and concentrate the services offered. In computer software, this might be said of Microsoft’s Windows software, and in consumer electronics, this was the case of the VHS standard which overtook its Beta competitor in videocassettes. In deregulated situations, it is possible for technological development to negatively affect further innovation by decisively taking over a market and blocking entry of competitors. Some type of new regulatory intervention may then be warranted, particularly for sectors characterised by these network externalities.

ECONOMIC REGULATION AND INNOVATION

A. COMPETITION LAW

Competition law is a form of economic regulation intended to promote economic efficiency by ensuring that enterprises produce what consumers most want at the lowest possible prices. In this context, competition agencies attempt to control anticompetitive behaviour and promote less concentrated market structures. However, there are different theories as to the relationship between market concentration (including the size of firms) and innovation.

According to Schumpeter, *concentrated market structures* should favour technological progress mainly for reasons of static efficiency based on scale and scope economies. Large firms in concentrated industries are more likely to innovate because: *i*) they are better able to finance large research projects from their own profits; and *ii*) they can more easily appropriate the returns from their innovations since there are few competitors. For these reasons, Schumpeter and others have argued that strict competition policies may actually slow the rate of technological progress. Modern proponents point to the break-up of monopolies such as AT&T as eliminating beneficial large-scale research efforts.

Other economists maintain that *competition among firms* favours innovation and technology development. For example, according to Kenneth Arrow and the “*Arrow Effect*”, monopolists and oligopolists have little incentive to innovate because they already control all or most of the market. Arrow and others have argued that the absence of competition will actually lead to less innovation; competition policy that focuses on eliminating monopoly and collusion should help dynamic efficiency.

Box 4
FIRM SIZE AND INNOVATION

Despite the recognised value of competition to the innovative process, economic studies of the relationship between firm size and innovation have been inconclusive, due in part to data and methodological problems. However, it appears that there is no general trade-off between the size of a firm and its innovative capacity. Innovation and technical advances seem to be highest in sectors with several competing companies, including both large and small firms. This is because:

- large firms may have scale and financial advantages in improving manufacturing productivity and product quality for established products and technologies;
- a high level of concentration may be inevitable at certain points of time in sectors with high R&D intensity and evolving technologies;
- smaller firms may have advantages in producing both “radical” and incremental changes to products and technologies;
- co-operative research efforts, particularly among smaller firms, allow them to achieve the scale and scope advantages of larger firms;
- a number of sector-specific factors, *e.g.* the nature of innovation and the extent of learning economies, price competition and product differentiation, must be taken into account.

(Symeonidis, 1996)

B. REGULATED INDUSTRIES

Governments have regulated some sectors more than others in terms of entry, prices and services due to perceived natural monopolies, the need to correct market failures and the desire to promote universal access to networks, among other reasons. Airlines, trucking, buses, railroads, telecommunications, natural gas, electricity, cable television, banking and insurance are among the sectors which have been heavily regulated or wholly or partly owned by governments. It was believed that, in the absence of government intervention, these industries would be characterised by excessive entry, unstable prices, inefficient services, costly duplication of facilities and inadequate investments in innovation. However, in sectors such as telecommunications, innovation seems to have been more vigorous in the more liberalised jurisdictions (see Box 5).

In recent years, most of these sectors have been the subject of *regulatory reform* and have experienced some mixture of privatisation, deregulation and increased competition. These reforms, which have largely been prompted by technical change, have stimulated further innovation. In many cases, inappropriate government regulation increased costs and prices as well as distorted technological change as a consequence of the lack of competition in these markets. Centralised decisions by a regulatory agency concerning research and development, equipment purchases and technical problem-solving tended to hinder innovation. Regulators were often inexperienced with new technologies, hostile to technical change and/or protective of domestic research efforts and nationally developed products and processes. For example, it has been said that the German *Bundespost* or public telecommunications service lagged in changing to digital switching due to over-reliance on domestic suppliers of mechanical switches. In some cases, overly generous research funding in the absence of market signals can act to misdirect some innovative efforts in these regulated sectors. This has been a criticism levied at France Telecom, which although technologically advanced, has invested in innovations such as the Minitel and consumer-oriented facsimile which are not thought to be broadly commercial (Baily, 1993).

Box 5
INNOVATION IN TELECOMMUNICATIONS

Using patents as an indicator (but an imperfect one) of innovation, data show that patents appear to have expanded more strongly in the last decade in countries where the telecommunications industry has been subject to greater competition (*e.g.* the United States and Japan) than in more regulated industries (*e.g.* Germany and France) (Table 1).

Table 1
Growth in patents in telecommunications-related areas
Average annual growth rate

	US Patent Office			European Patent Office		
	1980	1993	AGR %	1980	1991	AGR %
USA	3710	6978	5.0%	225	1005	14.6%
Japan	862	4518	13.6%	79	861	24.3%
Germany	341	482	2.7%	224	443	6.4%
France	254	409	3.7%	141	281	6.5%
UK	222	259	1.2%	44	186	14.0%

Source: OECD (1995), Communications Outlook.

C. FINANCIAL MARKETS

Banking and finance have been among those sectors traditionally regulated by governments for reasons of controlling the money supply and ensuring smooth functioning of the economy as well as protecting depositors against losses and fraud. Banks and financial institutions were traditionally regulated in terms of investment portfolios, accounting practices, insurance against financial loss as well as the types of services which might be offered to consumers. Institutions were once limited to providing certain services, such as commercial loans, consumer loans, checking accounts with or without interest, savings accounts or mortgages. Financial regulation was also extended to interest rates, capital movements, foreign exchange transactions and securities trading (see Box 6). A great deal of liberalisation has occurred in this sector, partly prompted by information and communications technologies which have forced alterations to financial operations at the national and international levels. Now, these same technologies have implications for concentration and market access in financial service industries, as larger organisations may be better able to exploit emerging new products and services.

In *retail banking*, countries first implementing reforms were marked by structural innovations and wider diffusion of new technologies. The United States was one of the first countries to eliminate the artificial segmentation of services which could be offered by various banking institutions, leading to a wider range of financial products and services being offered to customers, such as electronic fund transfer, over-the-counter sales of shares, and new insurance and financial products such as low-start and reverse mortgages. In addition, financial institutions in the United States were the first to install automated teller machines (ATM) on a broad scale, providing customers with quick access to a wide range of services and realising productivity gains in reducing the labour needed to dispense cash and conduct other transactions. Studies found productivity in US retail banking to be 30 per cent higher than in Germany or the United Kingdom, mainly due to the use of more innovative technologies and practices (McKinsey, 1992).

Box 6
REGULATION AND VENTURE CAPITAL

Industry access to finance, particularly venture capital, is a crucial element in the innovation process. Venture capital is needed to support high-risk investments in small, technology-based firms, which are often passed over by traditional financial institutions. Regulatory reform in financial markets is a prerequisite to improving the supply of venture capital. Among the OECD countries, the venture capital industry is most well-established in the United States, where it is oriented to technology-based sectors and consists of a range of investors, including pension funds, insurance companies and private individuals. In the more highly regulated European market, the venture capital industry is younger, oriented to mainstream rather than high-risk sectors and dominated by banks. Also highly regulated, Japanese venture capital firms are mostly subsidiaries of large financial institutions, which invest in established firms and provide mainly loan finance.

The creation of secondary or over-the-counter stock markets for small, growing companies is also important to the supply of venture capital. The NASDAQ market in the United States has been the trend-setter in this regard. Europe is trying to create an equivalent in the EASDAQ. In Japan, regulations on firms concerning net assets (1 billion yen), net profits (300 million yen) and period of establishment (seven years) have reduced listings in the over-the-counter market and prevented new technology-based firms from raising needed funds. This market has been further hindered by Japanese regulations limiting venture capital investments by pension and retirement funds – rules which are now under review (OECD, 1996*d*).

SOCIAL REGULATION AND INNOVATION

A. ENVIRONMENT

In the area of social regulations, such as those intended to protect the environment, the question is not so much one of deregulating or introducing more competition, but of learning how to regulate better. Environmental regulations are aimed at controlling the polluting by-products of industrial production and maintaining the cleanliness of air, water and soil. Despite recognition of the need for environmental rules, there continue to be *industry complaints* that environmental regulations (of the “command and control” type) are implemented in such a way as to discourage the application of innovative solutions. Companies often maintain that:

- ◇ environmental regulations are too prescriptive and do not allow companies enough latitude to develop new technologies or innovative approaches to address ecological problems;
- ◇ environmental regulations are not cost-effective and, in imposing high direct compliance costs, divert funds from research and development; and
- ◇ environmental regulations often encourage the modification of existing equipment rather than investment in new equipment and more innovative operating processes.

Box 7
ENVIRONMENTAL REGULATION AND INNOVATION

Studies using patents as a proxy for innovation show there is a positive link between environmental regulation and innovation. Regulations trigger pollution abatement expenditures and serve as “focusing devices” for research. Trends in innovation in the major OECD countries, as represented by patenting, reflect corresponding domestic regulation and spending on pollution control. In the United States, Japan and Germany in the 1970s and 1980s, the share of environmental patents in all patents varied between 0.6 and 3.0 per cent and tracked the corresponding share of pollution abatement expenditure in GNP, although at a higher level. These data only measure the extent of regulation as measured by expenditure and do not reflect the form of innovation or the effectiveness of different strategies for stimulating innovation (Lanjouw and Mody, 1996).

Past experience shows that, while driving research, most environmental regulations have resulted in incremental technological improvements rather than true innovation. For the most part, regulatory regimes have been directed towards the adoption of “best available technology”, an approach which encourages the adoption of existing technology and “end-of-pipe” pollution control devices. In addition, the tendency to apply stricter standards to new sources (*i.e.* new plants or equipment) creates an incentive to prolong and modify old technology. Ironically, innovative responses to regulation have been most in evidence when products have been banned; environmentally-superior substitutes emerged to replace PCBs, phosphate detergents, asbestos and CFCs. In the environmental area, technology-driving approaches are needed, which would include continual updating of standards, surveillance of old technologies, quality or ambient standards rather than design standards, emphasis on preventive rather than control techniques, similar standards for new and existing sources of pollution, waivers or fast-tracks for innovative facilities and products, and greater use of economic instruments and voluntary agreements or “technology compacts” with firms.

B. SAFETY AND HEALTH

Safety and health regulations are intended to protect the well-being of the population largely through controlling hazards arising from products and the workplace. They stem from the concern that consumers and workers generally have less access to information about the quality of products or workplaces than industry and thus may be victimised. As in the case of environmental regulation, the need for safety and health regulation is not in question, and the issue is not one of deregulation but of achieving regulatory objectives more efficiently. Also, as in the case of the environment, the challenge is to design rules governing products and workplaces that will encourage innovative solutions and not stymie technology development. Some product standards related to safety and health have also hindered market access at the international level, where greater competition could be beneficial to innovation.

Maintaining the appropriate balance between protecting human safety and health and promoting economic efficiency is not easy. A case in point is biotechnology and the development of a product approval process which incorporates sufficient regulatory guarantees but does not dampen innovation. Biotechnology companies are particularly concerned about time-consuming regulatory procedures and extensive testing and certification procedures, which delay approval for products whose life-cycle is becoming ever shorter (see Box 8).

Product approval procedures can differ significantly across countries. Europe has addressed this problem through establishing a centralised procedure for granting Community-wide marketing authorisation for medicinal biotechnology products. But there remain deeper differences among OECD countries with regard to the nature and degree of regulation needed for biotechnology products, particularly whether inherently different procedures are needed for genetically-modified organisms. Industry advocates that an innovation-promoting approach in biotechnology would: be based on the characteristics and risks of the products themselves rather than the processes by which they are produced; be designed to minimise the burdens on producers; emphasize standards of performance rather than design; reflect rapid technical developments in the biotechnology area; and be more harmonized across countries plus incorporate mutual recognition procedures.

Box 8
INNOVATION IN BIOTECHNOLOGY PRODUCTS

According to many parts of the European biotechnology industry, regulatory restrictions (affecting product testing, development and labelling) cause product development decisions to be directed towards the use of existing technologies and have played a role in the location of research and development activities outside of Europe. The EU approach emphasizes the method by which a product is produced more than the intended use of the product. Biotechnology companies surveyed identified the major regulatory areas creating problems as product approval delays (70 per cent), lack of adequate patent protection (60 per cent) and difficulties with planning/site approval (35 per cent) (Ernst & Young, 1994). Other data show that the United States, which takes a different regulatory approach, enjoys a substantive lead over Europe in virtually every biotechnology-related category (in 1994): number of biotechnology companies (1 300 versus 485), patents (65 per cent versus 15 per cent) and R&D expenditures (7 billion ECU or US\$8.85 billion versus 2.2 billion ECU). While Europe is still a major force in the biotechnology area, some worry about its future contributions to innovation in this field (Miller, 1996).

C. LABOUR LAWS

Labour regulations are social regulations intended to protect the rights of workers. They include rules concerning recruitment and dismissal, overtime restrictions, working hours, part-time and temporary work, female and child labour and pay rates. Like other areas of social regulation, labour rules are necessary to ensure the well-being of workers. However, sometimes labour laws can discourage innovation by making it more difficult to introduce new technologies or new approaches to workplace organisation. While such protection for workers is essential, studies show that a certain level of *labour market flexibility* can promote not only employment but also innovation.

For example, labour laws can make it harder to adopt and implement new process technologies, particularly when workers fear that this will adversely affect their employment, even though longer-term productivity and growth effects can enhance job creation. But this requires a flexible and adaptable workforce in the short term. Similarly, labour regulations which are not sufficiently flexible can make it more difficult or time-consuming to carry out research projects and make it harder for companies to respond to structural and technical change (see Box 9).

Box 9

LABOUR REGULATIONS AND AUTO RESEARCH

According to calculations by the European Car Assembly Association, a research project which is started in Germany in 1995 and is scheduled to terminate in 2002 will, assuming the same organisation and productivity, be finalised 1.25 years earlier in the United States and 3 years earlier in Japan. The main causes of the slower pace of development in Germany are alleged to be shorter working hours and less flexible working conditions, which are heavily influenced by employment regulations. The European Car Assembly Association believes that auto assembly companies in other countries, with different labour regulatory regimes, are better able to exploit new technologies, the shortening of product life-cycles and consumer demand for more fashionable and higher-technology products.
(ECAA, 1994)

In the knowledge-based economies of today, the stress is on high-performance workplaces and the new “flexible enterprise”. In these firms, the adoption of new technologies, the emergence of new occupational classes, an emphasis on employee participation and work teams, and continuous experimentation with the organisation of work are changing traditional notions of job-based compensation and favouring wages linked to knowledge and performance. There is more use of part-time employment and variations in the timing of work. There is a trend to outsourcing, decentralisation and downsizing with consequences for the security of employment. There is a stress on training and upskilling of workers. In many OECD countries, the reform of labour rules can encourage the emergence of more adaptable and innovative firms. Regulatory approaches include more elastic rules covering wage levels and dismissal costs, a greater range of work contracts, more flexible working hours and part-time arrangements, and encouraging greater occupational and geographic mobility. The situation differs, however, by country. For example, in certain “market-driven” countries, firms may need to assume more responsibility for worker training and job security; in some “relations-based” countries, greater use might be made of non-standard and more flexible work arrangements; and in countries with a “consensual” approach to labour relations, a heightened accent might be placed on worker flexibility and mobility (OECD, 1996*b*).

ADMINISTRATIVE REGULATION

A. BUSINESS OPERATIONS

Administrative regulations include different types of government rules covering the establishment and operations of businesses as part of government oversight of producer-consumer relations. These rules can be particularly onerous for small and medium-sized enterprises (SMEs) which, as studies of innovation and firm size have shown, are among the most technologically dynamic of enterprises. An area believed to be particularly adverse to the innovative process is rules concerning establishing a business, which can discourage the creation of new technology-based firms and innovative start-ups. In some countries, the process of setting up a business and recruiting a staff can take months and incur substantial costs (see Table 2).

Table 2
Comparison of formalities for setting up a business

COUNTRY (Type of firm)	Number of procedures	Number of days	Estimated costs (ECU)
France (SARL)	15	28-56	1 900-4 600
Germany (GmbH)	8	56-168	750-2 000
Greece (EPE)	24	21-70	750-2 000
Italy (SPA)	21	154	700-7 000
Ireland (ULC)	6	14-28	300-700
United Kingdom (PLC)	8	42	500-1 000

Source: European Commission (1995), *Green Paper on Innovation*.

Many countries have taken innovative approaches to *streamlining regulations*, so that they will be less of a cumulative burden on business. In many cases, regulations have multiplied and become duplicative as the range of government operations has both broadened and become more specialised. Yet the regulatory process itself has often failed to keep pace with the evolution of government and economies as well as technology. Recent innovations in the regulatory process have been particularly helpful to small and medium-sized enterprises. Among these approaches are:

- ◇ *Administrative reviews.* The United Kingdom, the United States, Japan and Canada are among those countries which in recent years have initiated sweeping reviews of rules and regulations in all domains with the aim of reducing, rationalising and (in US words) “reinventing government”.
- ◇ *Vetting new regulations.* Governments are now attempting to weigh more fully the costs and benefits of new regulations before implementation. This may include a small business “litmus test” to ensure that regulations do not have disproportionate effects on smaller enterprises.
- ◇ *Assistance centres.* Governments are setting up centralised centres or “one-stop shops” where businesses can acquire information about all relevant administrative regulations and carry out many administrative formalities. To this end, governments are also starting to make use of information technologies and disseminating information on business regulations to firms via electronic networks, including interactive web sites.

B. RETAIL DISTRIBUTION

The retail distribution sector, comprising stores and outlets selling goods to consumers, accounts for an estimated 8 per cent of GDP and 10 per cent of employment in the OECD countries. It has been one of the more heavily regulated sectors in terms of administrative regulation. Rules specify the hours which shops may be open, largely to protect small shopkeepers. Other regulations favour the maintenance of small, family-owned shops over larger, retail outlets for aesthetic, cultural as well as ecological reasons. Zoning laws limit the establishment of new outlets to certain geographic areas for the purposes of environmental protection and urban planning. Regulatory constraints may be placed on the marketing techniques to be used and the interactions between retailers and wholesale suppliers.

While there are many advantages associated with small shops, and disadvantages with large retailing formats, experience shows that regulatory flexibility has led to the emergence of *large retail chains* which have made many innovative contributions:

- ◇ Larger retailers have encouraged an acceleration in *product innovation* by spotting market trends and creating shelf space to accommodate them, reducing consumer loyalty to established market brands and developing new products themselves.
- ◇ Larger retailers have taken the lead in the implementation of *new technologies* in retailing based on telecommunications and information technology.
- ◇ Larger retailers have made *organisational innovation* a normal part of their operations, including new store formats and techniques of product promotion.
- ◇ Larger retailers have spurred *technology diffusion*, being keen to adopt new techniques and products from at home or abroad in a sector where imitation is easy.

Many retail innovations have in fact originated in the United States, where the retail distribution sector has traditionally been less highly regulated. Checkout operations and inventories were first computerised with the use of optical scanners in the United States. Self-service formats were first prominent there. Establishments such as Home Depot, Circuit City and Toys 'R' Us initiated the practice of discounting large volumes in particular segments of the market. Stand-alone stores were complemented (or replaced) by higher productivity retailing formats such as Wal-Mart. Mail order, television order and electronic order operations are now edging out standard retail outlets (Baily, 1993).

Box 10

REGULATION AND RETAIL DISTRIBUTION

Deregulation of the retail distribution sector is now being implemented in most OECD countries, including the liberalisation of shop-opening hours, easing of restrictions on large-scale stores and modification of zoning rules. Evidence points to increases in output and employment, declining prices, fewer trade barriers and greater innovation. Japan has been one of the last countries to reform its retail distribution regulations. Successive amendments to the *Large Scale Retail Store Law* have increased the size threshold at which approval must be sought, and applications for establishing large stores in Japan have increased from 1 667 in 1990 to 2 206 in 1995. Retailing in Japan is now seeing the emergence of suburban supermarkets, hyper shopping complexes, greater use of information technologies and more price competition.

C. INTELLECTUAL PROPERTY

Administrative regulation can include provisions relating to intellectual property rights (IPR), or the degree of protection granted by the government to creators and inventors for innovation. These “*appropriability conditions*”, which are embodied in patents, copyrights, trade marks, etc., are among the fundamental drivers of technical advance. Intellectual property policy must maintain a delicate balance between: *i*) rewarding inventors by limiting the appropriability of the invention and increasing the returns to R&D; and *ii*) promoting the interests of business and the public by allowing some use of the invention and enhancing technology diffusion.

In this trade-off, weak protection for intellectual property rights (*e.g.* limited patent duration, extensive compulsory licensing) can reduce the incentive to innovate. An innovator undertakes R&D in the expectation that the private returns to the investment will justify the expense. If a large fraction of the benefit to R&D accrues to others, private decisions will lead to an under-investment in research. However, the exclusive rights to exploit an invention provided by overly strong IPR protection can lead to abuse or misuse of monopoly power. The benefits of innovation may be greater if it is spread more broadly through society, increasing the allocative and productive efficiency of the economy. The regulatory challenge is thus to maintain an equilibrium between the interests of the innovator and those of the public.

In an era of globalisation and rapid technological progress, there are a number of concerns regarding the ability of traditional intellectual property regimes to stimulate innovation while promoting technology diffusion. Intellectual property regulations remain rooted in national cultures; *differences in national approaches* cause difficulties for multinational firms seeking to patent inventions in several countries as well as for those investing abroad. The majority of OECD countries apply the “*first-to-file*” rule, whereby the first patent applicant has priority over any subsequent applicant. Other countries, notably the United States, apply the “*first-to-invent*” rule, where applicants must prove they developed the innovation. Such regulatory differences underscore demands for greater world-wide harmonization.

Box 11
TO PATENT OR NOT TO PATENT

There is continuing debate about the value of protecting inventions through acquiring patents, and the role of IPR protection in the innovation process. One study, which estimated the value of patents across countries, taking into account differences in market size and patent costs, puts the total value of patent rights created by the OECD countries at over 20 per cent of their R&D expenditures. Countries share in this value roughly in proportion to their GDP, but Germany and the United Kingdom have a relatively higher share, while Japan has a lower share. US inventors tend to patent more in their home market than abroad. Japan, Sweden, Switzerland and Austria have a higher share of foreign than domestic patents (Putnam, 1995).

Other studies point to the decreasing value of patents. A survey of US business showed that “*secrecy*” is considered a better mechanism for protecting innovations due to both rapid technological change, particularly in information technologies and biotechnology, and the rising legal costs of defending patents. Firms also tend to patent for reasons other than protecting their innovations from being copied. For example, patenting is often seen as a means of blocking rivals from patenting related inventions. Thus, in a globalised economy, patenting may be becoming more of a competitive weapon than a stimulus to innovation. New IPR regimes may be needed to prevent such tactics from slowing the diffusion of technology (Cohen *et. al.*, 1996).

CONCLUSIONS

Several conclusions can be reached as to how to realise positive regulatory effects on innovation, while taking care not to jeopardise the original regulatory objectives:

- ◇ ***Understand regulation-technology linkages.*** Technical change has played a central role in prompting regulatory reform. Technology often changes the underlying cost and competition structure in an industry, leading to demands for new regulatory regimes. Regulatory reform itself can be a powerful stimulus to innovation in most fields, ranging from banking to environment to retailing. However, the resulting technical developments may warrant a new round of regulatory modifications. Regulatory reform may lead to abuses of new monopoly positions as in the case of new computer software or financial products; to different ecological hazards as in the case of larger shopping formats and their contribution to “*urban sprawl*”; or to possible unforeseen safety hazards. In some cases, supplementary government oversight will be needed to ensure the success of regulatory reform. In all cases, regulations must be ever vigilant to the effects of technical change.
- ◇ ***Introduce competition.*** Despite the advantages which large firms may have over small firms in mustering resources for research and innovation, a certain degree of competition is essential to the innovative process. Reforms which have promoted competition among firms, large or small, have stimulated innovations in most sectors, including telecommunications, utilities, financial services and retail distribution. Competition-enhancing reforms are also important to the diffusion of knowledge. Hard technologies such as automatic teller machines in the banking industry and electronic switches in telecommunications have diffused faster in deregulated markets. Similarly, soft technologies such as catalogue sales in retail distribution and “*hub and spoke*” systems in the airline industry have been adopted more widely in competitive markets. The competition-innovation link is demonstrably positive.

- ◇ ***Streamline regulations.*** Regulations place a heavy administrative burden on companies, particularly new or small firms, and the time spent on administration is often lost to innovation. In this era of technical change, speed is becoming a key determinant of the success of business activities. Duplicative and inefficient regulations can no longer be tolerated. The regulatory review process should include comprehensive accounting of all regulations on particular sectors or products, benefit-cost or cost-effectiveness analysis of major regulations, sunseting or automatic expiration clauses in the absence of assessment, and centralised information and administrative centres to provide assistance to firms.
- ◇ ***Use technology-driving approaches.*** The design of regulations can either hinder innovation or encourage it. To ensure their appropriateness, regulations should take into account the effects of the most advanced technologies in the field and reflect the views of both producers and users. Maximum use should also be made of regulatory approaches or alternatives which are technology-friendly, such as economic instruments (environmental taxes and tradeable permits in the case of the environment), voluntary agreements (compacts with companies to allow them to test innovative approaches) and performance rather than design standards (as in the case of biotechnology).
- ◇ ***Harmonize internationally.*** Harmonization of all regulations across countries is not possible, given their different economic, social and cultural backgrounds. However, countries should continue to pursue greater compatibility among regulations in the interest of both economic efficiency and innovation. Regulatory differences can not only constitute barriers to market access, they can also hinder technical advance and technology diffusion as in the case of conflicting competition, financial and intellectual property laws. Differences in content and enforcement can create uncertainties among firms which slow research investments and innovation. And, as companies seek to locate in markets with the most favourable regulatory conditions, governments should co-operate to minimise regulatory competition.

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