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Regulatory reform and innovations: Whether to trust the invisible hand or use the visible one?

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FOREWORD

This study was carried out as a part of the Research Programme on the Finnish Innovation System financed by Sitra, the Finnish National Fund for Research and Development. The national innovation system is defined as the system of organisations and actors whose interaction shapes the innovativeness of the national economy and society. The main goal of the research programme was to identify the future challenges of the Finnish innovation system. In a rapidly changing techno-economic environment, the Finnish innovation system cannot be expected to repeat its recent successes without continuous and effective development effort.

The research programme included 12 research projects that represented several scientific disciplines: sociology, economics, innovation research, psychology, jurispudence, etc. The cross-disciplinary approach was chosen to gain many different, but complementary, perspectives on the structure and functioning of the innovation system. The close cooperation of scholars from different disciplines was aimed at creating an innovative research environment for the programme. A particular emphasis was laid on understanding the micro-level innovation processes and innovation networks. The research projects went beyond the traditional organisation- and institution-oriented studies of innovation systems in order to better understand the drivers and context of modern innovation processes. In the changed environment, innovation policies cannot be effective without a deep understanding of these processes and their environment. The results of the whole research programme were synthesised in the programme's final report *Transformation of the Finnish innovation system: A network approach* (Gerd Schienstock and Timo Hämäläinen).

Sitra wants to thank all the researchers, policy makers and distinquished foreign experts that contributed to the success of the research programme. The results of the research programme provide plenty of challenges for further research and future innovation policies.

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1 INTRODUCTION

Motivation of the study

"To regulate or not to regulate, and if we regulate, how, these are the questions." (Määttä 1997.)

Virtually all regulations which affect output, profitability and technological constraints also have implications for innovative activities (Metcalfe 1995). This is not the whole story: the results of innovative activities have implications for regulatory policy e.g. new technological innovations often create challenges for the development of the regulation. Electronic commerce highlights the latter aspect well. For instance, how do we deal with offer and acceptance under contract law when they have been done by Internet, or how do we control improper tax avoidance in electronic commerce? Such legal problems emerge constantly in the innovative world we live in today.

Nevertheless, a basic question which arises is the significance of regulation with respect to innovations. An interesting viewpoint here is Mancur Olson, Jr's (1996) statement that "national boundaries mark the borders of public policies and institutions that are not only different, but in some cases better and in other cases worse. Those countries with the best policies and institutions achieve most of their potential, while other countries achieve only a tiny fraction of their potential income...there is also direct evidence of the linkage between better economic policies and institutions and better economic performance". However, authors do not necessarily agree that regulatory reform as such results in productivity gains, or whether differences in regulatory regimes affect the development paths of industries in different countries. (OECD 1996b; Wienert 1997.)

The purpose is to "test" whether certain – and only certain – fields of Finnish legislation are efficient from the dynamic point of view. Put it in another way, it is to assess, among other things, the options for mitigating any negative regulatory impacts on innovation and options for promoting positive regulatory effects on it. Against this background, proposals de lege ferenda will, if necessary, be made for amending regulations. In addition, we do not only concentrate on details of

legislation but our aim is to seek generalizations concerning principles which have to be taken into account when studying the need for amendments of regulations and redesigning the regulations.

More specifically, according to Wienert (1997), the following questions are important with respect to regulatory reform:

Whether to regulate. Deregulation is only a subset of regulatory reform, even though this concept has been used extensively within the context of that reform. Deregulation denotes complete or partial elimination of regulation in a sector (Wienert 1997). *Re-regulation* denotes the case in which old regulation is replaced by new or existing regulation is redesigned. We should note that stimulating innovations and their diffusion does not always imply reducing regulation. Thus, the key challenge is often not to choose between regulation or no regulation, but to redesign unnecessarily disruptive regulation (Koedijk & Kremers 1996). In addition, there may be a need for totally new regulation. For instance, technological innovations have created new markets e.g. satellite communications, that fall outside the scope of existing regulation, thereby challenging the viability of current regulatory frameworks (Wienert 1997).

How to regulate. Above all, this question includes issues related to the design of specific regulation. This is also the perspective from which regulatory reform has usually been analysed in the literature. However, an important dimension of the issue also involves the interaction between different regulations. Two viewpoints are worth noting here. First, regulations are *substitutes* for each other more often than is sometimes understood. For instance, environmental policy goals could be promoted by many different means, such as direct regulation, environmental taxes, emissions trading, environmental subsidies or voluntary means (so-called suasive instruments) (Shavell 1984; Määttä 1997). Regulatory reform supporting dynamic efficiency may then involve e.g. direct regulation being replaced by voluntary means. Second, regulations may also be *complementary*. One regulation may reinforce the effectiveness of another or one type may be used to speed-up the measures required by the forthcoming regulation. These complementary means could be labelled *reinforcing instruments* and *preparatory instruments*.

When to regulate. The timing of regulation is often omitted in research even though it may be an important factor in practice. Preparatory instruments are an illustrative example of highlighting the importance of the timing of regulation. For instance, if certain legal obligations are to be in force at the beginning of 2005, it would mean that the purchases needed to adjust to the new legislation should be concentrated (easily) at the end of year 2004. What would then happen? The prices of investments would increase and this could even lead to problems in fulfilling the new requirements (KM 1989:18). To avoid this kind of "congestion" of investments, preparatory instruments could be applied. For instance, taxes or subsidies could be introduced as early as possible to encourage economic actors to invest before the new obligations were implemented. Such regulation could balance the investments over a longer period of time as well as level the costs of the investments. The lower are the costs of those investments, the better the

opportunities for setting ambitious goals for regulation and the opportunities for rapid technological change.

Delays in regulation are also of great importance in this respect. Total delay in regulation can be divided into four sub-delays (Määttä 1999a):

1) A delay in observation is the time period between an event (demanding regulation or its amendment) and the point in time when the event is noticed.
2) A delay in decision-making (or resolution) is the period between the observation of the event and the point in time when the decision to introduce or amend regulation is made.
3) A delay in implementation is the time lag before the new or reformed regulation is put into effect after resolution.
4) A delay in effect is the time period between the implementation of regulation and the point in time when its effects occur.

At which level — i.e. local, national, or supranational — to regulate. Since markets have become more international, it is becoming increasingly difficult for domestic authorities to control the behaviour of their national private sector actors. It is also increasingly difficult for national governments to achieve the intended goals of regulation. For instance, in global markets firms can engage in *regulatory arbitrage*, by moving their business or capital to the country with the most favourable regulations (Wienert 1997). International tax competition is an example of this phenomenon. These factors stress the idea that regulations should be enacted at the supranational level more than has previously been the case.

Moreover, the ascent of the United States and Asia as economic rivals to Western Europe, including Finland, has created strong political pressure to reexamine national regulatory policies that affect the competitive position of European firms. Today it is more difficult for regulators and courts or other judicial bodies to discount efficiency — including dynamic efficiency — and vindicate other aims as European companies struggle against foreign companies (Gellhorn & Kovacic 1994). What does this mean to Finland and companies located in it? In particular, networking is a primary concern: at the international level, countries increasingly become integrated networks, and the European Union is only one example of this development; the management of business is characterised by networking both at national and international levels. Both of these tendencies are of great importance with respect to the need for regulatory reform nationally and internationally.

One challenge of this study is to outline whether the above-mentioned regulatory problems mentioned by Wienert (1997) are at all sufficient for analysing the relationship between regulations and innovations. Are these questions the essential questions, should we modify them somehow, or are there certain other regulatory problems which demand more attention?

Innovation failures. The basic problem in this study is the interaction between regulations and innovations. From this perspective, certain concepts have to be introduced. First of all, *innovation failure* is a useful concept in analysing the suitability of regulations from the point of view of innovativeness. More specifically,

there are three kinds of failures related to the impact of regulation on innovativeness:

1) regulation may hinder innovative activities (under-innovation or innovation deficit);
2) regulation may induce innovative activities beyond the optimal innovation-inducing level (over-innovation); or
3) regulation may distort the choices of economic actors (innovation bias) (Scott 1988).

Innovation failures are usually regarded as innovation deficits: there is too little innovation in relation to the optimal level. From this perspective, regulation should not hinder innovative activities. For instance, so-called design instruments (or specification standards) have been criticised from this point of view, but as we shall see later, there are numerous other regulatory problems related to this issue.

Innovation deficit is only one way of viewing innovation failures. For example, it is possible that there is too much innovation in relation to the optimal level. In other words, excess resources are allocated to innovative activities and too little to other activities. We call this situation over-innovation. From this perspective, we profit by keeping rewards from innovative activities at such a level that makes over-innovation unprofitable.

In addition, so-called innovation bias is possible: regulation may spur wrong (or non-optimal) innovative activities. This consideration can be highlighted by an example: a sulphur tax may be determined according to the value of the fuel products, i.e. a so-called *ad valorem* tax. A tax of this kind may spur innovations which reduce the financial burden caused by the tax, but those innovations may be such that do not promote the reduction of sulphur dioxide emissions into the environment in the most appropriate way. In other words, *ad valorem* taxes provide an incentive to reduce the use of the most expensive fuel qualities because tax savings would then be largest. However, the most expensive fuel qualities are not necessarily the "dirtiest" qualities. Moreover, *ad valorem* taxes do not include any kind of incentive to abate sulphur from emission exhausts and it would be very difficult to establish such a value-based sulphur tax which takes into account those emission reductions. On the contrary, a fuel tax based on sulphur content would easily permit the inclusion of an abatement system (Määttä 1997).

There may be numerous reasons behind the innovation failures. For instance, cooperation failures is one. They are failures to cooperate even though it would be beneficial to potential cooperation partners and to the whole society. Imperfect suitability is one problem: property rights are so ill-defined that incentives for creative activities are lost. Moreover, high transaction costs may also be a source of innovation failures. In addition, regulatory failures e.g. in the form of non-neutral legal treatment of investments or organisations may lead to innovation failures.

Outline of the study

The framework of the study is outlined in chapter two. First, the study is based on the law and economics approach. However, there are certain problems with respect to this. In particular, it is static efficiency, not dynamic efficiency (i.e. the regulatory impact on innovations), which has been the benchmark in this approach. Nevertheless, certain authors have taken dynamic impacts seriously in recent years, especially under competition law. Second, the types of innovations and the nature of the innovation process are also characterised in this chapter. For instance, the nature of the innovation process is critical with respect to the choice of appropriate regulation. Under competition law this is clearly reflected: those supporting the traditional approach are cautious in respect to cooperation between firms; those supporting the modern approach towards the innovation process are more permissive concerning this cooperation. Third, an essential problem involves the meaning of regulation and the way in which regulations can be categorised. Systematisation of regulations is needed, among other things, in order to generalise about the interaction between regulations and innovations. Fourth, numerous premises could be established to evaluate the regulatory impact on innovations. Technical constraints on economic actors, additional outlays and uncertainty created by regulation are examples of the premises concerned. Finally, regulatory impact on innovations is only one factor which should be taken into account in planning and implementing regulatory reform. Therefore, issues related to regulatory effectiveness, flexibility and efficiency properties are analysed as a part of the second chapter.

The third chapter of the study concentrates on the Act on Restraints of Trade and its impact on innovations. The purpose is to outline the need for reforming existing Finnish competition legislation. Prior to this analysis I deal with macro-policy issues. In particular, the Schumpeterian and Arrowian approaches are presented. The former approach emphasises that concentrated market structures favour technological progress. On the contrary, the latter approach emphasises that competition is the best guarantee for innovations. The choice of approach has, of course, a great effect on the legal implications. Horizontal and vertical restraints of trade, abuse of dominance and merger control are then analysed. In addition, several other details of Finnish competition legislation are dealt with from the point of view of innovativeness.

Chapter four of the study concentrates on environmental legislation, its impact on innovations and the possible need for developing environmental regulations in order to improve the preconditions for innovative activities. An important consideration is that environmental legislation constitutes a heterogenous whole. This is also one reason which has precluded a comprehensive overview of regulatory problems. Direct regulation is analysed to some extent. However, the dynamic efficiency of economic instruments is the main problem analysed in this study. The

reason is quite straightforward: many authors have point out that economic instruments provide a better basis for creative activities than traditional direct regulation. This study investigates whether this is so in practice.

The fifth chapter of the study highlights, first, the regulatory problems which should be addressed in the reform legislation. For instance, what other issues should we take into account in the design of regulation? A second issue concerns the generalisations which are possible to make on the basis of the study. We call these generalisations *regulatory principles*.

The study is mainly based on the review of the international literature concerning the interaction between regulations and innovations. Issues dealt with in that literature are applied with respect to the Finnish circumstances. Moreover, an inquiry was made among a small group of large enterprises and among certain interest groups in the business sector. The inquiry concerned issues related to competition law, environmental legislation and intellectual property rights. A reference to the results of the inquiry has been made in several places in the study.

Excursion: Suitability of intellectual property rights (IPRs) in Finland

The original purpose of the study was also to analyse intellectual property rights and their impact on innovations. However, this theme is so comprehensive that it would deserve a separate study. This is obvious from the fact that issues related to IPRs would cover such topics as the patentability of biotechnological inventions, legal treatment of inventions made by employees, problems related to software (e.g. whether to apply patents or copyrights within this context), all issues concerning copyrights, all issues concerning trademarks, and all issues concerning the enforcement of trade secrets. (Besen & Raskind 1991.)

In the inquiry, very few respondents believed — as a general impression — that IPRs do not work at all in Finland. However, many respondents thought that IPR legislation should somehow be modified. First of all, issues related to the substantive law were of the following nature:

- Employment copyright should be introduced.
- There is a need for amending legislation concerning employment inventions. However, proposed reforms contradicted with each other. On the one hand, some respondents proposed that compensation to employees be increased but, on the other hand, one respondent stated that employees should get no compensation.

– Some respondents demanded that patents (instead of copyright) also cover software. On the other hand, the extension of the scope of patents to cover processes in business was opposed.
– Some respondents noted that the threshold of novelty under the Patent Act is very difficult to cross.
– Patent legislation concerning universities should be harmonised with legislation concerning enterprises.
– IPRs should cover the Internet effectively.

In addition to the issues related to the substantive law proposals for reforms in procedures were also made:
– Procedure should not be so complicated as it is today, and should be faster.
– Concern over the protection of design was presented from procedural point of view.
– A specific court for IPR cases should be established.

The above-mentioned questions indicate how large a spectrum of regulatory problems is involved with IPRs. Therefore, a specific study concerning just one of these problems is worth considering.

2 FRAMEWORK OF THE STUDY

Study method

Progressive law and economics. The primary method of the study may be labelled progressive law and economics. Careful analysis of this kind can lead to the selection of *optimal regulatory forms* (Ogus 1994; 1998). As modified for this study, the approach involves a three-stage inquiry:

1) Identification and explanation of such regulations which reduce dynamic efficiency compared with the ideal regulatory option, i.e. identification of innovation failures.
2) Investigation of alternative regulations which can correct innovation failures.
3) Examination of the predicted responses of the actors to different methods, paying critical attention to dynamic efficiency.

Macro-policy and micro-policy levels. Of course, we cannot consider every possible problem related to regulations. For instance, we do not concentrate on the legitimation of regulations, i.e. identifying those market failures which do require regulatory measures by the government. Moreover, alternative methods of correcting market failures would be investigated only to the extent that they serve the objectives of the study. This would be done in two stages: on the one hand, instruments are examined at *macro-policy level* by taking into account only the principal — and to some extent ideal — characteristics of the instruments; on the other hand — and which is important — at the *micro-policy level*, where the design of regulations and their enforcement are of special importance (Määttä 1997). The statement that "the devil is in details" clearly indicates how important the micro-policy point of view is in practice. Taking those issues seriously makes it possible, among other things, to reduce the *regulatory gap* between researchers and legislators. On the other hand, an examination of micro-policy issues will suggest fruitful avenues for extending the boundaries of existing theory on regulatory reform and innovations. Thus, the analysis would not be exhausted on

these approaches: an important viewpoint is the *feedback* between the micro-policy and macro-policy levels. In particular, we can conclude whether those viewpoints made at the macro-policy level are correct at all (Määttä 1997).

It may be helpful to somehow highlight the distinction between the macro-policy and micro-policy levels. For instance, the macro-policy approach would concentrate on whether competition promotes innovative activities better than monopoly. In contrast, the micro-policy approach would concentrate e.g. on the problem of whether tie-in arrangements should be accepted under competition law even though they may, to some extent, have negative impacts on competition. In addition, the focus here is on the dynamic efficiency of different regulations. However, we acknowledge that other regulatory standards, such as regulatory effectiveness and administrative efficiency, should also be taken into account.

Our approach can also be called *rule formulation*: how to promote innovativeness without jeopardizing the accomplishment of the goals of regulation and its theoretical virtues, like cost-effectiveness and administrative efficiency. Rule formulation should be understood in a broad sense. It is not only a question of enacting regulation but also one of enforcing (or interpreting) regulation by courts or other judicial bodies, i.e. both statutory and court-applied regulation. Therefore, it is not sufficient to just analyse the wording of regulations, but also the practice of courts and other authorities applying the law, such as the National Patent and Register Board or the Office for Competition. Specifically, regulations are always imperfect and, thus, the application of a regulation also supplements it (Määttä 1999a).

The *effect evaluation* of the regulation is omitted in this study, that is, our aim is not to empirically quantify the economic effects, especially those related to the innovativeness of a particular regulation. This is not to say that the evaluative approach is unnecessary: if we want to carefully analyse the interaction between innovations and regulations, effect evaluation is inevitable. Otherwise, recommending regulatory reforms would be like "shooting in the dark".

From static law and economics to dynamic law and economics. It is astonishing to note that in so few cases dynamic efficiency considerations have been taken seriously in the law and economic analysis. In other words, conclusions concerning rule formulation have been made on the basis of allocative and productive efficiency, i.e. on the basis of static efficiency. However, certain exceptions exist. In particular, under competition law, many papers have been published in the last decade which analyse competition policy, not from the static, but the dynamic point of view. (It is also one of the reasons why competition legislation constitutes a prominent part of the study.) Even though such exceptions can be found in the literature, law and economics is still far away from the situation in which innovativeness would be as important an argument as static efficiency. Against this background, we can call today's approach *static law and economics* but, on the other hand, we can claim that there is a need for *dynamic law and economics*. From this point of view, it would be interesting to see how great the deviation is between the static and dynamic points of views. In any case, we can already state that quite a large

gap exists between interpretations under competition law depending on whether the static or dynamic approach is emphasised (Baumol & Ordover 1992).

Public and private interest analysis. An important point of view which has to be dealt with briefly here concerns *public interest analysis* and *private interest analysis* (Ogus 1994; 1998). The approach described above may be labelled public interest analysis: the purpose is to analyse which kinds of regulations most appropriately promote the social ends, and of course take dynamic efficiency considerations into account as well. Private interest analysis seeks to explain how politicians and bureaucrats may be motivated to meet the demands of private interest groups for a particular form of regulation; the normative dimension may also be used to indicate what constitutional and institutional arrangements can best constrain behaviour of this kind (Stigler 1971). Even though private interest analysis may be an important field of study, it has been omitted here. Thus, the purpose of this study is to point out the regulatory sources of innovation failures which have to be corrected in order to stimulate an optimal level of innovative activities. Moreover, the aim is to outline such principles on which regulation has to be established in order to achieve the optimal level of innovation.

Innovations, types, and the innovation process

The following questions are analysed within this context:

1) What is meant by innovation?
2) How can we categorize different kinds of innovation?
3) What is the *traditional view* of the innovation process?
4) What is the *modern view* of the innovation process, in particular, what are the distinguishing characteristics of the modern innovation process compared with the traditional one?
5) What is the relevance of the nature of the innovation process with respect to the appropriate regulation and regulatory reform at a general level?

The definition of innovation. First, of course, the concept *innovation* has to be defined. For instance, the following kinds of definitions can be found in the international literature:

"Innovation includes a product's or service's design, the segments it serves, how it is produced, how it is marketed and how it is supported." (Porter & van der Linde 1995.)

"Innovation is the search for, and the discovery, development, improvement, adoption and commercialization of new processes, new products, and new organizational structures and procedures. It involves uncertainty, risk taking, probing and reprobing, experimenting, and testing. It is an activity in which "dry holes" and "blind alleys" are the rule, not the exception." (Dosi 1988; Jorde & Teece 1990.)

"Innovation is ... used widely as a term to describe the whole technological process representing a shorthand for doing something new." (Stoneman 1995.)

Some remarks about innovations should be made here. First of all, inventions and innovations should not be confused. Invention is the creation of a new device, but innovation refers to the commercialisation of the invention. This distinction is also important from the legal point of view. The Patent Act only protects inventions, not innovations. A second important remark is that not all innovations are similar. An important distinction is between radical and incremental innovations. Radical innovation has a high degree of new content while incremental innovation builds incrementally upon prior innovations.

Market and social innovations. Two key aspects of innovation deserve specific attention, *market* and *social innovations*. Market innovation encompasses the development and adoption of new products and processes that will increase market measures of output per unit of input and thus increase productivity. More specifically, market innovations refer to product or process innovations that create benefits that firms can achieve through the sale of goods and services in the market (Stewart 1981). Among other things, social innovation includes the development and adoption of new products and processes that deliver the improved social performance presumed by regulations, though firms cannot directly gain them through market sales. Social innovation could include, for example, the development of clean automobile engines, less polluting, safer industries, and environmentally superior pest control methods (Stewart 1981).

Of course, a given innovation may confer both market and social benefits. For example, a system to recycle waste water in manufacturing processes may not only facilitate compliance with water pollution control requirements but also reduce manufacturing costs. Moreover, an innovation that enables one firm to meet regulations more cheaply than its competitors will allow an innovating firm to produce its products more cheaply and thereby reap market benefits. Furthermore, firms that produce and sell abatement equipment designed to achieve improved social performance will enjoy market benefits from such sales (Stewart 1981). In addition, social innovations e.g. in the field of environmental protection may promote the firms' green image. (Hilden et al. 2001.)

An important consideration is that legislation and its enforcement should not hinder or bias market innovations. The situation is different with social innovations; regulations stimulate these innovations. This kind of distinction is also the reason that two different fields of legislation have been chosen for the analysis:

competition law, though not innovation-enhancing as such should neither hinder or distort innovations. For instance, the research joint venture is a challenge under competition law. On the other hand, environmental legislation is social regulation; one purpose is to stimulate the introduction and diffusion of social innovations. For instance, encouraging polluters to develop such measures which may reduce carbon dioxide emissions from exhausts is one such regulatory problem.

Product and process innovations. A common distinction between innovations concerns *product* and *process innovations*. Product innovation relates to the generation, introduction and diffusion of a new product, with the production process being unchanged. Process innovation relates to the generation, introduction and diffusion of a new production process, with the products remaining unchanged. Nevertheless, product and process innovation in the real world go hand-in-hand. In addition to changes in products and processes, innovation encompasses changes in management methods, changes in materials and in intermediate inputs used in the production processes, and changes in markets (Stoneman 1995). Product and process innovations are by nature technological innovations. Other kinds of innovations, such as organisational changes within and between firms, also have to be taken into account (Schienstock 1999). The role of such organisational innovations should be emphasised because they might have greater impacts than technological innovations even though they have been studied less (Williamson 1985).

Innovation process. The innovation process has been viewed with divided opinions in the literature. The *Schumpeterian* trilogy divides the process of technological change into three stages:

1) the invention process, encompassing the generation of new ideas;
2) the innovation process, embodying the development of new ideas into marketable processes and products;
3) the diffusion stage, in which new products and processes spread across the potential market (Stoneman 1995).

The Schumpeterian model has also been labelled the traditional serial model (Jorde & Teece 1990) or the cascade model (Schienstock 1999). These traditional descriptions of the innovation process commonly break it down into a number of stages which proceed sequentially in a linear and predictable fashion from research to development, design, production, and finally to marketing, sales, and service. Today, the cascade model may characterise the innovation process in some scale-intensive industries (Jorde & Teece 1990).

On the other hand, the cascade model does not address many small but cumulatively important incremental innovations that are at the heart of technological change in many industries, especially industries like semiconductors, computers, and automobiles. Thus, the cascade model is an analytic convenience which no longer adequately characterises the innovation process in all circumstances (Jorde &Teece 1990; Schienstock 1999). The cascade model has also been criticised because organisational requirements have not been sufficiently explored. The

inadequacies of this model are present because of the simultaneous nature of the innovation process, which is particularly relevant in certain industries, like microelectronics, experiencing high rates of technological change. With respect to this issue, the extent that the cascade model is employed, organisational challenges which innovation provides are oversimplified and e.g. potential problems under competition law are underestimated (Jorde & Teece 1990).

A new view of the innovation process has been called the simultaneous model of innovation (Jorde & Teece 1990) or recursive model of innovation (Schienstock 1999). This approach recognizes

- the existence of tight linkages and feedback mechanisms which must operate quickly and efficiently, including links between firms, within firms, and sometimes between firms and other organisations like universities;
- that innovation does not necessarily begin with research; nor is the process serial and requires rapid feedback, mid-course corrections to designs, and redesign;
- aspects of the cascade model also recognize the constant feedback between and among activities, and the involvement of a wide variety of economic actors and organisations that need not have a simple upstream-downstream relationship to each other;
- that R&D personnel must be closely connected to the manufacturing, marketing personnel and external sources of supply of new components and complementary technologies, so that supplier, manufacturer and customer reactions can be fed back into the design process rapidly; in this way, new technology, whether internal or external, becomes embedded into designs which meet customer needs quickly and efficiently (Jorde &Teece 1990; Schienstock 1999).

The recursive model visualises innovation as an incremental and cumulative activity that involves building on what went before, whether it is inside or outside the organisation, and whether the knowledge is proprietary or in the public domain. This model also stresses the importance of the speed of the design cycle and flexibility (Jorde & Teece 1990). Thus, for many innovations time has become a major source of competitive advantage. Change in industries at the frontiers of technological progress is so rapid that it is discussed in terms of hypercompetition. Against this background, one question raised involves the value of patenting inventions for 20 years, when technologies become obsolescent in six months (Davis 1998). When innovation has this character, the firm which is quickest in product design and development will appear to be the pioneer, even if its own contribution to science and technology is small, because it can be first to "design in" science and technology already in the public domain. Both small and large organisations operate according to this model, reaching out upstream and downstream, horizontally and laterally to develop and assemble leading edge systems (Jorde & Teece 1990). Much innovation today is likely to require lateral and horizontal linkages as well as vertical ones. Particularly for small firms,

innovation may require accessing complementary assets which lie outside the organisation. If innovating firms do not have the necessary capabilities in-house, they may need to engage in various forms of restrictive contracts with providers of inputs and complementary assets. For instance, the cascade model relies on an implicit belief that arms-length contracts between unaffiliated firms in the vertical chain from research to customer will suffice to commercialise technology. In particular, there has been little consideration of how complex contractual arrangements among firms can assist commercialisation — that is translating R&D capability into profitable new products and processes (Jorde &Teece 1990). According to the recursive model of innovation, simple unilateral contracts, where technology is sold for cash, are unlikely to be efficient. Complex bilateral and multilateral contracts, internal organisation, or various hybrid structures are often required to shore up obvious market failures (Williamson 1985).

What is meant by regulation?

Definitions of regulation. Because the concept of regulation is very important to further discussion, it should be analysed here. Firstly, we will outline general definitions about regulations and, secondly, outline the ways by which regulations have been categorised in the literature.

In general, regulation has been defined, among other things, in the following ways:

"Regulation refers to policies where the government acts as a referee to oversee market activity and the behaviour of private actors in the economy. Regulations are generally rules issued by public sector institutions or authorised bodies and entail legally mandated compliance by firms. Such government intervention in the marketplace is usually justified on the basis of market failures and the need to ensure societal well-being." (OECD 1997b.)

"Regulation *refers to the various instruments (both formal legal instruments and such informal tools as 'guidance') used by government to control some aspect of the behaviour of a private economic actor. Regulation can also include rules issued by non-governmental bodies (e.g. self-regulatory bodies) to which governments have delegated regulatory powers. All regulations are supported by the explicit threat of punishment for non-compliance*." (Wienert 1997.)

"Regulation is used to denote the law which implements collectivist goals, that is, by which the state seeks to direct or encourage behaviour which (it is assumed) would not occur without such intervention. The aim is to correct perceived

deficiencies in the market system (and private law) in meeting public interest goals. Typically, but not always, it displays the following characteristics. Firstly, it has a directive function. To achieve the desired ends, individuals are compelled by a superior authority - the state - to behave in particular ways with the threat of sanctions if they do not comply. Secondly, it is public law in the sense that in general it is for the state (or its agents) to enforce the obligations which cannot be overreached by private agreement between the parties concerned. Thirdly, because the state plays a fundamental role in the formulation, as well as the enforcement, of the law, it is predominantly centralised." (Ogus 1998.)

The above-mentioned quotations show that no common definition of regulation exists (Wienert 1997). For instance, Anthony Ogus supports a narrow definition without taking private law into account at all, whereas according to OECD papers, the definition of regulation also includes fields of private law, at least such fields as intellectual property rights. In order to somehow organise the discussion, a distinction can be made between *regulation sensu stricto* (in the strict sense) and *sensu largo* (in the broad sense). Ogus's analysis represents regulation in a strict sense, i.e. that only public law provisions directive in nature are regulations. Regulation in a broad sense covers all statutes comprehensively regardless of their private or public law nature. For instance, contract law, damages law, and criminal law as well as environmental, tax, safety and health laws are included in this definition of regulation.

A broad definition of regulation may be of greater advantage because of the following reasons: first, private law institutions may be substitutes for public law institutions in solving many acute social problems. For instance, damages law or tort law may sometimes be a regulatory option to direct regulation. Moreover, it is not always clear in which circumstances tort law works better than direct regulation, or the circumstances in which both those instruments are needed (Shavell 1984). Therefore, it is impossible to get a comprehensive overview of the possibilities open to the legislator if only certain fields of legislation are taken into account. Secondly and partly related to the above, regulations which are omitted in many studies may also have a great impact on innovations. Thirdly, the borderline between private law and public law is not clear-cut. On the one hand, private law today contains legal rules which are by nature public law. One example is consumer protection legislation. On the other hand, public law contains elements which are private law in nature. For instance, public agencies do not necessarily regulate the behaviour of polluters by one-sided rules but by agreements with private organisations.

Within this context it is worth noting, too, that in certain circumstances legislation is so flexible that *de facto* legislative power is delegated to bodies or authorities applying the law. For instance, the Finnish Act on the Restraints of Trade has mainly been written is such a way that competition authorities decide to a large extent which restraints of competition are forbidden and which are allowed. Moreover, patent legislation is greatly elaborated and operationalised by

a considerable body of practice and a number of significant judicial decisions (Arup 1993). For instance, the statutory requirements for patentability, i.e. novelty, utility and non-obviousness, highlight the ambiguous concepts of the Patent Act. Therefore, it is not enough to concentrate on the wording of laws in studying the need for reform but attention should be paid to the ways that legislation is applied. On the other hand, the problem is that the courts often eschew any role in weighing policy considerations, but instead merely 'interpret' the existing law (Arup 1993). However, the fact that legislation is constructed in ambiguous terms and courts have substantial discretion to determine litigation outcomes facilitates rule formulation (Kovacic 1992). Thus, dynamic efficiency considerations may also be taken into account in the decision-making of courts.

At a general level, the regulatory problem is whether to regulate issues under law or whether to delegate legislative power to the courts or other judicial bodies applying law. At least, the following considerations should be taken into account in this context:

Regulators or public agencies in general probably have better expertise than courts in many social problems and, thus, detailed provisions may be preferred. On the other hand, the need for expertise can also be taken into account in ways other than by writing detailed provisions into the legislation. In this case courts would be replaced by specific and specialized authorities. We can refer here to two examples in the Finnish legal system. The Act on Restraints of Trade is applied in the first two stages by specific competition authorities (Office for Competition and Council for Competition). The Environmental Protection Act is applied in the first stage by local and regional environmental authorities.

Moreover, rapid changes in external circumstances would require that regulations are flexible. In this context, this concerns legal flexibility or flexible norms. On the other hand, legislation is always imperfect. There are several reasons for the imperfections in regulation. First, all world situations cannot be predicted and, thus, it is impossible to include provisions involving them in the legislation. One reason for this may be, and in practice is, the rapid development of technology. Second, certain of these circumstances can be predicted (at reasonable cost) but the probability of the occurrence is so low that there is no sense in writing provisions about them into the legislation. Finally, concepts in legislation are always indeterminate (Määttä 1999a).

In addition, it is difficult to create incentives for innovative activities by interpreting laws. The fact is that the argumentation is restricted and arguments based on substantive reasons, like the promotion of dynamic efficiency, are the basis of law. For instance, government bills and decisions of courts precede arguments based on substantive reasons when the law is applied. Therefore, if the purpose is to influence innovations, schematic regulations instead of flexible regulations may seem to be a better alternative. However, schematic rules have their own disadvantages, as we shall see later. In addition, flexible norms may be criticised because they create uncertainty over the interpretation of law. Of course,

the Supreme Court or the Supreme Administrative Court may solve the problems of interpretation, but this may take several years.

Classifications of regulations. Regulation usually refers to economic, social and administrative regulation. *Economic regulation* (or structural regulation) includes, among other things, competition law, regulation of financial markets, company law and intellectual property rights. This type of regulation is intended to ensure the efficiency of markets, partly through promoting adequate competition among actors in the marketplace (OECD 1997b; Wienert 1997). Economic regulation generally also includes the regulation of specific industries. Airlines, trucking, buses, railroads, telecommunications, natural gas, electricity, cable television, banking and insurance are among the sectors which have been strictly regulated or wholly or partly owned by governments (OECD 1997b). However, not all economic regulation targets specific industries, e.g. minimum-wage (or corresponding) laws apply, in one form or another, to almost all industries (Wienert 1997). The concept of economic regulation should not be confused with the concept of 'economic instruments,' because economic instruments typically represent social regulation.

Social regulation (or conduct regulation) is intended to promote the internalisation of all relevant costs by actors in the economy. An important field of legislation included in this category of regulation is environmental law. In addition, legislation related to safety and health in the workplace as well as the protection of workers and buyers against fraudulent or incompetent behaviour by sellers are usually regarded as social regulation (OECD 1997b). Moreover, social regulation is usually aimed at activities common to several industries (Wienert 1997).

Administrative regulation (also called process regulation) relates to general government management of the operation of the public and private sectors and seeks to ensure their smooth functioning. Administrative regulation can include administrative formalities through which governments collect information and intervene in economic decisions (OECD 1997b). More specifically, administrative regulation can include tax collection, fiscal regulation, health care administration, legislation to control the 'black economy,' and the provision of information about the performance of businesses (Wienert 1997).

Even though the above-mentioned classification seems to be clear-cut, no clear-cut distinction between different types of regulation can be made and the boundary between categories is often blurred (Wienert 1997). Examples of this "mess" are easy to mention. For instance, Anthony Ogus (1994; 1998) regards only social and economic regulation as regulation; OECD (1996c) has mentioned that taxation is part of administrative regulation, whereas Ogus (1998) emphasises that taxes are an important economic instrument (which is part of social regulation); intellectual property rights are part of administrative regulations according to OECD (1996c), whereas Wienert (1997) considers IPRs a part of economic regulation. From this point of view, no well-established overall classification of regulations can be used in this study.

Dewees, Mathewson and Trebilcock (1983) use a different approach compared with the above-mentioned distinction between economic, social and administrative regulation. They have distinguished the following types of regulations or policies concerning quality regulation:

- the provision or regulation of information,
- the adoption or modification of liability rules,
- the use of tax or subsidy policies,
- direct regulation or standard-setting, and
- the provision of the product or service directly by the government or its agencies.

They note, too, that the above-mentioned ordering is in some respects a ranking from the least to the most interventionist alternatives.

It is still worth mentioning that the classification of different kinds of norms is of great importance, because it creates a basis to more generally analyse the regulatory impacts on innovations. From this perspective e.g. the distinction between economic, social and administrative regulations is not useful. Thus, other kinds of classifications would be needed.

Social regulation. Nevertheless, a distinction which is both useful and realistic, has been made by Anthony Ogus (1994; 1998) with respect to social regulation.

The regulatory form called *prior approval* requires that firms, before lawfully engaging in an activity, must first obtain a licence or permit from an authorising agency. For such approval they have to demonstrate to the agency that certain conditions of quality are, or are capable of being, met. Prior approval is mandatory e.g. for pesticides: a manufacturer must obtain a licence before marketing them.

The *standards* technique allows the activity to take place without any *ex ante* control but the supplier who fails to meet certain standards of quality commits an offence. The basic economic justification for standards is that they can correct market failures, particularly information deficits and externalities, more effectively or cheaply than less interventionist measures. Standards can be individual in nature, i.e. they are designed for a particular unit. On the other hand, standards can be general in nature, i.e. they cover all or at least a group of actors (Hilden et al. 2001).

Standards can be subdivided into three categories representing different degrees of intervention. First, a *target standard* prescribes no specific standard for the supplier's processes or output but imposes criminal liability for certain harmful consequences arising from the output. Second, a *performance standard* (or an output standard) requires certain conditions of quality to be met at the point of supply, but leaves the supplier free to choose how to meet those conditions. Examples of performance characteristics are the quantity of emissions and toxicity of ingredients (Stewart 1981). Finally, a *specification standard* (or an input standard) can exist first in a *positive form*: it compels the supplier to employ certain production methods or materials; or second, it can exist in a *negative form*: it prohibits the use of certain production methods or material. For instance, the

regulations governing the construction of motor vehicles incorporate several specification standards (Ogus 1994).

Another category of social regulation is *mandatory disclosure*. Rather than imposing standards on suppliers, forcing them to adopt loss abatement, legislation simply requires that they disclose to purchasers and others information regarding harms or risks which may arise from the activity or product.

The fourth category of social regulation is *economic instruments* or incentives. The most important one is the regulatory tax or charge: conduct is legally unconstrained but if a firm chooses to act in an undesirable way it must make the stipulated payment (Määttä 1997). Subsidies and emissions trading are examples of other economic instruments used.

Regulatory reform. In addition, it is useful to define what is meant by *regulatory reform*. It is possible to denote that all amendments of legislation and other regulations represent regulatory reform. However, the reform usually refers to more comprehensive re-evaluation and redesign of regulations than only fine-tuning. In particular, when discussed in regard to tax reforms, it has meant comprehensive re-evaluations of tax legislation (Messere 1993). Nevertheless, it is difficult to draw a clear line between fine-tuning of regulation and regulatory reform.

It is also worth noting that regulatory reform involves two paradoxes with respect to innovativeness. First, there may be a clear-cut need for regulatory reform or at least for fine-tuning regulations in order to promote dynamic efficiency; on the other hand, amendments in regulations create uncertainty, which reduces the incentives to innovate and diffuse innovations. Thus, it may be better to live with small innovation failures in legislation than to amend legislation very often and thereby create uncertainty. The second paradox is related to the possibilities of regulators to manage successful innovation policy. For instance Japan's technological successes are often attributed to government policy, i.e. its role in identifying emerging technologies and coordinating public, industry and finance sectors to develop national innovation policy (Arup 1993); on the other hand, an enormous amount of information is necessary in regulatory policy, including innovation policy, to achieve anything that can approximate optimality by means of centralised calculations (so-called *Mises-Hayek argument*).

Innovation-promoting and innovation-facilitating regulations. One distinction still worth mentioning is that between regulations which primarily promote innovations and regulations which do not. Examples of the former group are IPRs or tax incentives and direct subsidies for R&D expenditure. Regulations which do not promote innovations can, however, be required to facilitate them. For instance, competition legislation is such a field of legislation, and in general so is environmental legislation.

A brief analysis of tax incentives supporting R&D expenditures may highlight the appropriateness of innovation-promoting regulation. Nevertheless, the analysis concerns only tax incentive regulation, and generalisations with respect to other kinds of innovation-promoting regulations should be avoided. Tax incentives, cash

grants and related financial assistance may be offered to encourage investment in innovation when the benefits seem difficult to achieve through the market (Arup 1993). Tax incentives can be implemented in many ways:

1) firms may be allowed to deduct current R&D expenditures implying a faster write-off than is justified by the depreciation of knowledge created by R&D;
2) they may be given tax credits based on their total R&D spending;
3) some sort of levy/grant system can be used in which all firms in an industry pay into a fund which is then redistributed as a subsidy to those firms who do more R&D (Geroski 1995).

Tax incentive policies have played an important role in the United States, Canada, Australia and Sweden. The Canadian and American systems applied credit only to increases in annual R&D relative to the average outlay in a previous run of years. The system, introduced in 1981 in the US, allowed companies to deduct from their tax bills 25 percent of the increased R&D in a given year above their R&D expenditure in the three past years, and defined R&D to exclude expenditures gathering market information but to include 65 percent of research contracted out to universities and non-profit-making bodies. The Australian system, introduced in 1985, had a nominal credit rate of 50 percent (Metcalfe, 1995). In Sweden, there was an R&D tax allowance equalling five per cent of a firm's R&D expenditure plus 30 percent of the increase over the previous year (Mansfield 1986).

As a preliminary point, taxes reduce the incentive to employ all inputs not excluding R&D. If the tax credit is included, the effect is clearly to reduce the costs of research and to directly (via the effects of lower costs on output) act as an incentive to perform more R&D. On the other hand, evaluations of the impacts of these tax incentives have not led to clear-cut conclusions. Part of the difficulty lies in the fact that R&D tax incentives have to be judged in the tax systems' often bewildering complexity along with other non-tax factors influencing the propensities of companies to spend on R&D (Metcalfe 1995).

However, some empirical work has been done in this field. In a study of the Canadian system, Mansfield and Switzer (1985) found that each unit of tax foregone increased R&D outlays, but only by a share between 0.3 and 0.4 of the lost tax revenue. This order of magnitude was also confirmed in the separate studies of the US and Swedish systems (Mansfield 1986). On the other hand, the US, Canadian and Swedish R&D incentives seemed to have increased R&D expenditures by about one — or at most two — percent (Mansfield 1986). Moreover, in the US, Canada and Sweden there was substantial evidence that these tax incentives resulted in a considerable redefinition of activities such as R&D. From this point of view, it is not surprising that recommendations have been made that the definition of R&D be tightened. The vagueness of the definition encourages firms to include many kinds of expenditures that are not really R&D (Mansfield 1986). Tax-based grants often reward creative accounting practices; subsidies tied to R&D input but unrelated to R&D output create severe morally hazardous problems and firms that are tax exhausted are unable to benefit from R&D tax credits (Geroski 1995). In

addition, many companies — especially smaller companies — have no current tax liabilities against which to offset the tax credits. On the other hand, they can carry the credit forward to be claimed against future tax liabilities, which lowers the value of the incentive to the company and reduces its effectiveness (Mansfield 1986; Metcalfe 1995).

Premises in evaluating the regulatory impact on innovation

Regulatory impact on innovations. Measuring regulatory impact on innovation is difficult for several reasons (OECD 1997a): first of all, the relevant time horizon is likely to be long, and there are clear practical difficulties in assessing effects over long time periods. On the other hand, possibilities to come to more far-reaching conclusions improve while the regulations are in force, especially if these regulations are not amended too often (Määttä 1997). Secondly, the pace of innovation is unlikely to be determined by the policies in force in one country alone. In the open world trading system, technologies developed in one country may be marketed elsewhere, and the rate of innovation is thus likely to be determined as much by the extent to which regulations are in use or in prospect world-wide as by their use in a particular country. Thirdly, many different and complex factors influence technical change, and regulatory policy is only one of them. For instance, structural changes in the economy complicate the interpretation of the facts. In addition, the innovation effect of a certain instrument may be inconclusive because that instrument is often applied in conjunction with other policy instruments (Määttä 1997).

For the above-mentioned reasons, *ex post* evidence on this aspect of the use of instruments is likely to be very difficult. Moreover, the purpose is not to study empirically the way in which regulations have hindered, biased or promoted innovative activities. Rather, the purpose is to create a conceptual framework in which those issues could be analysed. One part of such a study would be to outline the premises in evaluating regulatory impact on innovation. The idea is that new innovations do not fall like manna from heaven, but that the regulation and its design significantly influence innovative impact.

Technical argument. Regulation may adversely affect innovation *by imposing technical constraints on economic actors* (Stewart 1981). In other words, the more flexible regulation is from the technological point of view, the better opportunities it provides for creative activities as well as the diffusion of innovations (Galizzi & Venturini 1996). Technical constraints may be especially severe when a given firm or industry is subject to multiple regulatory requirements. On the other hand, the magnitude of such effects is highly uncertain (Stewart 1981). A related

point of view is organisational flexibility: the choice between different forms of organisations should be open to the economic agents. In addition, *technological* and *organisational neutrality* are of great importance: regulations should not favour any specific technologies or organisational forms. Otherwise, innovation bias would occur.

However, the regulatory problem is not solved by saying that technical constraints should be removed from the legislation. Rather, the issue involves the circumstances in which technical constraints should be tolerated. In any case, we can claim here that technical constraints should not be applied without specific reasons. Thus, it is worth analysing the specific reasons which may legitimise the application of technical constraints. In addition, the question not only concerns the application of technical constraints in certain circumstances, but which kinds of technical constraints should be applied.

Outlay argument. Regulation may adversely affect innovation *by forcing firms to make additional expenditures or outlays*. These outlays may, among other things, consist of testing costs and other costs for developing and manufacturing products likely to pass the testing requirements. More generally, additional outlays cover e.g. administrative, transaction and compliance costs and transfer payments. What is important to note, too, is that even if the impact of regulation on innovation is relatively modest from the perspective of the economy as a whole, it may be significant in particular sectors or industries, because compliance outlays and other regulatory burdens are unevenly distributed. Moreover, outlays easily impose a relatively greater burden on small firms, because outlays such as testing costs are not proportional to product sales or process size and because larger firms can benefit from economies of scale in coping with regulatory requirements (Stewart 1981).

Anthony Ogus (1994) has subdivided costs associated with standards into three groups:

1) *Administrative costs* are largely borne by the public agency which has the task of formulating standards, monitoring behaviour, and enforcing compliance. These costs vary significantly according to the design of the regulation. Some of the administrative costs are borne by the firms subjected to the regulations, notably acquiring relevant information, and keeping records relating to compliance.
2) *Compliance costs* comprise, most importantly, capital expenditure on equipment and adaptation to the plant necessary to meet a standard, any additional, recurrent maintenance costs; and any productivity losses.
3) Inefficiencies are examples of *indirect costs*, the generally unintended consequences of regulation. Broadly speaking, they fall into three categories:
   a) productive inefficiency, a lower ratio of output to input;
   b) the inhibition of technical change; and
   c) allocative inefficiency, where resources are not put to their socially most valuable uses.

Incentive argument. Partly related to the above, the *larger the (expected) net return from innovation*, the better the opportunities to promote innovative activities. This is also supported by empirical studies. They indicate that most market innovations are initially stimulated by the potential market demand for a successful innovation, rather than the supply of promising technical opportunities (Stewart 1981). The above-mentioned premise can be modified in the following way: the more *exclusive* the right to returns from the innovation, the better the opportunities to promote innovative activities. For instance, OECD (1997b) mentions that exclusivity is a necessary condition for innovation because economic actors need to receive some potential return in order to invest the necessary resources. This claim corresponds with the fact that the free rider problem erodes the incentives to produce public goods in the economy. In addition, a distinction between *obligations* and *incentives* is important from the above-mentioned point of view. Preliminarily, incentives should be preferred over obligations, because, by definition, incentives continuously imply rewards and penalties. Direct regulation can be classified as obligations whereas most economic instruments belong to the group of incentives.

Uncertainty argument. Uncertainty adversely affects innovation. Common wisdom states that radical innovations are subject to greater uncertainty and incremental innovations are subject to less uncertainty. On the other hand, greater certainty encourages investment in any area. If we start with a situation in which complete certainty exists, a firm would make its decisions on the basis of returns and costs and if the net result were positive, it would start the project. Uncertainty creates the need for *risk premium*: firms should have two returns, one from the project, second from the uncertainty. From the regulatory point of view, uncertainties surround the conduct to be regulated, the timing and stringency of controls, and the costs of complying with them (Stewart 1981). These regulatory uncertainties may be created e.g. by the fact that the wording of legislation is vague, the objectives of the legislation are not clear-cut or that regulations are amended too often. Moreover, it is characteristic of technological change that it involves risk and uncertainty. The risk may relate to *technological risk*: will the technology work, and *commercial risk*: will the technology yield a return (Stoneman 1995). Technological risks may be reduced by only introducing incremental, not radical, innovations and commercial risks may be minimised by selling new products which are only incrementally new with respect to the existing ones (Galizzi & Venturini 1996).

Resource argument. The final and to some extent controversial premise is that the more *resources* the economic agent has, the better its opportunities for creative activities. This corresponds to the hypothesis that large firms are more likely to innovate, as it is easier for them to fund such efforts and to reap the rewards (OECD 1997b). There are a number of reasons to expect this. R&D projects typically involve large fixed costs, and these can only be covered if sales are sufficiently large. Moreover, large diversified firms are also in a better position to exploit scale and scope economies which characterise the production of innovation.

In addition, large firms are in a better position to undertake many projects at any one time and thus spread the risks of R&D. However, results from empirical studies in this respect are not conclusive. It seems, nevertheless, that above a certain threshold size, R&D would rise more or less proportionally with firm size, with variations across industries, countries and time. Innovative output tends to rise less than proportionately with firm size, and small firms seem to produce more innovations or obtain more patents relative to their formal R&D spending than large ones (OECD 1997b). On the other hand, much depends on regulatory policy. For instance, the treatment of research joint ventures under the competition law significantly affects the possibilities of small firms to participate in innovative activities.

From the above-mentioned point of view, there may be a *contradiction between short-term and long-term goals of regulation*: if regulation is very ambitious in the short run, it may absorb the resources needed for R&D activities; if firms do not have the resources for such activities, the possibilities to tighten regulatory goals and regulations in the long run are less. Thus, a balance between short-term and long-term goals is essential to spur innovative activities optimally. Partly related to this, objectives should not be taken as given, i.e. objectives and the time schedule in which they have to be fulfilled are also part of the regulatory policy concentrating on innovativeness.

In summary, a recommendation could be made that regulators seek to reduce compliance outlays and expenditures, permit firms maximum technological flexibility in achieving regulatory objectives, and reduce the uncertainties associated with regulatory requirements. However, these objectives are often in conflict (Stewart 1981). Furthermore, regulatory reform supporting innovations is not easy to achieve due to several other reasons. For instance, different regulatory approaches may be required at different stages of the technological and organisational development of a given field: in other words, regulation that promotes innovation at one stage might become an obstacle at another, as Wienert (1997) has noted.

Dynamic efficiency among other regulatory standards

The need for regulatory standards. In the literature concerning regulatory reform and innovations it is astonishing to note that regulatory standards (or properties of a good legal system) have received so little attention, even though they are the yardsticks by which different types of regulation and regulatory reform can be examined. An example of this defect is Wienert's (1997) statement emphasising "the necessity for greater simplicity and flexibility, and clear specification of the

goals/objectives to be achieved by regulation", but nothing more. In general, regulatory standards are mentioned very briefly and without taking into account their relationship to dynamic efficiency, one standard in itself.

Regulatory standards are needed, both at the macro-policy and micro-policy levels, when competing regulations are compared with each other and the suitability of specific regulation is analysed as such (Määttä 1997). In spite of the importance of regulatory standards, the restrictions in their use have to be admitted, too. Firstly, not all criteria can be used in a quantitative sense, i.e. it is not always possible to quantify a degree of accomplishment. Secondly, we cannot expect that one single regulatory option is superior to all other options with respect to every criterion. In other words, various criteria are not usually in agreement. Therefore, it is necessary to assign relative weights to the importance of individual criteria, which is, however, difficult. Finally, the determination of the regulatory standards in an exhaustive way is not possible. Nevertheless, the regulatory standards create a basis for discussing the regulatory problems and at any rate for showing that it is impossible to answer these problems unambiguously. In any case, they can be used to narrow the scope of appropriate regulations (Määttä 1997).

First of all, we have to define what is meant by dynamic efficiency. Briefly, it refers here to how well regulations encourage the search for and adoption of new innovations. A regulation is dynamically the more efficient the greater the incentives to develop and implement innovations are (Määttä 1997).

Regulatory effectiveness. An essential standard with respect to every instrument in all policy fields is *regulatory effectiveness*, the ability to achieve the desired goals within a given time schedule (Määttä 1997). In certain cases, regulatory effectiveness and dynamic efficiency are compatible with each other. For instance, shortfalls in meeting the stated goals of regulation are attributable in part to the failure of existing regulatory strategies to stimulate development and adoption of new technologies (Stewart 1981). In other words, it is believed that the new policy objectives can only be fulfilled through scientific and technological advances (Stoneman 1995). However, regulatory effectiveness and dynamic efficiency are not inevitably compatible with each other. For instance, Peltzman (1975) has emphasised that new and safer automobiles that reflect legislated design changes as opposed to changes in consumer demand may not result in a reduction – or at least a significant reduction - in deaths related to traffic offences. Drivers perceive reduced risks from less cautious driving and adjust their behaviour accordingly, driving faster and with less care. Within environmental policy, it has been emphasised that environmental taxes are an ideal instrument if the purpose is to promote technological progress, but on the other hand, if it is more important to achieve a particular level of performance, direct regulation is better than taxes (Dewees, Mathewson & Trebilcock 1983).

Regulatory effectiveness is closely related to the *clear specification of the objectives to be achieved by regulation*. In the interest of supporting an innovative economy, a clear regulatory framework is needed, a framework which articulates transparent and long-standing goals (Wienert 1997). However, it is a manifold

problem. Firstly, the objectives of regulation are not necessarily determined in a clear-cut way. For instance, the legal drafts of Finnish energy tax laws have at a very general level referred to the improved state of the environment as one of the purposes of the law (Määttä 2000b). Secondly, in certain situations there have been too many objectives related to the number of instruments applied, which is against the Tinbergen rule. Thirdly, the actual goals of the legislation do not necessarily correspond with the explicit goals. For example certain excise duties may be justified by environmental considerations even though the actual purpose of the excise duty is primarily to generate funds to the public sector (Määttä 1997).

Flexibility. What does *flexibility* mean in this context? Above all, flexibility is a concept which has been used in a rather "flexible" manner in the literature and, thus, its content is far from obvious. Therefore, a distinction should be made between three aspects of flexibility (Määttä 1997).

External flexibility can be defined as the ability of regulation to react to changes in external circumstances, such as changes in technological progress, an increase in the number of households and firms in the market, inflation, and amendments in certain parts of legislation. External flexibility is an important regulatory standard because it takes time — among other things due to political reasons — to amend regulation, which threatens the accomplishment of policy goals. Moreover, uncertainty over the legislation and its amendments is a problem from the point of view of dynamic efficiency. As a rule of thumb, the more detailed regulation is, the less flexible it usually is externally with respect to technological changes. In other words, the more detailed a rule is, the more often it will have to be amended (Ehrlich & Posner 1974). Moreover, in the context of rapid technological change, effective regulation is difficult to enact. It refers here e.g. to the emergence on electronic commerce (Wienert 1997).

When regulation is *normatively* more flexible, it can be amended or corrected at any point of time more easily, e.g. when a change in policy goals requires it. This regulatory standard is also tested in circumstances in which the regulation proves to be externally inflexible. On the other hand, the problem with normatively flexible regulation is that such legislation may not be stable (Määttä 1997). Furthermore, stability of regulation is often a very important prerequisite for creative activities.

The more regulation covers the technical measures needed to achieve the desired policy goals, the more flexible it is *technologically*. Technological flexibility is a necessary even if it is not a sufficient condition for dynamic efficiency. An important consideration in this context is also that the regulation does not favour any kind of technical measures.

Efficiency properties. Cost-effectiveness implies that the social goal is achieved at as low a cost as possible. On the other hand, the higher the costs by which regulation can accomplish its goals, the more cost-ineffective it becomes. Cost-effectiveness may be compatible with dynamic efficiency, at least because — or sometimes if — more resources are left to economic actors than otherwise would

be the case so that they can invest those funds in innovative activities. Moreover, the possibility of lower-cost control by technological development means that the long-run savings may be much more important than the short-run cost savings (OECD 1994). However, every cost-effective regulation does not require that more resources are left to economic actors than in the case of cost-ineffective regulation. For instance, environmental taxes may be more cost-effective than direct regulation in environmental policy, but because polluters have to pay taxes in addition to the costs of the measures by which pollution is reduced, the economic burden is usually heavier with respect to environmental taxation. The dynamic efficiency of environmental taxes is not crystal-clear in this light.

We should not forget *economic efficiency* within this context either. An example of the issue is Sam Peltzman's (1973) study concerning the drug safety law (1962) in the United States and its impacts. The law complicated the research and testing processes required prior to putting a drug on the market. The starting point is that there are two types of errors in drug marketing: placing harmful drugs on the market too soon and delaying the marketing of drugs too long. The drug safety law had the benefit of increasing the safety of drugs available to consumers but also imposed the cost of delaying helpful drugs. Peltzman estimated that this law, which tended to delay the marketing of new drugs by an average of two years, imposed an opportunity cost approximately ten times greater than the associated benefits. It is self-evident that this kind of system does not spur innovation in an efficient way.

Administrative efficiency implies the minimisation of administrative costs incurred both by the regulators and regulatees. Administrative efficiency is often a critical regulatory standard in evaluating the appropriateness of regulatory options. In certain circumstances, specific regulatory options are excluded solely because of the high administrative costs associated with them. Nevertheless, the situation is not always so "dramatic", i.e. administrative efficiency is only one argument among others in evaluating the appropriateness of regulatory alternatives.

Transaction costs and their minimisation may also be important from the point of view of innovativeness. One perspective is that low transaction costs leave more resources for economic actors (outlay argument). Moreover, by minimising transaction costs the interactive nature of innovative activities will be better taken into account than in a world in which transaction costs are high. It could be even claimed that the minimisation of transaction costs is more important in the world characterised by a recursive innovation process than in one marked by the cascade innovation process! There are many factors which affect the magnitude of transaction costs. Transaction costs may be low with respect to the transaction of a standardized good or service but high in respect to a unique good or service; in a similar fashion transaction costs tend to be low if rights are clear and simple, but high if rights are uncertain and complex; if there are only few parties, transactions costs may be low, but *vice versa* in circumstances in which many parties participate in the action; moreover, instantaneous exchange is usually

a source of low transaction costs, whereas delayed exchange causes higher transaction costs (Williamson 1989; Cooter & Ulen 1999; Allen 2000).

Market efficiency is a factor worth noting in planning regulatory reform or in evaluating existing regulations. According to this standard, different kinds of enterprises (or other economic actors) should be dealt with in a similar way. On the other hand, regulation can distort market competition between small and large firms, and between new and established firms. In particular, the situation of small and medium-sized enterprises (SMEs) has been regarded as problematic (Wienert 1997). For instance, administrative costs are regressive with respect to the size of the enterprise. In addition to the regressive impact of administrative costs, there are different ways by which regulatory policy may cause harm to SMEs. We can mention two issues in particular:

1) smaller firms are excluded from R&D and technology development due to inadequate resources;
2) smaller firms are hampered in gaining access to information, including that concerning regulations, and lack the resources to assimilate and use it, and are thus unable to respond to changing demand and supply conditions (Wienert 1997; Määttä, Frank & Pääkkönen 2001).

Some proposals to improve the situation of small firms could be made here:

1) In order to avoid the regressive impact of administrative costs, at least two regulatory options exist. Firstly, simplifying and streamlining regulation would reduce the administrative costs of all the economic actors. Secondly, certain administrative relief could be implemented for smaller firms. This type of regulation has been applied e.g. under value-added taxation in many EC countries (OECD 1988).
2) Technological aid as well as other subsidies should also be made available to smaller firms. Of course, there are certain administrative reasons which may prevent the introduction of a totally comprehensive system.

3 INNOVATIONS AND THE ACT ON RESTRAINTS OF TRADE

The basic question

Price competition or innovation-based competition? A critical question is whether innovation-based competition (instead of price competition) should make competition authorities change the way competition legislation is applied or whether competition legislation as such should be modified. In other words, should innovation be the focal point of competition policy (or antitrust policy) instead of price competition (OCDE/GD (97) 44). Should innovation sometimes be the focal point, in particular with respect to innovative industries, and price competition, the focus with respect to "smokestack" industries? (Smokestack industries have been defined as industries which are based on relatively mature technologies (Pitofsky & Balto, 1998)).

Competition policy and enforcement have traditionally focused on the prices charged and excess returns as indicators of social welfare. This kind of approach has worked well in many smokestack industries, for example, when the question involves price fixing between business firms in those industries. These industries, however, are relatively mature. On the contrary, information technology industries differ from smokestack industries in that they are currently more dynamic than static: in practice, it seems that equilibrium is transitory if it exists at all in information technology industries. Furthermore, these industries may have contributed significantly to recent economic growth through increased productivity that is a direct result of innovation. From this point of view, it is not surprising that competition policy and enforcement appears to have been difficult, particularly in information technology industries (Sheremata 1998).

Against the above-mentioned background, it is understandable that the need for a more sophisticated approach to competition policy and enforcement has been emphasised. Industries should not be treated as similar black boxes but the effects of different legislation and enforcement should be micro-analysed in each industry (Sheremata 1998).

At the same time it is worth noting what Jorde and Teece (1992a) point out: "Antitrust policy in the 1990s will be shaped more by concerns about innovation and competitiveness than in any other period in recent history." According to them, innovation is the most powerful force animating competition, and add that innovations are an important factor mobilizing competition and insuring superior products and competitive prices for the consumer (Jorde & Teece 1991). Thus, there seems to be a need for re-evaluation of the traditional competition policy and, thereby, a redesign of competition legislation.

Nowadays, few economists would disagree with the claim that the dynamic efficiency gains from continuing innovation far outweigh the static gains from marginal-cost pricing. For example, Nelson and Winter already mentioned in 1982 that gains from continuing innovation are vastly greater than those associated with competitive pricing. Moreover, in markets where innovation is frequent, competition policy can be less vigilant. Monopolies will be constantly eroded as new products and processes are introduced (Jacquemin & Slade 1989).

However, mainstream antitrust analysis is static and neglects innovations. Ordover and Willig (1985) clearly point out this consideration: "The economic foundations of antitrust policy rest largely on static analysis, while the foundations of our economy have become increasingly rapid. It may be illogical and socially harmful to apply the static equilibrium framework to industries where technological progress is rapid and competition is driven by product and process innovations." Thus, a methodological problem is how the standard methodology of competition policy analysis should be modified to reflect the importance of innovations as competitive forces and engines of economic progress. This is problematic since dynamic efficiency considerations would support other kinds of regulatory options as the analysis is based on static efficiency (Baumol & Ordover 1992). On the other hand, particularly during the 1990s, certain ambitious studies have been made concerning the role of innovations under competition law. Nevertheless, because this approach is a new one, there are even several disagreements about theoretical premises.

Related to the above, a distinction can be made between *price reduction-driven competition policy* and *innovation-driven competition policy*. The former approach has been dominant but the latter has gained supporters in recent years. For instance, according to Jorde and Teece (1992b), innovation-driven competition generally stimulates rivalry and promotes economic welfare more effectively than price competition. They advocate regulatory reform in order to encourage innovation collaboration between business firms. In contrast, Brodley (1990) states that only a few narrowly targeted reforms are sufficient. Thus, there is also a distinction between opinions which support comprehensive reform of competition legislation and those supporting only its fine-tuning. Unfortunately, the discussion has concentrated on U.S. antitrust legislation and no such opinions have been presented in the literature concerning Finnish competition legislation.

Problems in evaluating the need for regulatory reform. We are confronted with several problems in analysing whether radical or only incremental regulatory

reform is sufficient. One problem is that at first sight efficient practices often look like anti-competitive ones. In the same way, cooperation may appear to be mischievous when in fact it is highly beneficial (Easterbrook 1992). The problem is verifying those situations in which behaviour promotes innovativeness and not anti-competitive, and in which innovative activities suffer from anti-competitive features. This difficulty is emphasised by Teece and Coleman (1998), who say that if antitrust agencies try to determine the legitimacy of choices by firms, they must then evaluate technological choices and consumer preferences. However, these agencies cannot adequately process and understand these data. Therefore they are likely to err if they question the design decisions of innovators. Furthermore, high-technology industries are so dynamic and complex that almost any competitive behaviour can be justified by an efficiency rationale (Sheremata 1998). The results of the inquiry made for this study emphasise the difficulty of this problem: not even enterprises know for sure what the impact of legislation on the innovative activities is.

Moreover, the redesign of antitrust policy for dynamic industries, i.e. industries in which product and process innovations constitute key market activities, raises significant methodological difficulties. Not only is the innovation process at a evolutionary stage but so is the economic theory which analyses these issues. For instance, the theory of network externalities has taken its first steps quite recently and many questions are still unanswered. In addition, many controversies exist, e.g. according to certain studies network externalities have to be distinguished from network effects, according to others they mean the same thing. Certain studies have concentrated only on the network effects (or network externalities) when they examine the need for the amending competition legislation. On the other hand, there are also authors who emphasise that network externalities are only part of the toolbox which should be taken into account when competition policy reforms are planned and implemented (Page & Lopatka 2000). These viewpoints do not only concern the economics of competition policy but also the economics of innovation as such (Brodley 1990).

A critical problem involves integrating rapid technological progress and slow regulatory process with one another. Delays in regulation are familiar in every field of legislation. However, they may become very problematic in fields where technological development is increasing in pace. Critics of intervention claim that markets erode monopolies more quickly and effectively than governments, particularly in high-technology markets. Moreover, the opportunities for agencies to harm competition are far greater than their opportunities to improve competition in sectors where there is rapid innovation. Thus, the agencies and courts should be very cautious about intervening, say Teece and Coleman (1998). On the other hand, proponents of the network externalities theory, among others, counter that markets take extraordinarily long to self-correct when network externalities are present. Thus, there is a need for intervention to correct the market failure.

Cooperation failures. Of course, the preliminary question is whether the existing legislation and enforcement of competition policy involves such defects that require

amendments in legislation: in particular, whether competition law is counterproductive from the dynamic efficiency point of view. In regard to this, it has been noted that "undeveloped cooperative relationships between individuals and between organizations stand out in our industry studies as obstacles to technological innovation and the improvement of industrial performance ... interfirm cooperation ... has often, though not always, been inhibited by government antitrust regulation" (Dertouzos, Lester & Solow 1989). Even though this statement concerns the situation in the United States, it clearly reveals that the treatment of various restraints of trade may have a substantial impact on innovation. The relationship is worth studying with respect to the Finnish competition law, too.

The above-mentioned issues are related to cooperation failures, i.e. in this context, inter-firm linkages promoting innovation. From another point of view and as Lester Telser (1985) has mentioned: competition may require some cooperation in order to obtain efficiency. Cooperation failures are general in our society: people and institutions fail to act cooperatively e.g. within the firm, between labour and management, with suppliers and customers and with other firms (Brodley 1990).

Cooperation failures are, by definition, failures to cooperate even though it would be beneficial to the parties in question. Several reasons can be presented for the failures concerned. Some cooperation failures are caused by legislation and its enforcement. On the other hand, many fields of legislation can be legitimated by the need for correcting cooperation failures. For example, one of the main tasks of contract law is to prevent opportunistic behaviour (Posner 1998). The legitimation of the tort law rests on the fact that it is impossible for injurers and victims to negotiate compensation before accidents, i.e. cooperation beforehand is not possible because of high transaction costs. Moreover, administrative law rather than private negotiations is needed because of the cooperation failures, i.e. transaction costs are again too high to facilitate the implementation of an efficient solution by private negotiations. It is only in the Coasian world that we do not meet transaction costs and cooperation failures.

Other regulatory problems. Nevertheless, cooperation failures are not the only issue analysed in this part of the study. For example, an important regulatory problem is whether technological development increasing in pace means that market power is eroded quicker, implying less reason to apply strict competition policy. Or does it reflect an extra entry barrier that would make competition authorities more wary of market dominance (OCDE/GD (97) 44). In particular, the role of high-tech industries is of great interest in this context.

Moreover, there are regulatory problems which may be characterised as *integrative* by nature. For example, do intellectual property rights (IPRs), such as patents, indicate market power to such an extent that the holder of an IPR can be regarded as a dominating firm according to § 3.2 of the Act on Restraints of Trade (Bowman 1984; Farrell & Katz 1998)? There are roughly two differing viewpoints concerning the relationship between IPRs and competition policy. On the one hand, IPRs have been viewed suspiciously, because they have been regarded as

monopolies. On the other hand, many authors and authorities have recognized that IPRs and competition laws are actually complementary, both directed at the enhancement of consumer welfare. Today, the mainstream approach is closer to the latter than the former viewpoint. To support the latter viewpoint, it has been noted, for example, that an invention may have little commercial value, and that substitutes for product innovations may be readily available (OECD 1989; Gellhorn & Kovacic 1994). In any case, integrative problems are inevitable. Problems may emerge, among other things, with respect to tying the sale of a patented product to the sale of an unpatented one. Moreover, grant-back clauses may raise antitrust concerns by discouraging the licensee from pursuing new inventions.

Under certain conditions, a firm with monopoly power has an incentive to maintain its monopoly power by patenting new technologies before potential competitors and this activity can lead to patents that are neither used nor licensed to others – sometimes called *"sleeping patents"*. The undesirable consequences of preemptive activity are evident. A firm may sustain its monopoly power through preemption. The firm may spend resources on the development of new technologies, and then deny society the use of these technologies. Resources are expended on R&D only to produce sleeping patents which are withheld from use. Although patents serve to illustrate incentives for preemptive activity, the complexities of R&D limit preemptive patenting to exceptional circumstances. Preemptive patenting may be unnecessary if potential entrants can be deterred more cheaply by other behaviour, such as capacity expansion. Preemption is too costly if an established firm has a sufficient comparative disadvantage in research and production; and uncertainty about the expectations and resulting investment activities of potential rivals may lead an established firm to choose a R&D strategy that allows entry by optimistic firms. On the other hand, preemption would be very hard to identify in any practical situation because it is difficult to distinguish between product development resulting from superior foresight and technological capabilities and development motivated by the entry deterrence (Gilbert & Newbery 1982).

In summary, issues dealt with here are the same as those pertaining to the competition law as a whole:

1) *horizontal restraints of trade*, i.e. agreements between competitors at the same manufacturing or distributor level;
2) *vertical restraints of trade*, i.e agreements between supplier and manufacturer, or between manufacturer and distributor;
3) *abuse of dominance*, i.e. anti-competitive behaviour by firms with significant market power; and
4) *mergers* or *acquisitions*.

At a general level, the problem of the study is reduced to the question of what is the proper role of government in promoting the development of specific industries and e.g. in facilitating competition among rival firms. Related to this, some ideological disagreements may arise. Some researchers are *regulatory optimists*, because they believe that government can correct market failures effectively;

others are *regulatory pessimists*, because they believe that government cannot correct market failures effectively and, thus, legislators should be as cautious as possible in regulating different activities. The approach adopted here is characterised by *pragmatism*: problems of regulation are analysed case-by-case taking into account both pros and cons of different regulatory options.

Competition legislation from the macro-policy point of view

Schumpeterian and Arrowian approaches

The often-mentioned starting point in the literature is that competition is good, because it gives consumers the greatest choice at the lowest possible price. Monopolies and cartels are bad because they lead to socially inefficient allocation of resources, shift wealth to producers that would otherwise remain in the hands of consumers, and generally waste resources through inefficient production and insufficient innovation (Wood 1997). However, as we will soon see, the issue is not black and white but rather various tones of grey dominate the market outcomes.

Our analysis starts with a brief outline of the problems related to the macro-policy issues, i.e. issues which are not related to the design of competition legislation but otherwise to the essential questions behind competition legislation. A critical question is, in particular, whether competition promotes innovative activities or whether business firms with monopoly power and thereby greater profits create a better basis for promoting innovativeness. There are two different approaches to the relationship between market concentration and innovation.

According to *Schumpeterian theory*, concentrated market structures should favour technological progress mainly for reasons of static efficiency based on scale and scope economies. Economies of scale are realised when the firm's average costs decline with output. On the other hand, firms realise economies of scope where it is possible for one firm to produce two products more cheaply than two or more firms could. Large firms in concentrated industries are more likely to innovate because they are better able to finance large research projects from their own profits, and because they can more easily appropriate the returns from their innovations since there are few competitors. For these reasons strict competition policies may actually slow the rate of technological progress and, thus, competition policy that actively promotes static competition is not obviously the most appropriate policy (OECD 1996c).

Another approach states that competition among firms favours innovation and technological development. For example, according to Kenneth Arrow (1962),

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 (OECD 1996c). For example, this *competition optimism* is characteristic of Finnish competition policy. A case in point is that according to the preparatory drafts for competition legislation, competition would among other things promote progress in product and process innovations (HE 148/1987 vp).

Critique of these approaches

The need for high profits. Both of these approaches can be criticised on many grounds. For example, according to the Schumpeterian approach, monopoly is necessary to generate profits that support risky but valuable inventive activity. On the other hand, it is not inevitable that monopoly invests resources in innovative activities, but in socially unproductive activity that may yield or maintain market power. In particular, monopoly might spend heavily on rent-seeking, e.g. services of lawyers and lobbyists to persuade government or authorities to impose barriers to entry for potential rivals (Posner 1975). Another problem attributed to monopoly is a greater managerial tolerance of inefficiency. Monopolists might opt for the easy life rather than engage in the constant vigilance necessary to minimise costs. This may also include reduced pressure to be dynamically efficient through constantly improving products and processes (Gellhorn & Kovacic 1994).

Moreover, high profits may not reflect market power, but superior profitability may reflect superior efficiency. Teece and Coleman (1998) have viewed the issue more analytically: firstly, Ricardian or scarcity rents reflect a difficulty in expanding competences. The scarcity rent is the normal return on the scarce asset, and there is no efficiency loss to monopoly. It is likely that the innovator is simply collecting sufficient Ricardian rents to cover the initial investment and offer encouragement to other innovators and entrepreneurs. From the competition policy perspective, these rents are beneficial since they encourage investment in innovation. Secondly, Schumpeterian or entrepreneurial rents occur because imitation does not occur instantaneously, even though imitators might well "swarm" around the innovators' key technologies and products. In the absence of imitation, the innovating firm has significant control over the scale at which the innovation is implemented in the long run. These profits are the return on innovation and are generally necessary to induce investment in the creation of such innovations. Such rents are accordingly necessary and desirable, and should not be the target of antitrust action. Thirdly, monopoly or Porterian rent is the type of rent that ought to be the target of competition concern, because it stems from the abuse of market power by a firm or firms. These circumstances might arise, among other things, because of exclusionary conduct lacking efficiency justifications, or from predatory conduct (Teece & Coleman 1998).

The Schumepeterian approach may also be criticised because small and medium-sized enterprises (SMEs) can appropriate the returns from their inventions in particular as a result of patent law. Moreover, trade secrecy is an option in their use. In other words, regulation has ensured that SMEs can also appropriate the returns from their inventions and innovations. Furthermore, the empirical relationship between innovation and market concentration is not very firm. In other words, extensive theoretical and empirical efforts to test the above-mentioned competing views have failed to establish strong links between alternative market structures and levels of technological progress (Cohen & Levin 1989; Sutton 1998). In addition, empirical research points to the important role of newcomers. From this point of view, entry barriers should be kept at modest levels (OCDE/GD (97) 44).

The Arrowian approach can be criticised for being too simplified. For instance, market conditions differ from case to case, i.e. in some circumstances only one firm may succeed in markets because of the economies of scale. Moreover, the Arrowian approach does not take into account at all the issues related to the design of competition law, and in practice, the "devil is in details" in competition policy, too. More generally, there are other factors such as market structure, which may critically influence the innovativeness of the business firms. For instance, the uncertainty over the regulatory framework and the design of regulations in every field of legislation are of great importance here.

Development of industries. It is worth noting, too, what developments have been characteristic of the industries in recent decades. First, in the 1900s, many economies underwent a transformation from largely raw material processing and manufacturing activities to the processing of information and the development, application, and transfer of new knowledge. As a consequence, diminishing return activities have become increasingly replaced by activities characterised by *increasing returns*. With increasing returns, the market at least temporarily tilts in favour of the provider that gets out in front, as Teece and Coleman (1998) have expressed it. If one believes in the growing importance of increasing returns, one would predict monopoly as the eventual industry structure. However, even if increasing returns do lead to the elimination of competitors who use a particular supply technology, this need not establish a monopoly if there are competing products available from suppliers who use alternative technologies. Moreover, any dominance is likely to be temporary – certainly more so than in a less technologically dynamic context (Teece & Coleman 1998).

Second, the network externalities theory often supports larger firms. While increasing returns is a production-side characteristic, network effects is a demand-side phenomenon associated with value to the customer (Katz & Shapiro 1985). Many products have little or no value in isolation, but generate value when combined with others (Katz & Shapiro 1994). A simple example may highlight the issue: no consumer would value owning the only fax machine in existence. A *network* exists when a product's value to the user increases as the number of users of that product grows. Each new user derives private benefits, but also confers

external benefits (*network externalities*) on existing users.

Two kinds of networks should be distinguished when analysing them. In a *communications network* or *physical network* various end users join a system that allows them to exchange messages with one another. The public telephone system is an example of this kind of network. Because the value of membership to one user is positively affected when another user joins and enlarges the network, such markets are said to exhibit network externalities. Another situation in which consumer coordination is vital arises when consumers choose durable hardware e.g. when they purchase a device to play a new format of prerecorded music. These hardware/software systems can be thought of as forming *virtual networks* that give rise to feedback effects associated with physical networks (Katz & Shapiro 1994). In the hardware/software market, one consumer's decision to adopt has no impact on other consumers. However, since the consumer anticipates that his choice leads to being "locked-in" to the corresponding hardware/software system, the consumer must anticipate what will happen in the second period (Katz & Shapiro 1994).

Excursion: Regulatory reform in technical inspection services

In Finland, a reform related to technical inspection services was put into force in the latter half of the 1990s. As an essential part of the reform, technical inspection services were no longer organized and managed by public bodies but by private enterprises. An inquiry was made among the enterprises concerned (more than 60 per cent responded) (Määttä, Frank & Pyykkönen 2001). One of the questions was whether the competition reform had promoted or slowed down technical progress in these fields of business.

According to the results of the inquiry, technological progress has not been slower after the reform than it was before it. However, most of the respondents answered that technological progress had been similar before and after the reform. In any case, about one-fourth of the respondents believed that faster technological progress had been the result of the competition reform.

Among other things, the following factors were mentioned as sources of faster technological progress:

- internal education has developed well, which has facilitated the diffusion of new technologies;
- new methods of risk evaluation have increased the freedom of enterprises;
- standards have developed well, and this has had a positive influence on the development of technology;
- the development of measurement technology and the development of testing equipment;
- in addition, in order to survive in competition new innovations should be adopted.

On the other hand, the respondents were asked whether they saw factors which hinder innovations and their diffusion. The following viewpoints were mentioned:

- affordability has been so weak that it prevented the development of new innovations;
- related to the above, price competition was regarded to be so tough that it eroded the possibilities to invest in R&D activities;
- new technology was seen as being too expensive;
- guidance from different authorities was viewed as contradictory, which, of course, created uncertainty;
- more detailed orders were required to reduce the uncertainty of the legal treatment of services;
- product standards quickly become outmoded;
- the inflexibility of legal norms was criticised, as was defective information about the content of regulations, especially among the small enterprises.

The legal treatment of restraints of trade in Finland

Goals of competition legislation

As has been emphasised in the literature, competition policy cannot be made rational until we are able to give a firm answer to one question: "What are the goals of competition legislation?" Are competition authorities to be guided by one or several goals? If several, how are authorities to decide cases where a conflict in goals arises (Bork 1978)? Our special interest is, of course, the role of dynamic efficiency under competition legislation.

The goals of legislation can be analysed by studying the law text and the preparatory drafts of legislation. Today, it is common in Finnish legislation that a law begins with a provision which outlines its objectives. This is the case with the Act on Restraints of Trade. According to § 1.2 of this Act, consumer welfare and the liberty to engage in trade are of specific importance when the law is applied. It is worth noting that nothing is mentioned about dynamic efficiency in this provision.

However, competition legislation involves other provisions – so-called *efficiency defence rules* – which can be regarded as requirements for taking dynamic efficiency seriously. According to § 6.2 of the Act on Restraints of Trade, horizontal non-price restraints are allowed if they are necessary to arrangements contributing to production or distribution efficiencies or technological or economic progress (and if the arrangements concerned mainly benefit customers or consumers).

Quite similar factors are also emphasised under § 19.1 of the Act: this provision allows Office for Competition to grant special permission to implement otherwise forbidden restraints of trade. Thus, according to law text it appears that dynamic efficiency has been taken into account; but to what extent has this actually been determined in the decisions of competition authorities? This is because legal norms are flexible in nature: the actual legislative power has been delegated to the enforcement agencies.

It is also of importance to note that preparatory drafts of competition legislation involve certain statements which denote dynamic efficiency (HE 148/1987 vp; KM 1987:4; KM 1991:15). On the other hand, the weight of dynamic efficiency is not obvious among the goals which have been mentioned in these drafts. Should static efficiency be the primarily consideration and dynamic efficiency only secondarily, or *vice versa*, or are there other goals which take precedence over dynamic efficiency when competition legislation is applied? These questions remain unanswered in the preparatory drafts of Finnish competition legislation.

The *Tinbergen rule* has to be recognised in this context: for every goal a different instrument has to be chosen. It is evident that achieving certain goals sometimes will come at the expense of others. For instance, it may sometimes be difficult to promote both static and dynamic efficiency at the same time (Baumol & Ordover 1992). Proposing multi-dimensional goals structures would require a method for ranking different goals and resolving possible conflicts among them (Gellhorn & Kovacic 1994). An essential question is whether we can rank innovativeness as a primary goal of competition law. Another problem involves which legislation would best promote innovativeness. This problem is not a minor one because disagreement exists whether competition or concentration would best do so, and what form of competition legislation design should be adopted to promote dynamic efficiency.

There are at least three alternatives for ranking innovativeness as a goal of competition legislation. First, it can be a primary goal, i.e. innovativeness should be a benchmark in the application of the competition law even though it may restrict competition and erode allocative efficiency. Second, it can be a secondary goal, i.e. innovativeness can be taken into account in the application of the competition law so as not to restrict competition and reduce allocative efficiency. The third approach can be labelled the Kaldor-Hicks criterion or cost-benefit analysis. Innovativeness can be taken into account if the dynamic advantages are larger than the losses due to the restraints of competition.

Problems of definition

Naked and ancillry restraints of trade. There are certain concepts which we have to define before analysing the restraints of trade (or restraints of competition). First, a distinction has usually been made between naked and ancillary restraints (Bork 1978). Naked restraints of competition are such restraints whose main

objective is to eliminate competition; they are not legitimated e.g. by dynamic efficiency considerations. On the other hand, ancillary restraints of competition are those which have legitimate purposes even though they reduce price competition in the market. One such legitimate purpose is the promotion of innovativeness.

Competition policy may be regarded as very easy to manage from the above-mentioned point of view, i.e. naked restraints would be forbidden and ancillary restraints accepted, at least under certain conditions (Bork 1978). Of course, the issue is not so straightforward. Firstly, competition authorities as well as courts have to make their decisions in a world which is characterised by imperfect information. Related to this, enterprises have no incentives to reveal their information: they claim that restraints which they have implemented always have legitimate purposes. Secondly, it is difficult to compare e.g. the reduction of price competition with the promotion of dynamic efficiency. In addition, as Schmalensee (1992) puts it: "The distinction between primary and ancillary provisions of a complex agreement is somewhat blurry and is not particularly useful in distinguishing between harmful and beneficial restraints." He emphasises that it is the package as a whole that matters.

Per se rule and rule of reason. An interesting question under the Act on the Restraints of Trade is whether to apply the per se rule or the rule of reason. The per se rule means that the restraint of competition is forbidden if those engaging in it cannot show that the benefits from innovation collaboration or other restraints are larger than their costs or disadvantages. According to the rule of reason, the restraint of competition is allowed provided the competition authorities cannot show that the disadvantages of restraint are greater than its advantages. From this point of view, the difference between the per se rule and the rule of reason is reduced to the burden of proof: briefly, which party must prove what.

However, the above-mentioned discussion about the policies towards restraints of trade is too simplified. The per se rule and the rule of reason provide too categorical a picture of competition policy. Instead, the following five categories of measures may be applied under competition law:

1) *Per se rule without exemptions:* a specific restraint of trade is always forbidden.
2) *Per se rule with permit-based exemption*: a specific restraint of trade is forbidden, unless competition authorities permit its implementation.
3) *Per se rule with permit-based and legal exemptions*: a specific restraint of trade is forbidden, if it is not allowed under conditions set by the competition law or competition authorities.
4) *Rule of reason:* restraint of trade is allowed provided the competition authorities cannot show that the disadvantages of restraint are larger than the benefits.
5) *Per se legality*: restraints of competition are always allowed regardless of their impacts.

Ex ante and ex post instruments. Moreover, an important distinction is made between ex ante and ex post instruments. Per se rules without exemptions and with permit-based exemptions as well as the regulation of acquisitions are ex ante measures. In contrast, the per se rule with legal exemptions and the rule of reason can be regarded as ex post instruments. In analysing the appropriate borderlines between different legislative strategies under competition law we have to take into account the discussion concerning the distinction between ex ante and ex post instruments in general. A critical viewpoint is the relationship between benefit and harm caused by the measures. For example, if the harm only rarely occurs, and measures are usually beneficial, ex post instruments could be applied.

Main points of the legislation

Four kinds of restraints of trade. Legal treatment of restraints of trade in Finland today is determined according to the following rules:

1) Horizontal price restraints: § 6.1: per se rule with permit-based exemptions.
2) Horizontal non-price restraints: § 6.2: per se rule with permit-based and legal exemptions.
3) Vertical price restraints: § 4: per se rule with permit-based exemptions.
4) Vertical non-price restraints: § 9: rule of reason.

Horizontal restraints of trade are agreements between competitors at the same manufacturing or distributor level. As noted above, horizontal restraints include both non-price and price restraints. The per se rule with permit-based and legal exemptions is applied with respect to non-price restraints; only permit-based exemptions are applied with respect to the price restraints.

Vertical restraints also include both price and non-price restraints of trade. The former practice is usually referred to as resale price maintenance: it is imposed by manufacturers in order to determine the resale prices charged by their distributors. Vertical non-price restraints typically limit e.g. the territories within which distributors may sell, or the types of customers to whom they may sell. The rule of reason provides the basic standard for vertical non-price restraints, whereas the per se rule with permit-based exemptions is applied with respect to vertical price restraints.

As can be seen from the foregoing, the legal treatment of vertical and horizontal price restraints seems to be consistent because the per se rule is applied to both of these restraints and because permission for exemption may be granted to both types of price restraints under the conditions mentioned in § 19.1 of the Act on Restraints of Trade. On the other hand, the legal treatment of vertical and horizontal non-price restraints differs: the rule of reason is applied with respect to vertical restraints but the per se rule (with permit-based and legal exemptions) with respect to horizontal restraints.

The heavy emphasis that competition law places on characterizing collective action as being horizontal or vertical has been considered problematic. For example, Gellhorn and Kovacic (1994) have stressed that the evaluation should occur according to the impact of measures on output and prices, not according to the denomination of the conduct as horizontal or vertical. In other words, formalism should be avoided and the actual impacts should be critical (Määttä 2001).

An important factor is that price restraints are governed by the per se rule (with permit-based exemptions), whereas the legal treatment of non-price restraints is not determined so strictly. One can ask whether there are good reasons for this deviation. For instance, Posner (1981) states that the legal treatment should not be dependent on the way the restraint of trade is implemented, i.e. whether the restraint is price or non-price in nature, as both forms of restrictions tend to have the same competitive effects (Gellhorn & Kovacic 1994). On the other hand, Comanor (1985) has pointed out that despite the functional similarity between non-price and price restraints, they may sometimes have different implications for economic efficiency.

Efficiency defence rules. Under Finnish legislation two kinds of efficiency defence rules are applied. The first rule concerns horizontal non-price restraints of trade (§ 6.2 of the Act on Restraints of Trade). It is *legal* in nature (Aalto-Setälä et al. 1999; Kuoppamäki 2000; Määttä 2001). According to this rule, restrictions on production are allowed, if they are *necessary* for arrangements contributing to productive or distribution efficiencies, or technological or economic progress, and if the measures concerned will mainly benefit customers or consumers. Under these circumstances, no permit from competition authorities is required. Another efficiency defence rule under Finnish competition law can be characterised as *permit-based* in nature. According to § 19.1 of the Act, a permit may be granted for measures regulated under § 4—6 of the Act, if those measures contribute to productive or distribution efficiencies, or technological or economic progress, and if those measures mainly benefit customers and consumers. It is worth noting that under the legal efficiency defence rule, the restraint must be deemed necessary to achieve the goals mentioned in the law, whereas under the permit-based rule, no such requirement exists.

How strict an approach should be adopted in the enforcement of efficiency defence rules? For example, a very strict practice has been applied in Italy. This approach has been motivated by the warning that an extensive utilisation of individual permits could transform the authority into a regulatory agency (van Cayseele, Sabbatini & van Meerbeck 2000). In other words, permits should be granted only in exceptional cases, if this train of thought is followed. From this point of view, the per se rule cannot be applied in circumstances in which dynamic efficiency requires permissive policy.

There is a further problem with respect to efficiency defence rules. Reservations can be expressed about the capacity of authorities to distinguish effectively between pro-innovative and anti-innovative conduct (Demsetz 1992). On the other hand, a similar problem confronts legislators. In other words, decisions have to be made

under circumstances in which information is highly imperfect. A regulatory problem then exists whether the Office for Competition and other competition authorities have greater knowledge than the legislator. The following considerations can be cited: first, officials are closer to the markets than legislators. Second, officials can make case-by-case evaluations of restraints of trade or mergers. Third, legislators would need to amend legislation each time it intervenes in the market, which would be uncertain and sluggish. On the other hand, the predictability of legal treatment would require legislation to be as clear as possible, with detailed and inflexible rules.

All in all, it is very difficult to manage "ideal" competition policy in practice (Schmalensee 1987). In addition to the information problems, there are several other reasons for the difficulties. For instance, economics is hardly an exact science. It is not possible to predict the precise quantitative effects of any particular restraint of trade or merger on costs and prices, and the net impact on buyers, sellers, and society as a whole is even harder to quantify. And especially dynamic impacts of legislation are very difficult to forecast.

In the face of the above-mentioned difficulties, the best one can hope for in practice is a competition policy that makes as few major errors as possible and operates with enough speed and predictability so as not to become a major source of uncertainty. Such a policy must necessarily rely on presumption and shortcuts that reflect the current state of economic knowledge and belief, as Schmalensee (1987) has put it.

A regulatory problem related to the efficiency defence rule is whether the so-called *"consumer protection rule"* ("while allowing consumers or customers a main share of the resulting benefits") would be needed at all. According to Sheremata (1998), innovation not only reduces prices but also increases the quality and variety of goods and services consumers can access. From this perspective, it appears that the improvement of dynamic efficiency strongly fulfils the requirements of the consumer protection rule. It can also be motivated by the economic fact that transfer payments ought not to matter. Thus, analysts should only be concerned with the question of whether the efficiencies obtained outweigh deadweight loss and not with the question of who reaps the benefits. However, Fisher (1987), for example, is very reluctant to approve measures for efficiency reasons if they seem likely to lead to a restriction of competition. Efficiency arguments are easy to make, but hard to evaluate, he adds.

Anti-competitive conduct. In any case, the situation is often such that measures promoting innovativeness may be anti-competitive in nature. What we should do in such circumstances? First, however, we have to define what anti-competitive conduct means. According to Ordover and Saloner (1989), "business conduct would be deemed anti-competitive if it were to injure competitors and reduce the level of long-run social welfare relative to the level that would be attained in the absence of the complained-of conduct or business tactic". However, there are many problems related to this definition. One severe problem is its implementability. Such an open-ended definition of business conduct would not only consume

significant resources but because of its complexity frequently lead to erroneous results. Furthermore, such an open-ended test of anti-competitive conduct would complicate business planning and might increase incentives for anti-competitive abuse of competition legislation (Ordover & Saloner 1989).

Teece and Coleman (1998) have a more specific approach to the definition of anti-competitive conduct. For them, the conduct must satisfy at least three criteria to be anti-competitive: firstly, the conduct must not be the sort that society seeks to encourage, such as non-predatory price reductions. Secondly, the conduct must be socially inefficient, in the sense that it tends to inhibit industry innovation or otherwise create distortions inconsistent with long-run consumer welfare. Thirdly, the conduct must be substantially related to the maintenance or acquisition of monopoly power, and ought to be a cause of the monopoly power under scrutiny.

Recognition of the difficulty in formulating legal rules for determining anti-competitive conduct has provoked at least three responses: (Ordover & Saloner 1989). The first response is to urge removal of virtually all constraints on the behaviour of a single firm, including that of dominant firms. The rationale for this position is that firms reach a dominant position by virtue of business acumen, and to restrain their behaviour penalizes bigness and creates disincentives to aggressive competition. Furthermore, markets are self-correcting so that any market-place advantages which are not related to superior skill and efficiency are quickly eroded. Consequently, anti-competitive conduct is, in general, unprofitable. According to the second point of view, all possible scenarios in which a firm's conduct could be scrutinized for its anti-competitive effects should be elucidated. The rationale for this public policy response is that while anti-competitive behaviour is rare, it cannot be ruled out completely. The two-stage procedure of filtering out claims and then applying simple rules to assess conduct effectively reduces the risk of labelling vigorous pro-competitive conduct as anti-competitive. A third response calls for open-ended rules. Under this approach, a detailed investigation of the purpose and the effects of specific acts under the rule of reason, is emphasised.

Relevant markets

Two kinds of relevant markets. From the legislative point of view, it is important to determine what is meant by the concept 'relevant market.' Thus, there is a regulatory problem concerning whether the Finnish practice of determining the scope of a relevant geographical and product market distorts innovative activities. The process of market definition cuts across nearly every area of competition law: restraints of trade by different firms, abuse of dominance and mergers and acquisitions (van Cayseele, Sabbatini & van Meerbeck 2000). It is still worth noting that two dimensions of the market must be considered: the relevant product market and the relevant geographical market.

Relevant product market. In defining the relevant product market cross-elasticities of demand — that is, what effect an increase in one product's price will have on consumer demand for a close substitute — have been taken into account. Commodities reasonably interchangeable by consumers for the same purposes constitute a relevant product market. In recent years authorities have also looked for other tests to define product market.

The analysis of supply and demand substitution possibilities and opportunities is quite complicated in regimes of rapid technological change. Analysing the market from a static perspective will almost always lead to the identification of markets that are too narrow. Because market power is often quite transitory, standard entry barrier analysis will often find that an innovator has power over price when its position is in fact extremely fragile. Furthermore, much of the data on which antitrust authorities rely are necessarily backward-looking, meaning that firms at the end of an innovation-based period of dominance are actually more likely to be subject of antitrust scrutiny than in a position to exercise market power. Not all firms in existing product markets are well-positioned to compete in next-generation product markets. If a firm is unable to keep up with a shift in the technological basis of the market, whether because of path dependencies or problems in replicating technical success, market analysis should dramatically discount that firm's participation in the market in evaluating market power. Unfortunately, for the most part past success has been used as a proxy for future viability. In many cases, doing so will overstate (or understate) the competitive forces at work in a market. In summary, there are severe difficulties in defining the relevant market is in high-technology industries (Teece & Coleman 1998).

Relevant geographical market. The definition of geographical market follows the same methodology. Some products, such as automobiles and computer software are sold in a market that is almost global. Other products, however, move only in local markets, sometimes national, sometimes only a small locality. This may be due to high costs of transportation, customer purchasing needs, or the special needs of a local market.

At one extreme, globalization implies that all relevant markets are worldwide. And worldwide relevant markets would involve, among other things, national innovation collaboration not being a problem from the competition perspective. There will always be suppliers of innovations outside this collaboration. It would guarantee that cartels are very difficult to implement in these circumstances. But, of course, this kind of globalization has not been occurred. For instance, Brodley (1990) mentions several factors which make relevant markets less narrow than worldwide:

1) international trade restrictions;
2) differing national standards;
3) local subsidies; and
4) disadvantageous exchange rates.

Related both to relevant product and geographical markets and from a static point of view, a small market share is thought to show the absence of market power while a larger share is an indication of its presence. This is not necessarily the case when there is rapid innovation. A large share and related high profits do not make a monopoly if the source of rents are Ricardian or Schumpeterian. It is only a monopoly if it earns monopoly rents. Put differently, a true monopolist is a firm that earns monopoly and not Ricardian or Schumpeterian rents. The latter rents tend to be transitory unless renewed by continuous innovation, even if they are significant (Teece & Coleman 1998). Thus, a recommendation may be presented that competition policy should be *de facto* more permissive with respect to innovative industries.

In summary, two points are clear. First, the determination of relevant product markets is a difficult challenge for innovative industries: the backward-looking approach does not provide an appropriate basis for evaluating what is a relevant market in the future, and the future-oriented approach is very speculative. However, the future-oriented approach is required in this respect, or innovation failures would occur. A second viewpoint concerns relevant geographical markets. A common theme in the critique of competition legislation in the inquiry was specifically related to this issue. A common proposal was that relevant geographical markets should be defined more extensively than is the case today. If the global perspective is omitted, the growth of Finnish enterprises would not be facilitated and industrial competitiveness would be eroded, many respondents maintained in the inquiry.

Horizontal restraints of trade

Vulnerability to cartelisation

Innovation collaboration. Where are the borders of the acceptable/forbidden *collaboration in innovation* between business firms? Innovation collaboration can be defined as a long-term or intermediate-term contractual relationship, short of merger, that binds the participating firms to a mutual goal promoting the invention, and the development or diffusion of new products or production processes.

There are at least two differing viewpoints on this problem. According to Jorde and Teece (1990), there is very little risk of cartelisation in rapidly evolving high-technology industries. They claim that such industries are unlikely to injure the competition by innovation collaboration. For instance, within this context global competition demands that collaboration not cover the whole market, which makes it difficult to cartelise business conduct. Thus, the benefits from permissive competition legislation can be achieved at virtually no cost. What is important is

that Jorde and Teece (1990) believe that permissive policy should also be followed in *production* and *marketing*, because the application and commercialisation of research is vital to innovation.

On the contrary, according to Brodley (1990), innovation collaboration can create anti-competitive risks and should be subject to competition legislation. He asserts that greater collaboration in production and marketing should not be allowed because suitability problems are less acute within this context, and especially if economies of scale or scope are not present. Brodley emphasises that innovation collaboration will not harm competition under certain conditions: firstly, alternative suppliers of innovation should exist; secondly, downstream product markets should be effectively competitive; and finally, collaboration should be limited to a constrained fraction of innovation suppliers. On the other hand, Brodley stresses the following points which are capable of injuring competition: collaboration in essence includes the whole market; entry barriers exist; and the joint enterprise attempts to deny necessary inputs to rival firms.

Emergence of collusion. From the above point of view, it is important to identify those markets in which conditions are propitious for the emergence of collusion, i.e. cartelisation. The following brief analysis is based on Posner's (1976; 1998) works. Nevertheless, certain preliminary notes have to be given before our analysis. First of all, no single condition is either sufficient or necessary to permit us to conclude that collusion exists in the market concerned. Moreover, the list of conditions is not exhaustive, i.e. there are also other kinds of direct and indirect evidence which can be used to analyse the issue.

If the market is concentrated on the selling side, it is more vulnerable to cartelisation. In other words, the fewer the number of sellers, the lower the costs of coordinating their activities, including collusion. On the other hand, the globalization of certain markets would influence this feature dramatically. However, a clear majority of industrial economists disagree with the following statement: "International competition has made the regulation of monopolies an outdated policy" (van Cayseele, Sabbatini & van Meerbeck 2000). In any case, one cannot claim that concentration is the only factor predisposing a market to cartelisation. For example, if there are numerous small sellers outside the cartel, market concentration then does not matter so much. In addition, rapid technological progress may erode cartels as well as eroding monopolies.

The market has been regarded as vulnerable to cartelisation when demand is inelastic with respect to price. The reason is simple: the less elastic demand is, the larger the profits that a monopoly price will generate and hence the greater the incentive to monopolize (Asch & Seneca 1976). From this point of view, an important question is whether the products of innovative industries are inelastic or elastic in regard to demand.

If entry takes a long time, the market is vulnerable to cartelisation (Demsetz 1982). At first glance, because technological progress is rapid, it may seem probable that entry would not take much time, at least in those markets characterised by rapid development. Much depends, however, on the entry barriers: the size of

investments needed for the new firms, and whether there are legal or corresponding entry barriers. Thus, three kinds of innovations have been distinguished from this point of view (OCDE/GD (97) 44). Firstly, there are product innovations that require relatively small resources. Under these market conditions, competition policy concerns diminish as collusion becomes more difficult. Moreover, easing the tasks of competition policy can be expected with respect to product innovations where learning is relatively unimportant. Secondly, for process innovations it also seems that the task of competition policy would become easier. This is because the increased tempo of such innovations can be expected to make collusion more difficult. Thirdly, there are innovations requiring large R&D resources where learning is important. Under these circumstances, a quickening of the innovation process could be seen as increasing entry barriers and, thus, requires more attention in competition policy. The same holds for innovations where interoperability between products is important: when a product sets a new standard, access to the market may become difficult.

The less standardised or less homogenous a product is, the more difficult it will be for those selling the product to collude effectively, because it will be easy to cheat by altering the quality of the product. For example, if incremental innovations are characteristic to the product market, a cartel is not so big a threat.

The enforcement of a cartel is complicated, and the feasibility of collusion therefore reduced, when some members sell at lower levels in the chain of distribution than others. This feature may vary among industries, as well as among innovative industries.

If other forms of competition than price competition are very important, the only effect of eliminating price competition may be to channel competitive energies into other forms of competition. Thus, in markets where innovation competition is important, cartels are not so usual as in markets where only price competition matters.

Collusion is more difficult to police in a market where demand is growing over time than in one where demand is static or declining. This is an important point of view since markets related e.g. to information technology have been growing rapidly, which implies that cartelisation has been more difficult than in static markets.

A "record" of price fixing or related violations of competition legislation is indirect evidence that the structure of the market is favourable to collusion. Related to this point of view, a consideration worth mentioning is that anti-competitive abuse has not been unknown in innovation collaboration, at least in the United States (Brodley 1990). On the other hand, Brodley (1990) admits that anti-competitive practices in high-technology markets are rare; nevertheless, he continues, it cannot be assumed that those practices would be rare in the absence of competition legislation. From this point of view, it seems that per se legality is not an appropriate rule with respect to innovation collaboration.

In summary, cartelisation of industries experiencing rapid technological change, and in particular, which are open to international trade, is very difficult. Therefore, cooperation among firms in dynamic markets should be made easier.

Horizontal price agreements

Legal treatment. According to § 6.1 of the Act on Restraints of Trade, horizontal price agreements fall inside the scope of the per se rule. However, two exceptions are worth noting here. First, according to the *de minimis rule*, minor restraints of competition may be allowed. A so-called five-percent-rule is applied within this context: if the market share of the restraint is less than five percent, competition authorities do not necessarily deal with such a restraint. Nevertheless, naked restraints are not subject to the five-percent-rule, i.e. they are not allowed even though the market share is less than the percentage mentioned. A second and perhaps more important provision is § 19.1 of the Act, which permits the implementation of restraints of competition under certain conditions. A critical question is then whether the practice tends to restrict competition and decrease output or whether it is designed to increase efficiency.

The legitimation of the prohibition of cartels can be presented as follows: cartels behave more or less as monopolists do, although they have the added complication of the transaction costs of coordinating their activities. Though some cartel members will inevitably be more efficient than others, cartels do not facilitate the use of efficiency gains. On the other hand, the more efficient members will especially be tempted to cheat on the cartel's artificially high price.

The need for reform. According to Schmalensee (1992), the per se rule for horizontal restraints is dead. He points out that many of the theoretical reasons for cooperation that have been advanced in the vertical areas are applicable in the horizontal areas as well. Relatedly, "the horizontal/vertical distinction is often not nearly as sharp in practice as it seems in the classroom". The fact that vertical and horizontal restraints are so often blurred is a reason for caution in using the per se rule for horizontal restraints. Moreover, cases in which horizontal restraints are likely to be beneficial in practice seem to occur with some frequency. Furthermore, high-technology industries, with their emphasis on investments in R&D that are characterised by imperfect suitability and excludability, may provide socially beneficial grounds for cooperation among potential competitors. Such cooperation is frequently likely to prove pro-competitive since it can increase returns to innovation through improved suitability, encourage dissemination of innovations, facilitate exploitation of economies of scale and scope in the creation of new knowledge, and permit better spreading of the risks associated with the investments in R&D when market mechanisms for risk sharing perform inadequately (Baumol & Ordover 1992).

In this context is worth noting that some industries require cooperation in order to exist. *Network industries* often fall in this category. On the one hand, in physical networks perfect competition may be inefficient, and on the other hand, in virtual networks perfect competition may be impractical. Network externalities can often be internalized only by contract or joint ownership. For instance, bank cards require cooperation among banks in order to compete with cards issued by a single firm (Carlton & Frankel 1995). This is also recognized in Finland.

Telecommunications networks require agreements on interconnection and sharing of joint costs and revenues. Producers of both hardware and software must settle on standards to assure compatibility (Page & Lopatka 2000). Moreover, standard-setting organizations may be necessary.

While these points suggest pro-competitive explanations for some types of agreements, they do not exclude the possibility of such an organization being used as a cartel or an exclusionary device. Some networks may thus require continuing antitrust control. For example, certain services offer positive network externalities, but do not justify price fixing by participating agents. And network externalities do not imply that standard-setting joint ventures should be permitted to exclude competitors (Anton & Yao 1995; Page & Lopatka 2000). Against this background, the per se legality of horizontal agreements cannot be recommended even in network industries.

The consistency of legislation as such requires both price and non-price agreements being treated in a similar fashion. However, there are other reasons, too. Perhaps the most important one is that price restraints and non-price restraints of trade are substitutes for each other. For instance, suppliers can raise the price of products either directly through an agreement or indirectly by agreeing about quantity limitations for the products they sell. The result is, in principle, the same in both cases. It is somewhat astonishing that the legal treatment of the restraints concerned differ, even though the economic consequences of the measures should be in a critical position with respect to legal implications, not the formal manner by which restraints of trade are implemented.

We should also analyse whether the rule of reason can be applied with respect to price fixing as well as other horizontal restraints of trade. One problem is that some industries are "smokestack" industries, whereas others are related to information technology or corresponding activities. From this point of view, it might seem appropriate to apply a differentiated legislative strategy so the per se rule (modified by permit-based and legal efficiency defence rules) is applied with respect to smokestack industries and the rule of reason with respect to more innovative industries. However, this kind of legislative strategy is not without problems: how do we distinguish those industries in which permissive legislation would be applied from those employing more traditional legislation? How do we deal with multi-product firms, some governed by permissive legislation and others not? And how do we know at all which kinds of industries deserve more permissive legal treatment than others? These questions indicate the problems confronting the legislator if differentiated legislation is applied. Therefore, the following recommendation can be made with respect to the reform of competition legislation: uniform legislative strategy should be preferred in regulating restraints of trade, i.e. differentiation of legislation between innovative and non-innovative sectors should be avoided. On the other hand, the characteristics of each industry should be taken into account in the enforcement of competition law.

The enterprises and their organisations which took part in the inquiry quite often stated that cooperation at the horizontal level should be allowed more

liberally than is the case today. They emphasised that reform is needed to improve the preconditions for innovativeness. Cooperation failures were sometimes mentioned as well: expensive innovative activities require that enterprises have a possibility for dialogue. Another requirement was that price fixing be approved in circumstances in which participants of the cartel do not have significant market power. A reference was made to a specific market in which a large enterprise was dominant: the possibility of SMEs allying with each other may balance the situation. From the point of view of organisational neutrality, such a requirement seems to be justified.

A preliminary conclusion is the following: certain "anti-competitive" horizontal price agreements should be accepted more easily to avoid cooperation failures in innovative activities. An important consideration supporting a reform of this kind is that cartelisation of industries experiencing rapid technological change and, in particular, open to international trade, is very difficult. However, the reform would not necessarily require the legislation to be modified radically. The only need for amending the legislation is that the scope of the legal efficiency rule be extended to also cover horizontal price restraints. This would mean that both horizontal price and non-price restraints are treated legally in a similar fashion.

Research joint ventures (RJVs)

Research joint ventures (RJVs) have been one challenge to the competition law both domestically as well as internationally (Claydon 1986). RJVs have certain advantages. Even very large firms do not have adequate resources to undertake unilateral development of some new technologies and, therefore, numbers of them should conduct development jointly (Kamien, Muller & Zang 1992). Cooperative research efforts, particularly among smaller firms, allow them to achieve the scale and scope advantages of larger firms (Symeonidis 1996). Moreover, one alleged advantage of RJV is the elimination of duplication of effort (Jorde & Teece 1990; Kamien, Muller & Zang 1992). Furthermore, learning by interacting has been regarded as important to innovation (Schienstock 1999). This may be difficult in a world in which the interaction and cooperation between firms is strictly regulated by the competition law. In addition, restraints such as RJVs are necessary to reduce the possibilities for opportunistic behaviour and free riding by the venturers that can undermine innovative efforts (Ordover & Willig 1985; Baumol & Ordover 1992).

On the other hand, RJVs may have certain drawbacks: there is a fear that the participating firms in an RJV will tend to free ride on each other or curtail competition in other phases of their interaction (Kamien, Muller & Zang 1992). This is an issue which has often been omitted in the RJV analysis, i.e. the coordination of prices and output decisions of the venturers (Ordover & Willig 1985). However, if RJVs are compatible with the competition law, they are compatible with the

contract law, too. And contract law is an "insurance" mechanism against opportunistic behaviour (Posner 1998). Moreover, horizontal cooperation may reduce diversity. However, an economy without horizontal coordination and communication offers no guarantee that the desired level of diversity is achieved cost-effectively. In addition, cooperation needs not be the enemy of diversity. If firms can coordinate their research programs to some degree, duplication can be minimised without the industry converging on a single technological approach (Jorde & Teece 1990; Geroski 1995).

The issue, then, is how to achieve the alleged advantages of an RJV while avoiding potential disadvantages. An obvious solution is to allow cooperative research while barring any curtailment of competition in product markets. According to Demsetz (1992), horizontal agreements, in general, should be allowed especially if the aggregate market share controlled by the firms making this kind of agreement is too small to allow it significantly to influence price. At a minimum, integration by contract or alliance should be treated no less favourably than full mergers.

Moreover, Jorde and Teece (1990) have proposed that cooperation should be allowed if inter-firm agreements involve less than 20 to 25 percent of the relevant market. In theory, this schematic rule is appropriate because it improves the predictability of legal treatment. However, in practice we should note what has been mentioned above about the definition of relevant markets: there are severe difficulties in defining relevant markets in innovative industries and, thus, also the market share of the firms. Therefore, it is difficult to apply such schematic rules as Jorde and Teece propose.

In addition, we should remember that cartelisation of industries experiencing rapid technological change, and open to international trade and investment, is very difficult. So long as these industries remain open and innovative, competition policy should err on the side of permitting rather than restricting inter-firm contracts (Jorde & Teece 1990).

Vertical restraints of trade

Preliminary considerations

Our discussion assumes a two-level distribution model consisting of manufacturers and retailers. Thus, we omit such actors as wholesalers, jobbers and other service providers. Moreover, we assume that vertical restraints fall into two categories: the first consists of those measures which restrict the distribution of products. An example of this is minimum resale price maintenance (RPM), through which the manufacturer specifies a minimum or a maximum price at which the product can

be resold to retail consumers. Another group of vertical restraints consists of measures excluding or foreclosing competing firms from the market. Such an example is a tying clause in which the manufacturer conditions the sale of one product on the buyer's purchase of a second product (Katz 1989).

According to Bork (1978) and the so-called Chicago school, competition policy towards vertical restraints, such as exclusive dealing and exclusive territories, should be permissive. They demonstrate that manufacturers impose vertical restraints in order to encourage distributors to supply certain consumer services. These services include delivery, credit, repair, advertising and promotional activities. The manufacturer's interest is, of course, to derive higher profits by increasing sales. Consumers receive net benefits from increased services, too.

On the other hand, various anti-competitive effects of vertical restraints have been identified by the competition authorities in the United States (Wood 1997):

1) Elimination of intra-brand competition, i.e. competition for sales of the identical, usually branded, product. This kind competition can be very important, especially when inter-brand competition is weak.
2) Facilitation of collusion.
3) Foreclosure, i.e. exclusion of competitors. More specifically, vertical restrictions can raise entry barriers, erect new barriers, and force competitors to operate inefficiently.
4) Allocative inefficiency from retail promotion induced by vertical restraints.
5) Reinforcement of oligopolistic behaviour.

In practice, the rule of reason is applied with respect to non-price vertical restraints of trade, but not with respect to price restraints in several countries, Finland among them. Courts and competition authorities generally presume that non-price vertical restraints are designed to increase efficiency and should be permitted except in extraordinary circumstances (Gellhorn and Kovacic 1994). The situation is rather the opposite with respect to price restraints.

Resale price maintenance (RPM)

RPM is a practice by which manufacturers attempt to control the prices at which their products are resold by dealers and distributors (Marvel & McCafferty 1985). This general definition includes both price floors (or minimum RPMs) and price ceilings (or maximum RPMs) established by the manufacturer.

RPMs as cartels. An anti-competitive use of RPM involves manufacturers' attempts to obtain or preserve monopoly power through control of their distribution system. This is called the *manufacturers' cartel explanation*. According to the *dealers' cartel explanation*, manufacturers are forced to adopt RPM by the threat of dealers' boycotts. Many commentators have regarded these explanations as unlikely in practice. Moreover, competition authorities have the option of

straightforward action against the offending manufacturers and dealers engaged in a horizontal cartel. From this point of view, the per se rule against RPM is unnecessary because the primary restraint of trade is price fixing, not RPM (Posner 1981; Marvel & McCafferty 1985).

An important distinction is that between *primary* and *secondary restraints of trade*. As noted above, resale price maintenance may be regarded as a secondary restraint of trade, i.e. RPM is used to strengthen horizontal restraints of trade either at the production or distribution level. Thus, (horizontal) cartel is the primary restraint and RPM only a secondary restraint. It is important that the legal treatment of restraints should be determined according to the primary restraint (Posner 1981). However, sometimes imperfect information makes it difficult to determine whether cartels exist and in such circumstances, secondary restraints may be critical from the legal point of view, even though the economic effects, not formalities, are emphasised as a basis of legal decision-making (Määttä 2001).

Benefits of RPM. Most commentators have assumed that the benefits generated from RPM will come almost entirely from increased services provided as a consequence of reduced free-rider problems in distribution (Telser 1960). It may be to the manufacturer's advantage that the retailers provide effective service to their customers or that the product be better promoted throughout a relevant market in order to attract buyers. Creating an effective minimum resale price induces dealers to compete more aggressively on non-price criteria such as service and promotion. The second beneficial purpose of RPM is to protect the signal of high quality created by a retailer's approach to doing business. In other words, manufacturers might use RPM to encourage retailers to devote resources to activities that help certify quality (Marvel & McCafferty 1984). The role of retailers in informing customers is especially important when the product is complex and rapidly changing, such as personal computers (Mathewson & Winter 1985). A further pro-competitive goal of RPM is to facilitate entry by new firms and the introduction of new products. Ensuring generous resale margins with RPM can induce retailers to carry a new entrant's goods or to stock a product early in its life (Mathewson & Winter 1985).

The above-mentioned considerations support the viewpoint that the rule of reason be applied with respect to RPM. There are several other reasons also supporting this regulatory option. First, various practices have arisen to replace RPM. For example, firms may resort increasingly to vertical integration, even though the cost of doing so exceeds the cost they would incur if such firms could enforce RPM contracts. In general, this state of affairs may adversely affect innovation by forcing firms to make additional expenditures or outlays. Second, one means of achieving the optimal level of retail servicing is through direct contractual specification of the servicing, periodic monitoring, and termination of those dealers defaulting on the contract. However, there are problems with this method as an alternative to RPM (Mathewson and Winter 1985). On this basis, RPM would be needed in order to achieve the optimal level of retail servicing.

We have discussed above only the suitability of minimum RPM. Another question is whether the imposition of a *price ceiling* improves social welfare. First of all, the combined profits of the retailer and the manufacturer would increase: otherwise the restraint would not be observed. Secondly, the consumers surplus would also increase with the vertical price ceiling. Economic analysis thus concludes that a vertical price ceiling is normally welfare-optimal in the sense that all affected parties are better off if the practice is allowed (Mathewson & Winter 1985). Against this background, there is no economic rationale for applying the per se rule with respect to the maximum RPM.

A preliminary conclusion concerning RPM is clear: the per se rule should be removed and legal treatment of RPM should be similar to other vertical restraints of trade, i.e. the rule of reason should be applied with respect to RPM as well.

Vertical non-price restraints of trade

Territorial and customer restrictions. Territorial and customer restrictions involve the assignment of potential consumers by geographical area to specified retailers or distributors. Sometimes the assignment is strict in the sense that consumers within a territory must deal exclusively with one retailer. Sometimes the assignment is less strict in that retailers have zones of influence (Mathewson & Winter 1985). These vertical restraints are legitimated by the fact that dealers need protection from intra-brand competition to support desired activities:

1) superior dealers are attracted;
2) they respond to manufacturer suggestions;
3) they carry larger inventories;
4) they increase market penetration through greater advertising and sales efforts; and
5) they provide higher quality maintenance and repair, which are important for continued sales of complex durable goods (Gellhorn & Kovacic 1994).

Territorial restrictions may be the consequence of either a cartel or an efficient distribution system. The cartel may be either a manufacturers' or a dealers' cartel as in the case of RPM. According to Mathewson and Winter (1985), the general conditions necessary for the facilitation of a manufacturers' or a dealers' cartel through exclusive territorial assignment are unlikely. Rather, territorial restrictions are restrictions to reduce quality and advertising free-riding or to provide sufficient ex ante incentives for investment in product development and efficient dealer networks and display. Such restrictions yield not only more profitable distribution systems but dealer networks, product information and introduction, and retail prices that also enhance welfare.

However, there are differing views about the acceptability of territorial and customer restrictions. For instance, Schmalensee (1992) believes that one of the

most likely examples of naked restraints is territorial and customer restrictions. Therefore, he would put these restraints into the per se category. On the contrary, Jorde and Teece (1992b) find territorial and customer restrictions attractive in certain cases, if such restrictions limit free-riding by imitators. The Finnish practice is closer to the latter viewpoint, since the rule of reason is applied with respect to territorial and customer restrictions which are vertical in nature. Tentatively, it seems that there is no reason why Finnish competition legislation should be amended in this respect.

Exclusive dealing. The practice of exclusive dealing involves agreements to engage in this practice and refusals to deal with those who reject these agreements. Such contracts confine distributors to the goods and services of a particular supplier and prohibit them from dealing with the supplier's competitors. In the *Standard Fashion* exclusive dealing case in the United States concerning dress pattern designs, original dress designs were easily copied by rival pattern makers. Under such conditions, dealers can switch customers to lower cost copies of the original designs, attenuating the fashion designer's return on and incentives for new designs. Exclusive dealing was used by all major dress pattern manufacturers up to the time of this case, to protect property rights in dress designs, by preventing dealers from switching customers to low price copies. Closely allied to this type of property right protection is the protection of proprietary information shared with dealers. This could include recipes, formulas, market survey results, and marketing strategy (Ornstein 1989). In short, because property rights in product innovation are subject to free riding, exclusive dealing has been allowed.

In general, we can claim that exclusive dealing is needed to solve the problems in the distribution of goods and services in the following cases (Ornstein 1989):

1) Free riding by manufacturers on a product's image, advertising, and customer drawing power.
2) Free riding by manufacturers on a manufacturer's investment in its dealers.
3) Protecting manufacturer property rights in innovation.
4) Retailer free riding on brand name reputation through cheating on product quality.
5) Securing full dealer commitment.
6) Reducing manufacturer and retailer administrative costs.
7) Securing specialized assets and long-term financing.

On the other hand, economic theory alone cannot predict whether the imposition of vertical restraints will enhance efficiency (Comanor 1985), including dynamic efficiency. However, it seems that there is no need to amend the Finnish competition legislation concerning exclusive dealing as a vertical restraint, i.e. the rule of reason may be applied in the future as well.

All in all, there is no need to alter the legal treatment of vertical non-price restraints of trade, such as territorial restrictions and exclusive dealing. This preliminary conclusion is also supported by the results of the inquiry; little critique was directed at the legal treatment of vertical non-price restraints of trade.

Abuse of market power

Preliminary considerations

The term "market power" refers to the ability of a firm (or a group of firms acting jointly) to raise a price above the competitive level without losing sales so rapidly that the price increase is unprofitable and must be rescinded (Landes & Posner 1981). One point of view is that all products face some substitutes for the services they provide, and total monopoly power never exists. Thus, monopoly is a matter of degree, not an absolute (Gellhorn & Kovacic 1994). On the other hand, the standard method of proving market power in competition law cases involves

1) defining a relevant market of the firm or group of firms,
2) computing the market share of the firm or firms, and
3) deciding whether it is large enough to support an inference of the required degree of market power (Landes & Posner 1981).

The significance of the abuse of market power can be illustrated by a simple example. Under competitive circumstances, competition legislation does not restrict the right of the trader or manufacturer to freely exercise his own independent discretion as to parties with whom he will deal. In contrast, enterprises in a dominant position may refuse to deal with rivals only if there are legitimate reasons for the refusal (§ 7.1 of the Act on the Restraints of Trade).

One distinctive feature of a monopoly market is the existence of *barriers to entry*. Without such barriers, other firms are likely to enter and take sales away from the monopoly which enjoys supranormal profits. From this point of view, a critical question involves the constitution of an entry barrier. Even though the issue is controversial, some examples may be presented here. First, potent entry barriers are legal constraints that effectively bar other firms from serving specific markets; second, exclusive property rights to inventions for which there are no close substitutes have similar function; third, essential raw material may provide monopoly power; fourth, exclusive distribution channels may create monopoly power; finally, monopoly can result from efforts to realise economies of scale and scope (Gellhorn & Kovacic 1994).

Tying

What is tying? Under a tying arrangement (or tie-in arrangement) the seller conditions the sale of one product to the buyer's agreement to purchase a second product. For instance, a producer of photocopiers (tying product) may require purchasers to buy their copy paper (tied product) from the seller. In relation to this, the owners of a patented product may attempt to tie-in a second, usually

unpatented article to the tying product. According to the competition law, authorities have expressed concern about the attempt to extend the patent's monopoly grant in this way. Thus, tying arrangements have sometimes been banned because the holder of a legal monopoly in one market uses that leverage to monopolize another market (Gellhorn & Kovacic 1994). This train of thought has been labelled "leverage theory" in the literature. However, the theory is not fully persuasive with respect to patents. This is because patents do not necessarily give a firm monopoly power in the tying product field. Leveraging arguments have also been criticised (Teece & Coleman 1998).

The practice of tying is ubiquitous. For example, one cannot easily buy an automobile without an engine. A tying claim requires proof that two separate product markets exist. However, as Lemley and McGowan (1998) point out, evidence that two product markets exist is typically based on current marketing practices and the existence of separate demand functions for each product. For example, the difficulties of product market definition arise within the context of software: software changes rapidly in shape and form as defects are corrected and new features are added in later versions of products. Particularly in innovative industries, the legal treatment of tying has been considered difficult to determine from this specific point of view (Mustonen 2001).

Pros and cons of tying. At least three questions related to tying may be asked: First, does tying in any particular case represent an extension of monopoly power from the tying-good market to the tied-good market, as was noted above. Second, is tying used as a means of price discrimination? In other words, a monopolist might impose a tie-in as one way of segregating buyers according to the intensity of their demand. Third, can the practice of tying be explained as an efficient means of lowering costs and promoting innovativeness?

Where there is little market power, a tie-in arrangement may be difficult to operate and, to the extent that it is operated, may not have any adverse effect. In other words, in those cases tie-in arrangements are usually compatible with the competition law. Therefore, tying may be evaluated as an undesirable restraint of trade only if the seller has market power in the market for the tying good. This is primarily a question of a measure which falls inside the scope of § 7 of the Act on Restraints of Trade. However, it is also possible that § 9 of the Act, i.e. the rule of reason, would be applied.

Ties which are potentially anti-competitive — i.e. when the firm has market power — may often be defended on technical grounds, as in the case of tying spare parts and consumable materials. An efficiency explanation for tying is that the servicing or maintenance of a product must be tied to the sale of the product to ensure that product quality does not deteriorate. If consumers could identify the source of poor product performance perfectly, then the maintenance market would function well. But if the general product reputation suffers as a consequence of poor performance, then the manufacturer is the only seller in the maintenance market with the correct incentive to service that product (Mathewson & Winter 1985).

An important acknowledgement is that tying arrangements may serve desirable ends. For example, tie-ins often reduce the costs of implementing a particular type of pricing strategy, such as the cost of meter pricing. Meter pricing is a practice in which a seller attaches a meter to a machine and requires the customer to pay a specified amount each time customer uses the machine (Markovits 1985). A more important justification for tie-ins with respect to technological progress is that seller may want to control the quality of the complement that the customer uses together with the seller's product. For instance, the seller may fear that the customer will out of ignorance use a complement that reduces the customer's as well as the seller's profits (Klein & Saft 1985; Markovits 1985). In addition, tying can also assist in the diffusion of new technology in circumstances where consumers are not quite sure of the value of a new product (Lunn 1990). It will also be hard to analyse the dynamic efficiency of particular tie-ins (as well as other restraints of trade) because many of the relevant facts are difficult to ascertain in individual cases.

Bundling occurs when the price of two or more products sold together as a package is less than the sum of their individual prices. Bundling is frequently beneficial since it results in lower prices to consumers. In the high-technology context it may also enable experience to be obtained in the use of certain goods that might not otherwise sell on a stand-alone basis. Once experience is obtained, the product in question might be viable on a stand-alone basis (Teece & Coleman 1998).

Predatory arrangements

Predatory pricing. Predatory pricing means that a firm sells below cost (at least in some markets) and, after its competitors are driven out, sets a monopoly price. The preliminary question with respect to predatory pricing is whether rational firms can choose to cut prices to lower their rivals' profits and induce them to leave the market. That question has been a point of controversy in the literature. For example, McGee (1958) and Bork (1978) have argued that predatory pricing would not be rational at all, whereas some other researchers have demonstrated that predation has occurred. However, we will not analyse how rational and common predatory pricing is in practice. Our principal problem is whether the regulation of predatory pricing may have a negative or positive impact on innovations, and in the former case, which kind of reforms would be needed to correct innovation failures.

The theoretical literature on predatory pricing analyses three major sets of models (Ordover & Saloner 1989): the basic idea behind *long purse models* is that a firm with greater financial resources can outlast its rival in a "fight to the death" and is, therefore, in a position to drive its rival out. In *signaling models* there is some asymmetry of information and the predator sets low prices in order to convince his rival that conditions are such that the rival is better of exiting.

Reputation models simply assume that it is feasible to drive the rival out and instead focus on a particular aspect of the profitability of doing so, namely the effect that this might have on future entry.

In theory, if the firm sells its products at a price lower than marginal costs (MC), it can be regarded as predatory pricing. However, marginal costs are very difficult to verify in practice, because MC is not a figure carried on a firm's account books or readily derivable from the figures that are. Therefore, the so-called *Areeda-Turner rule* has quite often been applied in practice: if the price of the product is below the *average variable cost*, the practice is regarded as predatory pricing.

Even though the average variable cost is sometimes a pretty good proxy for marginal cost, it is not always so (Posner 1998). The problem which may be related to innovative industries is sometimes that the legal treatment between a highly capital-intensive and a highly labour-intensive plant differs substantially. The former will have higher fixed costs, the latter higher variable costs. Therefore capital-intensive firms will have greater pricing flexibility under the Areeda-Turner rule because their average variable costs are low compared with labour-intensive firms.

Penetration pricing. Predatory pricing issues may also be influenced by network externalities. Katz and Shapiro (1994) have discussed "*penetration pricing*": "By selling hardware below cost early on, the network sponsor is stimulating the demand for software, which may lead to a lower price of software if software is produced according to economies of scale or if the elasticity of demand is higher for marginal consumers than for the average hardware consumer." This pricing strategy may resemble predatory pricing, but its goal is to overcome network externalities in building an installed base. Below-cost pricing of some products, like computer software, may be a rational means of establishing an installed base for a complementary product sold by the same firm (Page & Lopatka 2000). Farrell (1989) even suggests that this sort of competitive below-cost pricing by sponsors of proprietary technologies will typically lead to better technology being adopted. It has been noted that such a price war raises concerns only if one of the "combatants" has greater staying power.

Predatory innovation. Two conditions are necessary for predatory pricing to be effective: firstly, the predator must be capable of driving his rival out of the market, and secondly, he must be able to enjoy a higher level of profitability once that has been achieved. The first condition may be substantially easier to achieve through new *product innovation* than through a price reduction. On the other hand, so long as the rival remains viable, the innovation increases welfare. Yet, if the innovator can raise the price to the monopoly level, there may well be a welfare loss even though the quality of the product has been increased. On the contrary, it has been demonstrated that socially valuable innovations exist which are profitable only due to the monopolist profits forthcoming from the induced exit of the competing firm (Ordover & Saloner 1989). A special case of predatory product innovation occurs when the dominant manufacturer of a system redesigns

the system in order to render the components incompatible with those of its rival. Even if the old system can still be offered, and if the new system is superior, it can be priced in such a way as to eliminate the sales of the old system. If entry into the new system is foreclosed to the rival and re-entry with the old system is difficult, the predator will be able to raise prices to the monopoly level. Even if the rival is able to compete in the market for the new system, but redesigning its components is time-consuming, the predator will at least be able to enjoy a temporary price increase (Ordover & Saloner 1989). Profits from this temporary price increase are so-called Schumpeterian profits, and as mentioned earlier, they should not be the target of antitrust action.

An action as seemingly benign as a firm (truthfully) announcing in advance that it will introduce a new product at some future date can eliminate competition and reduce welfare. In markets characterised by demand-side economies of scale, consumers may become "locked-in" to a technology that achieves a sufficiently large "installed base" of users. In such a setting, a firm that has new technology may be able to prevent the lock-in by announcing its product in advance and giving consumers that have not yet purchased old technology the opportunity of waiting for the new. In this way, the new technology may be adopted, whereas it would not have been before. If the new technology is proprietary, the rivals may be eliminated by this strategy. Moreover, even though the new technology is preferred by new consumers, consumers who already purchased the old technology are "stranded". Overall, welfare may be reduced (Ordover & Saloner 1989; Page & Lopatka 2000).

In any case, the following preliminary conclusion can be made concerning the abuse of dominance under competition law. The behaviour of firms in a dominant position may be dealt with more liberally than before in order to create preconditions for innovative activities. It is worth noting is that many respondents in the inquiry demanded that the legal treatment of abuse of dominance be modified. Network externalities as well as increasing returns of scale in innovative industries support this kind of reform. In other words, abuse of the dominant position no longer raises so much concern in high-tech markets as in "smokestack" industries. In addition, globalization of markets mitigates the problems related to the abuse of dominance. However, abuse of dominance has to be evaluated on a case-by-case basis, as has been shown e.g. in connection to predatory arrangements.

Mergers

Taxonomy of mergers

Different types of mergers. In order to evaluate anti-competitive effects and then consider them in respect to promoting innovativeness, it is very important to take into account the type of merger (or acquisition) we are discussing. The following distinction is important from this point of view (Gellhorn & Kovacic 1994):

1) *horizontal merger*: one firm acquires another that produces and a sells similar product in the same geographical area, and thereby eliminates the competition between the two firms;
2) *vertical merger*: one firm acquires either a customer or supplier; the former is called forward integration, and the latter backward integration;
3) *conglomerate mergers* encompass all other acquisitions; they are classified as
   a) pure conglomerates, where the merging parties have no evident economic relationship;
   b) product line extensions, where a firm producing one product buys a firm which makes a different product that requires the application of similar manufacturing or marketing techniques; or
   c) geographical market extensions, where the buyer makes the same product as the target firm but does so in a different geographical market.

Pros and cons of mergers. With respect to horizontal mergers, three basic competitive problems may be posed. First, the elimination of competition between the merging firms may be significant, in particular depending on the size of the firms. Second, the unification of the merging firms' operations may create substantial market power and could enable the merged entity to raise prices by reducing output unilaterally. Third, by increasing concentration in the relevant market, the merger may strengthen the ability of the market's remaining participants to coordinate their pricing and output decisions (Gellhorn & Kovacic 1994). On the other hand, horizontal mergers that pose competitive threats may also create significant efficiencies, for example, by generating economies of scale and scope.

Various efficiency rationales can motivate vertical mergers. The most important is to reduce transaction costs (Williamson 1985). Replacing market exchanges with internal transfers can offer at least two benefits. It helps to eliminate problems created by the tendency of independent entities to behave opportunistically during a contractual relationship. Moreover, internalization can give management more effective ways to monitor and improve performance (Gellhorn & Kovacic 1994). On the other hand, vertical integration may foreclose competitors by limiting their access to sources of supply or to customers. However, this foreclosure explanation has attracted extensive criticism. We should also note that merger is not the only way to integrate vertically (Perry 1989). A firm can produce the same market

effect (as vertical integration) by expanding internally, and there is no sound policy basis for treating vertical merger or internal growth differently. From this point of view, it is understandable that lenient policy has been recommended with respect to vertical mergers (Gellhorn & Kovacic 1994).

Conglomerate merger ordinarily has no direct effect on competition because this merger involves firms which operate in separate markets. There is no change in the number of firms in either market; foreclosure is generally absent, nor is there any change in the market structure, the firms' market shares or concentration levels. However, conglomerate mergers sometimes are feared because they may lessen future competition, they may convert a large firm into a dominant company, and they may increase the merged firm's political power (Gellhorn & Kovacic 1994).

Merger control in Finland

Legal treatment. High levels of market concentration are not forbidden under our competition legislation. From the point of view of innovativeness, there are good reasons to manage such policy. Mergers attract support as a means of achieving efficiencies not only of scale but also of scope, as firms need to combine complementary assets in converging technological change (Arup 1993). Mergers may also be a necessary rationalisation of local industry in the cause of international competitiveness (Arup 1993). According to the preparatory drafts of the Finnish legislation (HE 243/1997 vp), concentration as such is not bad, in particular, if acquisition improves efficiency and international competitiveness. The need for specialization, sufficient R&D resources and increasing firm size have been emphasized, too. On the other hand, the purpose of merger control is to prevent harmful market concentration which would increase price levels and reduce consumer welfare. Moreover, the aim is to keep avenues open for entry (HE 243/1997 vp).

The control of acquisitions represents ex ante regulation whereas controlling the abuse of dominant position represents ex post regulation. The reason for ex ante regulation is the insufficiency of ex post regulation. For example, there are problems in controlling abuse of market power in certain situations. A case in point is monopoly pricing: the Finnish Office for Competition has been very cautious in regard to pricing as monopoly pricing. An important point of view mentioned in the preparatory drafts of Finnish legislation is that § 7 of the Act on Restraints of Trade does not take into account dynamic efficiency sufficiently and, thus, merger control is needed (HE 243/1997 vp).

Regarding merger control, any operation has to be cleared in advance by the Office for Competition,

1) if the merging firms jointly reach (worldwide) sales above 2 FIM billion;
2) at least two of them reach sales (worldwide) above FIM 150 million;
3) in addition, the target firm of the acquisition or the joint enterprise has to carry on business in Finland.

In small countries such as Finland, the sales criterion alone may not be sufficient to prevent the monopolization of certain markets (van Cayseele, Sabbatini & van Meerbeck 2000). Even though no proposals will be made here in order to amend competition legislation in this respect, evaluation would be needed to analyse whether the regulatory strategy adopted in Finland has created a gap in legislation.

If the acquisition were to create or strengthen the dominant position of the firm, and prevent competition in Finnish markets, the Council for Competition may forbid the acquisition. Moreover, instead of forbidding the merger, conditions may be set in order to approve the merger.

In Finland, by the end of June 2000, Office for Competition made 140 decisions concerning acquisitions: 128 were approved as such; only in one case did the Office propose that the acquisition be forbidden; in other cases, the Office set conditions for the approval of the acquisition. Practice concerning the approval of acquisitions has also been similar elsewhere. For example, at the European Union level, the largest share of acquisitions has overwhelmingly been approved by the European Commission. Only in seven cases were acquisitions forbidden between 1989—1997. Furthermore, in Germany in 1998 a total of 1 888 concentrations were examined and only 12 were stopped (van Cayseele, Sabbatini & van Meerbeck 2000). In summary, prohibition of acquisitions is exceptional everywhere merger control legislation has been adopted. On the other hand, this does not mean that the legislation concerned has no impact on the conduct of enterprises. In other words, enterprises may take the requirements set by the legislation into account beforehand and modify their behaviour to fulfil the requirements.

Appropriateness of mergers. Several factors have been emphasised in Finland regarding the appropriateness (acceptability) of acquisitions (HE 243/1997 vp):

1) existing and potential competition;
2) structure of the market;
3) economic and financial position of merging firms;
4) development of the supply and demand of the products concerned; and
5) economic and technological progress.

It is worth noting that dynamic efficiency should be taken into account, too. However, in this context the comprehensive approach has been stressed. On the one hand, while anti-competitive effects should be considered, on the other hand, efficiency impacts should not be omitted either. Of course, it is difficult to say *in casu*, whether anti-competitive effects or efficiency gains are more critical. As a rule of thumb, it has been mentioned that the more concentrated the market is after acquisition, the more likely it is that anti-competitive effects exceed efficiency gains (HE 243/1997 vp). On the other hand, mergers with a high market share should not be forbidden if entry barriers are very low. This is also justified from the point of view of innovativeness because newcomers are often innovative actors.

One particularity of Finnish merger control is the absence of an efficiency defence rule. On the other hand, there are differing viewpoints on whether

competition legislation should involve such a rule. According to van Cayseele, Sabbatini and van Meerbeck (2000), the absence thereof could paradoxically cause a softer application of the ex ante concentration control. On the contrary, according to Fisher (1987), one should be cautious of using efficiencies as an excuse for permitting a merger if those efficiencies are unlikely to be passed on to customers. He is very reluctant to approve mergers for efficiency reasons if they seem likely to lead to a restriction of competition; efficiency arguments are easy to make, but hard to evaluate; and the same efficiencies will often be achievable in less restrictive ways. The last viewpoint is interesting to compare with Teece and Coleman's (1998) opinion: they suggest that there is almost always a less restrictive contractual mechanism for achieving any economic outcome; the creative mind can always find an arrangement that is less restrictive.

In the inquiry, very many enterprises and organisations criticised Finnish merger control. In particular, procedural rules were regarded as inappropriate. For instance, a demand was made that Scandinavian arrangements be managed by one notification; notification procedures should otherwise be simplified; delays in decision-making should be shortened; and the need for information in advance was emphasised. In addition, a demand was made that enforcement should not concentrate on national markets, because it prevents the growth of Finnish enterprises and, thus, their competitiveness in Europe and world-wide would be lessened.

Two preliminary conclusions can be made here. First, mergers and acquisitions should not be dealt with strictly because of network externalities and increasing returns of scale in many fields of business. Second, the possibility of efficiency defence should be open to companies under merger control as well as in applying the competition legislation.

Other remarks concerning Finnish competition legislation

Provision involving the objectives of legislation

Nowadays it is quite common that a specific law involves the objectives of legislation. This is also the case with the Act on Restraints of Trade, which specifically mentions that the benefits of consumers and the right to carry on business have to be taken into account in the enforcement of the law. In order to emphasise the weight of innovations, the following recommendation can be made: the promotion of innovative activities and the diffusion of innovations should be included in the provision outlining the main objectives of the competition legislation. Thus, dynamic

efficiency would no longer be a consideration in legal or permit-based efficiency defence rules, but would always be a factor to be taken into account when competition law is applied.

Small cases

In Finland, the Office for Competition will in principle not intervene in agreements between a restricted number of small and medium-sized enterprises when their combined market share does not exceed five percent (HE 243/1997 vp; Aalto-Setälä et al. 1999; Kuoppamäki 2000). Thus, restraints of trade that have a limited impact, i.e. small cases, are *de facto* exempted from the competition law. However, the five-percent-rule does not cover naked restraints. On the other hand, it is very difficult to verify whether restraints are naked or ancillary in practice, as has been mentioned earlier.

The Finnish literature has noted the possibility that restraints improving the efficiency of the market should also be regarded as small cases. For example, if the restraint helps to create markets for totally new products, it could be regarded as a small case (Aalto-Setälä et al. 1999). This viewpoint can be shared. Thus, § 12 of the Act on Restraints of Trade may be amended so that the efficiency defence rule is also written into this provision; in particular, if such a rule is not included as a general clause at the beginning of the Act.

Certificate of non-intervention

Predictability of legal treatment is important with respect to innovativeness simply because it influences the (un)certainty concerning regulation. From this point of view, the certificate of non-intervention by the Office for Competition regulated under § 19a of the Act is an appropriate arrangement. According to this provision, the Office for Competition may grant a certificate that the agreement, decision or other procedure by business firms, is not governed by the prohibitions regulated by § 4—6 of the Act.

The first regulatory problem concerns the reasons this procedure does not imply an abuse of dominant position, in particular, since firms in a dominant position often need such information and a "guarantee" of non-intervention. Innovative activities nowadays create more and more such situations in which borderline problems emerge. Moreover, why is it possible for a joint venture to get this information and "guarantee", but not for one firm (in a dominant position) engaging in corresponding activity? Neutrality in organisation demands that both (groups of) firms are dealt with similarly. In addition, the Netherlands can be cited as an example where competition authorities may, on request, declare that abuse of a dominant position is inapplicable to a specifically defined practice if the

provision of a service of general economic interest would be prevented without this exemption.

A second issue is whether firms should have the right to a certificate of non-intervention concerning activities governed by the rule of reason, i.e. under § 9 of the Act on Restraints of Trade. In practice this concerns non-price vertical restraints of trade. As has been shown, these restraints may also cause problems with respect to innovative activities, and thus, from the point of view of innovativeness, a need for certification should be extended to these measures, too.

In summary, a recommendation could be made that a certificate of non-intervention by the Competition Office should also be extended to cover the prohibitions regulated by § 4—6 of the Act on Restraints of Trade, abuse of dominant position (§ 7) and measures covered by the rule of reason (§ 9).

European guidelines

van Cayseele, Sabbatini and van Meerbeck (2000) have proposed that the European Commission issue *guidelines* based on a sound industrial economic analysis of the evolution of competitiveness in each industry. These guidelines should be kept in mind when non-binding decisions are made at the national level, in much the same way US merger guidelines provide a point of reference for the courts. As Schmalensee (1987) has mentioned, for a judge the law is the law; it would necessarily be applied less flexibly than the guidelines and also in a less economically sophisticated manner. However, the above-mentioned guidelines should be followed by the national authorities whenever possible. They will provide a serious guarantee that prevents a situation in which one country tolerates every operation in a certain sector, to maintain viability, while in another country nothing is tolerated because the players are foreign. In addition, European Guidelines for Competition Policy may also be necessary to restrict *regulatory competition*. This means that one country first mitigates the requirements in order to tempt foreign firms into its markets; then, other countries follow, mitigating the regulation further, and the result is a vicious circle. However, in order to keep the competition legislation at such a level that the competitiveness of European firms would not worsen compared with US and Asian enterprises, ambitious, though not too strict legislation is required.

4 INNOVATIONS AND ENVIRONMENTAL LAW

Preliminary considerations

In a dynamic setting, environmental policy instruments may have an impact on both the degree of technological innovation and the process of diffusion of new technology (OECD 1994). The impacts of environmental legislation on innovations can be positive as well as neutral or negative. Positive effects occur, for instance, when plant operators find technical solutions achieving more than the pollution abatement required under environmental legislation. The impact of technological innovations is neutral e.g. when more than the pollution abatement required has been achieved, but by application of common techniques to more emission points. Negative impact on technological innovations occurs e.g. when the environmental regulation discourages the replacement of old, high polluting equipment with new clean equipment (Opschoor & Vos 1989).

The influence of environmental policy instruments on innovations – either intended or unintended – has been given increasing attention in recent years (Hilden et al. 2001). However, evaluations have mainly been theoretical in nature, and only few empirical studies have been made of the topic. From this point of view, more resources should be devoted to empirical studies concerning the impacts – among them impacts on innovations – of environmental policy instruments. This is emphasised by the fact that there is no consensus among researchers on whether, for instance, economic instruments are dynamically more efficient than direct regulation.

An important consideration within this context is that environmental legislation constitutes a heterogenous whole. This is not only a question about administrative environmental law, i.e. so-called direct regulation, but in principle an issue which covers the whole spectrum of fields of legislation. Property rights in environmental goods as well as damages law and criminal law have to be taken into account.

Today, regulatory problems related to economic instruments are of great importance. More specifically, these problems concern environmental taxes, environmental subsidies and emissions trading. In addition, so-called mixed systems have to be considered, i.e. systems which are constituted by more than one environmental policy instrument. However, the purpose here is not to make an exhaustive study on the relationship between environmental legislation and innovations, i.e. our aim is to highlight certain illustrative examples concerning the regulatory impact of environmental legislation on innovations.

Damages law

Damages law in general. Damages law is private in nature and works not by social command but indirectly, through the deterrent effect of damage actions that may be brought once harm occurs. In contrast, for instance direct regulation is public in nature and modifies behaviour through requirements that are imposed independently of the actual occurrence of harm (Shavell 1984).

At a general level, damages law has at least the following distinguishing features (Rea 1983): First, damages law relies on the private enforcement of the law. It leaves the affected parties free to make independent decisions, subject to their legal rights and duties. Second, tort law economizes on monitoring costs compared with direct regulation. Third, damages law may be relatively flexible in dealing with new situations: one or both of the parties have an incentive to bring new information on hazards to the attention of the court, and the court is not bound by precedent in the interpretation of these facts. Important here is that the prohibition of retroactive legislation does not concern damages law as it does, e.g. criminal law (Ehrlich & Posner 1974). In particular, the latter issue is of great importance with respect to the topic at hand. New innovations create new problems and against this background damages law may be sufficiently flexible to take into account those new challenges.

Damages law also has numerous disadvantages (Rea 1983): the costs of the court proceeding are substantial and must potentially be borne by victims. Moreover, the courtroom may not be an efficient forum for analysing the costs and benefits of complex changes in methods of production. It is extremely difficult to link a particular injury or disease to a particular environmental cause. Even when injuries can be linked to environmental agents, it is often extremely difficult to identify which of many pollution sources bears responsibility. Thus, the theoretical advantages of assigning liability through case-by-case adjudication may not be achievable in regulating environmental risks. When victims have overcome these hurdles, the courts may have produced highly unsystematic levels of compensation (Menell 1991). All these features should be taken into account when examining

the suitability of environmental damages law from the dynamic efficiency point of view.

A necessary element for damages liability is that the plaintiff has suffered harm. On the other hand, without harm there can be no suit in tort, even if the act was dangerous (Cooter & Ulen 1999). Thus, there would be no incentive to create procedures or processes which reduce the dangerousness of the acts concerned, if only damages law were applied. In order to create an incentive to innovations and their adoption dangerous acts should either be criminalized or otherwise regulated, e.g. by standards. A somewhat similar issue is that exposure to risk is not compensated, only the realisation of the risk. For instance, victims may wait 30 years before receiving compensation, provided certain chemicals have been shown to cause cancer.

Negligence rule and strict liability. In theory, negligence liability can effectively lead firms to optimum investment in innovation. Under the so-called *Learned Hand test* of negligence, an economic actor will be liable for the full cost of the breakdown if the cost of avoiding that breakdown was less than the expected loss. The effect of this rule is to encourage firms to invest in safety so long as the expected benefits from the investment exceed the costs. However, in practice formidable difficulties confront the court in attempting to operationalise the negligence rule. For instance, firms will have an incentive to exaggerate preventive costs in order to make more accidents seem cost justified. In situations involving complex technology, firms are likely to have the best access to the relevant information on abatement technology and courts are likely to be dependent on this cost data (Dewees, Mathewson & Trebilcock 1983). Problems emerge from the dynamic efficiency point of view, too. To the extent that the courts adopt the current state of the art as the basis of estimating the costs of abatement, few incentives will exist for firms to invest resources over time in seeking lower-cost means of achieving higher levels of protection (Dewees, Mathewson & Trebilcock 1983; Ogus & Veljanovski 1984).

One of the possible alternatives is a regime of *private enforcement of public standards*. Here the government, or a related agency, would set the desired safety levels but the aggrieved individuals would have to initiate civil actions for damages for breaches of the prescribed standards. This alternative regime provides the court with a predetermined standard of safety. In effect, the benefit-cost analysis is done by the government agency rather than the court. However, unless the standards are constantly revised in the light of changing technological potential, this regime may not promote dynamic efficiency in that no incentives exist to invest resources in seeking lower-cost abatement technology than that reflected in the prevailing standard (Dewees, Mathewson & Trebilcock 1983).

Under a strict liability regime the defendant will be held liable for any damage he causes, regardless of whether or not there was any negligent behaviour on his part or any breach of publicly prescribed standards. Strong incentives are created for firms to make ongoing investments in searching for lower-cost abatement technology so as to minimise over time the damage claims they would otherwise

face, thus promoting considerations of dynamic efficiency (Dewees, Mathewson & Trebilcock 1983). In summary, strict liability appears to be dynamically efficient from the point of view of the incentive argument. On the other hand, strict liability may be less appropriate from the point of view of outlay. Moreover, the certainty argument supports the application of strict liability since this rule is more unambiguous than the negligence rule. Taking into account all of these arguments, it is not possible to say *a priori* whether strict liability is better than the negligence rule from the innovativeness point of view. Nevertheless, strict liability is the rule on which the compensation of environmental damages is based in Finnish legislation.

Temporary or permanent damages? Compensatory damages can be temporary or permanent. With temporary damages, the plaintiff receives compensation for the injuries the defendant has inflicted upon him or her in the past. If injuries continue in the future, the plaintiff must return to court to receive additional damages. Thus, temporary damages impose high administration costs for resolving disputes. With temporary damages, reductions in future injuries translate directly into reductions in liability. Consequently, temporary damages create incentives for injurers to continually adopt technical improvements that reduce injury.

With permanent damages, the plaintiff receives compensation for past injuries plus the present discounted value of all reasonably anticipated future ones. One lump-sum payment eliminates claims for past and future injury at the level specified in the judgement. Unfortunately, future changes in technology and prices are difficult to predict, so the estimation of future injury suffers from error. Thus, permanent damage imposes high error costs. Furthermore, by paying permanent damages the injurer "purchases" the right to external injury up to the amount stipulated in the judgement. Consequently, permanent damages create no incentive for injurers to adopt technical improvements that reduce external costs below the level stipulated in the judgement.

In summary, temporary damages tend to be more efficient given easily measured damages and rapid innovation. Conversely, permanent damages tend to be more efficient given costly measurement of damages and slow innovation (Cooter & Ulen 1999). From point of view of dynamic efficiency, Finnish legislation is vulnerable to critique. The reason is that — unlike the Finnish Damages Act — the Environmental Damages Act facilitates prior compensation. When we recall that technological change is particularly rapid in the environmental sector, this critique becomes even more relevant. Thus, as a preliminary proposal, we should consider whether there is a need for prior compensation under the Environmental Damages Act.

Appropriateness of direct regulation

Some opinions. An example of innovation pessimism in the context of direct regulation is clearly expressed by the *Commission of the European Communities* (1992): "Command and control measures only give an incentive to improve the environmental performance up to the level specified. Thus, they do not give an incentive to improve environmental performance beyond what is formally required. This means that they are not dynamically efficient." However, this opinion is too categorical: it does not take into account at all the fact that direct regulation (or command and control measures) can be implemented in many ways. Thus, it can be presumed that direct regulation is not necessarily a homogenous legal institution with respect to its dynamic properties. "The devil is in details" in this case as well.

Companies maintain that environmental regulations are too prescriptive and do not allow them enough latitude to develop innovative approaches to address ecological problems (OECD 1997b). Related to this, companies also prefer the application of performance standards instead of specification standards (or design instruments). This has also been the approach generally preferred in the literature concerning environmental policy (Porter & van der Linde 1995). However, technology-based standards and prescriptive regulations are sometimes less costly for both firms and governments, e.g. requirements for catalytic converters, and can spur innovation in certain circumstances (OECD 1997b). In addition, it is useful to emphasise that improvements in the technological flexibility of Finnish environmental policy had already been implemented in the 1990s (KM 1989:52). Thus, the redesign of regulation has also increased the opportunities of firms to develop innovative solutions to environmental problems.

Prior approval. Nevertheless, environmental regulation can be analysed more specifically than by referring only to design and performance instruments. Under the prior approval system, the administrative costs of scrutinizing all applications are very high and the opportunity costs arising from any delay before the licence is granted must be added. Moreover, significant welfare losses arise if the system is used to the anti-competitive purpose of creating barriers to entry. And barriers to entry may be barriers to innovations and their diffusion. The benefit from prior scrutiny must therefore be large enough to justify these substantial losses (Ogus 1998).

Standards. Under the standards approach, the most important economic variables in choosing between different types of standards are the costs of being informed of the technological means of achieving the regulatory goals and the administrative costs of formulating appropriate standards and monitoring compliance. According to Ogus (1998), there is a presumption in favour of less interventionist measures, because firms should be given a choice of how to meet the goals, since this encourages innovation in loss abatement techniques. However, the benefits of such measures might be outweighed by the costs of administering

them and the costs to firms of acquiring information about loss abatement technology.

Target standards have apparent cost advantages. Under the stipulated goal of the regulation, e.g. reduction to a certain concentration of pollution in the environment, firms are left to determine the cheapest means of avoiding undesired effects (Ogus 1998). This is compatible with technological flexibility and thereby promotes opportunities for innovative activities. On the other hand, the information costs to the firm of determining what performance quality will ensure compliance with the target standard may be high either because consideration has to be given to third party activities, or because centralised agencies have better knowledge about the aetiology of the specific harm (Ogus 1998). High information costs is a synonym for uncertainty, and in this respect target standards are not an ideal institution from the dynamic efficiency point of view.

Performance standards are more costly to formulate than target standards. On the other hand, performance standards imposed on each firm will be less uncertain and therefore legal and other information costs will be reduced (Ogus 1998). From the latter point of view, performance standards could be recommended as a dynamically efficient means of achieving environmental goals.

The principal advantages of *specification standards* relate to administrative efficiency. In addition, the firms, themselves, do not face uncertainty as regards either the law or the action necessary to achieve particular outcomes (Stewart 1981; Ogus 1998). By means of specification standards it is, thus, possible to spur innovations, if we take into account this consideration. However, specification standards include significant disadvantages, too. In particular, these standards induce technological rigidity, since they inhibit firms from innovating in general and from developing other, and cheaper, means of meeting regulatory targets. Specification standards become obsolete very rapidly and there is typically a delay before technological changes are reflected in the regulations (Ogus 1998). It follows that the case for specification standards is weak unless the standard-setter has better access than firms to information concerning the technology of production and unwanted effects, or firms or their products are sufficiently homogenous that innovative activity is unlikely to occur or to generate significant social benefits (Ogus 1994; 1998). In addition, there is still one disadvantage with respect to specification standards: adaptation to the technology required by the standard, because of economies of scale, is usually cheaper for larger than smaller firms. Specification standards thus provide larger firms with a competitive advantage (Ogus 1994).

It is worth noting that specification standards are still often used even though the problems related to them have been recognized. For instance, in a study concerning the evaluation of Finnish environmental policy Mikael Hilden et al. (2001) found that approximately 25 percent of the decisions made by the environmental authorities included technological standards, e.g. combustion filter type and chimney height. The study by Hilden et al., however, only concerns the Finnish paper and pulp and chemicals industry.

The drawbacks of technology-forcing standards (i.e. ambitious specification standards) have been clearly articulated by Dewees (1983). First, while setting a high standard for the future provides an incentive for manufacturers to develop control technology that will meet that standard to permit them to operate in a market where less innovative manufacturers may be unable to operate, the opposite effect may take place. If no manufacturer develops the technology that meets the standard, the implementation of these standards may be postponed. This has happened on numerous occasions with regard to automotive pollutants. The possibility of postponing the effective date of the standards provides a powerful incentive for manufacturers to fail to develop pollution control systems that meet the standard. Regulators would be under intense political pressure to postpone the standard. Thus, the standard may not be technology-forcing but technology-delaying.

Second, the application of rigid standards on a seemingly fixed timetable also affects the manufacturers' choice of which control technologies to pursue. Manufacturers may choose to investigate and develop technologies which are more certain of meeting a particular standard by a particular date, even if they cost more than other technologies whose time path of development is less certain. Thus, forcing the pace of technology may narrow the range of the technological options considered, and may thereby increase the cost to society of achieving any given level of emission control (Dewees 1983).

Guiding emission limits. From the above-mentioned point of view, problems are present in those sectors of pollution control where technological development is rapid. For instance, this problem was noticed in Finnish nitrogen oxides policy in the early 1990s. On the one hand, the conclusion was that it is not appropriate to amend regulation too often but, on the other hand, the development of technology should be taken into account in the legislation. One solution to this kind of *technology-regulation trap* was, according to the Committee on Nitrogen Oxides (1990:11), that an emissions tax be introduced to supplement direct regulation. However, no taxes on nitrogen oxides emissions have been introduced in Finland, and direct regulation was modified to permit the rapid development of technology to be taken into account. The traditional way of regulating emissions, i.e. strict standards, was not introduced but regulations which could be labelled guiding emission limits were (KM 1990:11). We should note here is that there are several ways to implement direct regulation, and some of them are more appropriate than others from the dynamic efficiency point of view.

Grandfather clauses. One problem is still worth mentioning. Grandfather clauses are often applied under direct regulation. They exempt the standard firms engaged in the regulated activity before a certain date. They are not costly to administer and are commonly encountered. They may, however, give rise to inefficiencies: the application of a standard to 'new' firms alone may create barriers to their entering a particular market, and thus insulate 'old' firms from competition. They may also discourage innovation and thus perpetuate the use of outmoded technology (Ogus 1994). A separate treatment of old and new installations has been common, for

example, in Finnish air pollution control. The purpose of grandfather clause is to improve cost-effectiveness (Hilden et al. 2001), but unfortunately, it happens at the expense of dynamic efficiency.

Economic instruments

Which policy instruments are economic instruments?

General remarks. There are no well-established characteristics of economic instruments even though certain attempts to define them been made in the literature. For instance, Opschoor and Vos (1989) have defined economic instruments in the following way:

"Instruments could be labelled 'economic' insofar as they affect estimates of costs and benefits of alternative actions open to economic agents, with the effect of influencing decision-making and behaviour in such a way that alternatives are chosen that lead to an environmentally more desirable situation than in the absence of the instrument. Economic instruments, as contrary to direct regulations, leave actors free to respond to certain stimuli in a way they themselves think most beneficial."

As previously noted, there are also other definitions of economic instruments. Some of them emphasise the cost-effectiveness of the instruments concerned, others the decentralisation of the power to decide on pollution abatement and still others the overall flexibility of economic instruments. No single definition is satisfying as such because of the heterogeneity of the instruments concerned (Määttä 1999b). Therefore, economic instruments have often been defined by an enumerative approach. In particular, environmental taxes, environmental subsidies and emissions trading have been taken into account in this respect. We will concentrate here on the first two instruments.

Environmental taxes. Perhaps, the most important economic instruments – at least in Western Europe – are environmental taxes. They can be divided into three categories (Määttä 1997). *Incentive environmental taxes* are created in order to steer the behaviour of polluters, whereas their revenues are of secondary importance, if revenues have any importance at all. The tax level is determined by the desired goal of pollution reduction. Incentive environmental taxes serve ends which are similar in nature to those served in environmental policy by direct regulation. This means that a given environmental policy goal can be structured by using either incentive taxes or direct regulations to meet the chosen target. In Finland, seven

incentive environmental taxes are applied today. First, the carbon tax is based — in principle — on the carbon content of fossil fuels and its purpose is to reduce carbon dioxide emissions. Second, the purpose of the tax differentiation in favour of unleaded petrol is, of course, is to promote the consumption of that fuel. Third, in order to promote the use of reformulated petrol, the tax applied is also lower than the tax on regular petrol. Fourth, a tax differentiation favouring sulphurless diesel fuel is also applied. Fifth, a catalytic converter discount is applied under motor vehicle taxation to reduce e.g. emissions from nitrogen oxides. Sixth, the purpose of the tax on beverage containers is to reduce the consumption of non-returnable containers, and thereby littering. Finally, waste tax is used to minimise waste generation in production and consumption processes.

Taxes designed as mechanisms for raising revenues for environmental protection are called *financing environmental taxes* as distinct from incentive environmental taxes. In Finland, two financing environmental taxes are applied. First, a waste oil tax is levied on lubricant oils. The goal of the tax is to generate funds for the collection and treatment of used oil. Second, a tax to combat oil pollution is levied on imported oil. Its goal is e.g. to generate funds for the procurement of equipment for cleaning oil spills (Määttä 2000c).

Fiscal environmental taxes are primarily aimed at generating revenue but they may have significant effects on the environment. The fiscal nature of these taxes should be emphasised, and it should be distinguished from the regulatory character of incentive environmental taxes. There is considerable imprecision in the identification of tax measures according to the impact on the environment because it could be argued that, in effect, all tax provisions have an effect on the environment (OECD 1996a). Nevertheless, certain taxes have in practice been labelled fiscal environmental taxes. Taxes on energy, such as (basic) taxes on motor fuels and other energy products as well as electricity tax and taxes on motor vehicles are fiscal environmental taxes applied in Finland.

Environmental subsidies. There are various forms of financial assistance to spur environmentally friendly behaviour either directly or indirectly. These environmental subsidies can be distinguished according to the form by which they are implemented (Opschoor & Vos 1989). *Grants* are non-repayable forms of financial assistance, and are provided if certain pollution abatement measures are taken by polluters. Interest on *soft loans* is set below the market rate. *Tax subsidies* (or tax expenditures) favour polluters e.g. by means of allowing accelerated depreciation for anti-pollution equipment or a lower value-added tax rate for electric cars. In Finland, environmental subsidies to industry amounted to FIM 31 million in 1999. They included subsidies for water protection, air pollution control, and for cleaning up polluted soils (Hilden et al. 2001).

Appropriateness of economic instruments — preliminary considerations

General remarks. The appropriateness of economic instruments for environmental protection is highlighted in the following sections against the experience gained about them in OECD countries. Even though certain kinds of economic instruments are not applied in Finland, information about their success and factors influencing it may also help to develop Finnish legislation.

For instance, Porter and van der Linde (1995) maintain that where possible, environmental regulations should include the use of market incentives, including environmental taxes, emissions trading and deposit schemes. Other researchers have also emphasised that in this respect environmental taxes and emissions trading are better candidates for environmental protection than direct regulation (Milliman & Prince 1989). Furthermore, the OECD has stressed the desirability of strengthening the role of economic instruments because they are expected to provide incentives for innovation (Opschoor & Vos 1989; OECD 1997b). Moreover, the introduction of environmental taxes has been justified by dynamic efficiency in drafting legislation e.g. in certain Scandinavian countries, but only in a rather unqualified manner (Määttä 1997).

In literature, the experience of the United States has quite often been noted: schemes for *emissions trading* have encouraged firms to find less expensive and innovative ways to meet pollution targets (Opschoor & Vos 1989; OECD 1997b). Nevertheless, such generalisation may be misleading because a great deal depends on the way in which emissions trading is designed. In particular, the dynamic efficiency of the earlier programmes in the United States is questionable. No empirical evidence exists that emissions trading would have spurred technological change. On the other hand, the Acid Rain Program — implemented in the 1990s — has worked well and may have also led to technological development (Määttä 2000a). Furthermore, the circumstances under which emissions trading is applied is of great importance with respect to dynamic efficiency. This factor refers especially to the market structure: if there are only few participants in emissions trading, the trade of emissions rights is likely to suffer, which leads to dynamic inefficiency. Emissions trading without trade-offs is the same as direct regulation.

Environmental taxes from the macro-policy point of view. There are two differing approaches to the dynamic efficiency of environmental taxes from the macro-policy point of view. The mainstream approach still states that environmental taxes provide a permanent incentive to reduce pollution and innovate even below target levels to reduce tax payments. For instance, Dewees, Mathewson, and Trebilcock (1983) have mentioned that "if one is seeking long-run technological progress, the tax approach may be ideal for creating incentives that will lead to such progress". The counterargument is that the burden of the tax leaves firms with fewer resources for R&D, and that the creation of innovative, less polluting methods of production may be slower than under direct regulation (Palmer, Oates

& Portney 1995). For instance, in the inquiry made for this study, some respondents claimed that high environmental taxes hinder investments in innovative activities.

However, we can assert that both of the arguments are too categorical. For example, environmental taxes can be implemented as redistributive in nature, which means that tax proceeds are refunded to those liable to tax, e.g. in the form of subsidies for environmental protection measures (Määttä 1997). The Swedish charge on nitrogen oxides emissions provides an example of redistributive environmental taxes. The net financial burden of a redistributive tax may be even less than the financial burden of the corresponding direct regulation.

A related issue is that emissions trading can be implemented by grandfathering emission rights to polluters. In the United States almost all programmes have been introduced and implemented to grant free emission rights to polluters. Under these circumstances, the financial burden of emissions trading is less than the financial burden of corresponding direct regulation, provided that at least one trade of emissions rights occurs (Määttä 2000a). Nevertheless, there are problems with respect to grandfathering and not least because of rent-seeking: polluters may try to influence the decision-making of public agencies in an inappropriate way in order to maximise the amount of their emission rights.

The empirical evidence concerning the dynamic efficiency of environmental taxes is only anecdotal. We can refer to the Swedish charge on nitrogen oxides emissions as an example. The charge has helped to significantly reduce emissions in the 1990s. Investments in new equipment, optimisation of combustion, and the development of new control systems have all contributed to the reduction of those emissions (OECD 1996a). More specifically, some plants have sought to give employees an incentive to operate the process in the optimal manner by paying bonuses related to the achieved reduction in emissions. Selective non-catalytic reduction measures through the injection of urea or ammonia proved a cheap way of reducing emissions. Before the introduction of the charge such measures had not been used at all in Swedish plants; in the mid-1990s it was used by about 20 plants and is under consideration by others (OECD 1997a).

Another example concerns the German water effluent tax implemented in 1981. It is interesting in this context that the clean water technology market has grown rapidly in Germany and is one of the largest segments of the environmental protection market. According to Opschoor and Vos (1989), this development might also indicate that the water effluent tax has made at least some contribution to technical innovation. Moreover, Japan has been a world leader in sulphur dioxide emissions reducing technologies, and a sulphur tax has been applied there since 1973. An additional example comes from the Netherlands: a water effluent tax has been applied for three decades and the Dutch have had a strong position in the market for water treatment equipment (Huppes & Kagan 1989).

On the other hand, according to the *Environmental and Natural Resources Policy and Training Project* (1993), little evidence has been found to suggest that environmental taxes, in general, have stimulated innovations in pollution abatement. The OECD (1994) has also mentioned that empirical evidence casts some doubts

on the dynamic efficiency of environmental taxes. They may have sizeable effects only in so far as

— firms with significant waste loads are affected,
— evasion by illegal dumping can be prevented, and
— charges can be tailor-made to generate incentives to innovate in the appropriate directions.

As has been mentioned above, only some speculations can be presented about the dynamic efficiency of environmental taxes. Therefore, there is a clear need for empirical studies concerning the dynamic efficiency of environmental taxes. More generally, a systematic follow-up of the impacts of environmental taxes should be implemented. Otherwise, environmental tax policy can be compared with "shooting in the dark".

The results of the inquiry are worth mentioning here as well. A question was posed about the suitability of environmental policy instruments and the results showed that: First, voluntary agreements were regarded as the most appropriate environmental policy tool. Second, even though direct regulation is often criticised in the literature as dynamically inefficient, quite few respondents criticised direct regulation. Finally, even though the introduction of environmental taxes, as well as economic instruments in general, has been recommended in the literature, many respondents saw them as inappropriate from the point of view of innovativeness.

Dynamic efficiency of environmental taxes evaluated at micro-policy level

General remarks. Micro-policy considerations are worth noting within this context even though they would only lead to hypothetical conclusions. Micro-analysis is, however, required because so many opinions in literature are too categorical and completely ignore the design and the implementation of environmental taxes. For instance, environmental taxes are said to be technologically more flexible than direct regulation. Polluters have at least three options to reduce emissions under environmental taxation besides reducing output: they may install pollution abatement technology, improve production efficiency and change processes to reduce the use of polluting substances. However, environmental taxes are sometimes implemented as they are considered specification standards by nature. A reference can be made to the catalytic converter discount in motor vehicle taxation and to several kinds of differentiations of motor fuel taxes favouring environmentally-friendly qualities. In some other cases, too, the technological flexibility of environmental taxes can be criticised, i.e taxation does not spur all possible innovations by which pollution could be reduced.

Introduction of the environmental tax. A difficult regulatory problem is the *length of the timescale* applied in the introduction of environmental taxes (Määttä

1997). This is due to the speed at which environmental taxes are introduced can be critical in determining the response adopted by polluters. For instance, it has been suggested that too short a timescale will favour the adoption of end-of-pipe technologies since alternative clean technologies may not be immediately available. In this context, it has been pointed out that the scope for improving energy efficiency is much less with existing plants. Thus, to achieve quick results a much higher level of taxation would be required than if energy consumption changes were sought over a longer period of time (Ingham, Maw & Ulph 1991). It has also been pointed out that quick implementation may lead to an unjustified increase in the price of depollution plants because of the growth in demand (Herzog 1991). In summary, it is important that dischargers have a reasonable time in which to comply to encourage an innovative response to an environmental tax (Orr 1976; OECD 1985; Määttä 1997).

On the other hand, too long a timescale may send the wrong signals, because it may give the impression that improving the state of the environment need not be a high priority for polluters (Medhurst 1993). Uncertainty over environmental tax policy may also increase because external circumstances may change, among them political attitudes and the relative strength of political groups (Määttä 1997). Uncertainty also creates problems, of course, from the point of innovativeness.

All in all, there is a need to strike the right balance in terms of a timescale which will enable dischargers to respond in a way that minimises short-termism and one which is too long and would allow for too many variables. Of course, a timetable in which the goals have to be accomplished is of great importance. On the other hand, environmental protection goals are in practice political decisions, nothing more, and, thus, in the setting of these goals the short-term as well as long-term problems have to be taken into account.

The level of the environmental tax. A major problem with environmental taxes is finding the *right tax level.* The legislator does not know whether polluters will decide to pay a tax or to reduce pollution unless the legislator knows the polluters' control costs. The settlement of these costs may be a difficult task because of the asymmetrical information; polluters know these costs but the legislator does not.

Even though it is difficult to find the right tax level for environmental taxes, it is not impossible. Economists have often recommended an iterative, trial-and-error process. This process begins by setting the tax rate at an arbitrary level. If it leads to under-inclusive pollution reduction, the tax rate is raised and *vice versa*. The process continues until the right tax rate is found (Baumol & Oates 1988). However, this will undermine the predictability of the tax treatment and also reduce the incentive for innovative activities. In practice, the iterative process is rarely the method applied in environmental taxation (Määttä 1997).

Perhaps a better policy option than the iterative process would be the application of a *progressive timetable*. The characteristic feature of progressive implementation is that it begins by setting low tax rates and increases them until the desired quantitative response is achieved. In general, the use of progressive implementation

has been justified in terms of the disadvantages connected to the iterative process: any disadvantages – among other things, related to dynamic efficiency – with the application of a progressive timetable are likely to be less pronounced (Pezzey 1988). A progressive timetable in the setting of tax rates may be appropriate in particular regarding taxes which create a heavy economic burden for dischargers; in short, stiff policy measures will bring about fundamental changes in economic institutions and induce transitional problems (OECD 1991; Heister, Michaelis & Mohr 1992).

Another procedure for determining the right tax level and guaranteeing an acceptable state of the environment is to apply *mixed systems*. In other words, direct regulation can be used as a transitional arrangement before the right level of environmental tax is found. Direct regulation may be kept to a minimum standard and environmental taxes used to tighten environmental policies. From the point of view of innovativeness, applying the iterative process would be problematic in this context. A better alternative here would be to apply a progressive timetable in setting the tax level.

The level of environmental taxes has been – especially earlier – so low that taxes have not influenced the behaviour of polluters (Opschoor & Vos 1989; Määttä 1997). In this case, the incentive to engage in creative activities in pollution reduction is also small (Kemp 1997). In other words, environmental taxes would be fiscal in nature. In this respect, environmental taxes may also be problematic with respect to other innovative activities because taxes reduce the resources of economic actors to introduce market innovations. On the other hand, existing tax rates matter as much as anticipated further increases. From this point of view, however, the predictability of the tax rates in the near future is of great importance. Thus, in setting tax rates by a progressive timetable, future tax rates should be determined beforehand.

Moreover, the structure of environmental tax rates may influence dynamic efficiency. With an environmental tax, potential dynamic efficiency becomes significant because polluters pay the tax on any remaining units of pollution. The situation changes if the so-called target load principle is applied. Such a of system is applied today under the Dutch small users' energy tax: tax is imposed only on energy use which exceeds a threshold level (Määttä 1997). This regulatory option has also raised interest in Finland (TM 1991:59), but from the dynamic efficiency point of view it should be abandoned. Another issue worth discussing here is the reduced tax rates directed at certain activities in environmental taxation. For instance, the carbon tax rate of natural gas in Finland is only 50 percent of what it would be if the tax rate is determined according to the carbon content of this fossil fuel. This tax relief, of course, is an incentive to move to increased use of natural gas instead of coal and peat. On the other hand, the reduced tax rate on natural gas is a source of innovation bias. Because it is possible to produce energy with non-fossil fuels, the reduced tax rate on natural gas slows down the movement to non-fossil fuels.

Different tax rates and relief for certain actors complicate environmental taxes and erode the transparency of taxation. Finnish energy taxation is an example. First, industry and professional greenhouse growers pay a lower electricity tax than other users of electricity, such as consumers and the service sector. Moreover, energy intensive industry — industry for which the paid energy taxes are more than 3.7 percent of their value added — can get their tax partly refunded. More specifically, a company which has paid more than 3.7 percent of its value added in energy taxes can get up to 85 percent of the taxes refunded, provided that those taxes exceed FIM 300 000 (Määttä 2000b). This relief raises several problems. Problems of interpretation are unavoidable in this kind of legal environment. For instance, how should such enterprises which belong partly to industry and partly to the service sector be dealt with under electricity taxation? Moreover, different tax relief measures provoke enterprises to "innovations" which do not generate welfare. Finally, quite a commonly mentioned disadvantage with respect to complicated legislation is that it usually favours large enterprises compared with SMEs. SMEs cannot devote sufficient resources to plan their taxation and, thus, complicated taxation is not *de facto* compatible with the neutrality principle.

The linkage principle. The linkage between pollution and the tax level may — and in practice often is — be inappropriate, which distorts technological advances in the environmental field. For instance, tax may be imposed on electricity even though the purpose of the tax is to spur the reduction of carbon dioxide emissions. However, the electricity tax may not spur measures in the production of electricity which would limit the emitted emissions (Määttä 2000b). More specifically, taxes like the electricity tax do not provide an incentive to install available emission reduction technologies such as scrubbers (OECD 1996a). This type of tax works as a technical constraint under direct regulation.

Related to the above, Stewart (1981) suggests that increasing petrol taxes would be an appropriate alternative to regulation of new motor vehicle technologies. This regulatory option deserves closer examination. It is an appropriate alternative in regard to the reduction of carbon dioxide emissions because those emissions are directly related to the amount of petrol used. But problems emerge with respect to nitrogen oxides emissions, because those emissions are not directly related to the nitrogen content of petrol. Instead, what matters here are the technological characteristics of the engine. Therefore, the petrol tax would be a cost-ineffective way to reduce nitrogen dioxide emissions and similar reasoning may also be true with respect to dynamic efficiency.

Examples may also be presented concerning the linkage principle. For instance, effluent charges based on actual measurement may have incentive effects. The Dutch water pollution charge set on large firms is an example of such a feature. On the contrary, households and small firms pay a fixed amount, and no incentive effect exists (OECD 1994). This is an important factor: if there is no incentive, but an "outlay effect", the result is that environmental tax erodes innovativeness.

The interaction between regulations and innovations. An interesting point of view is that technological development has paved the way for some new

environmental taxes. In particular, environmental differentiations of motor fuel taxes have been implemented only after new, environmentally-friendly fuel qualities were developed. In this respect, tax differentiations have been the results of technological development rather than the causes (Määttä 1997). Moreover, the experience of the tax differentiation favouring unleaded petrol has been so promising that we can ask whether measures like this should be applied more extensively. Therefore, we have to acknowledge the technical and market conditions under which the change-over from leaded to unleaded petrol succeeded. Kogels (1995) has mentioned the following factors:

1) there should be no technical restrictions, i.e. car engines must be fit to run perfectly on the alternative fuel;
2) the environmentally more favourable fuel should be available to the market as widely as possible in a relatively short term;
3) a third technical reason for the growing use of unleaded petrol has been the use of cars using catalytic converters; the use of leaded petrol causes irreparable damage to the catalytic converter.

On the other hand, it is important to foresee the possible technological advances when environmental taxation is planned and implemented. The Finnish carbon tax provides an example. A carbon tax is imposed on fossil fuels on the basis of their carbon content. Unlike the Swedish tax, the Finnish carbon tax contains no abatement system, because it is not economically possible to eliminate carbon dioxide emissions from exhausts. In other words, according to Swedish carbon taxation, if the polluter manages to reduce carbon dioxide emissions while using fossil fuel, compensation proportionate to the reduction of emissions is granted. Incorporating an abatement system in the Finnish carbon tax would provide an incentive to develop technologies which eliminate carbon dioxide emissions from exhausts. This provision also promotes dynamic efficiency by creating a certainty that such measures will be compensated (Määttä 1997).

Recycling incentives. An example of recycling incentives may highlight the issue. The Finnish waste oil tax on lubricants is financing in nature, i.e. its primary purpose is to finance the collection, storage and disposal of used oil. From the point of view of innovativeness it is significant that the waste oil tax includes an incentive for recycling: those lubricants produced from used oil are exempted from the tax. Even though no empirical evidence exists about the effectiveness of the recycling incentive, this type of scheme may be recommended for introduction in other parts of environmental taxation, too (Määttä 2000c). In particular, product taxes motivated by waste policy considerations as well as waste taxes may be good candidates in this respect. Moreover, an interesting possibility is to introduce such a fertiliser tax which would contain an incentive for recycling plant nutrients.

Inappropriate tax avoidance and tax evasion. An important consideration is the vulnerability of environmental taxes to inappropriate tax avoidance and tax evasion. Inappropriate measures as such are legal measures which reduce the tax burden but do not promote the achievement of environmental policy goals. These

measures can, for instance, take the form of cross-border shopping of taxable products by consumers. Tax evasion must also be considered: in this case, the minimisation of the tax burden takes the form of illegal practices, for instance, the smuggling of taxable products for business purposes. It is possible to intervene against tax evasion by intensifying penalties or improving tax control. On the other hand, the design of environmental taxes is a very important consideration with respect to inappropriate tax avoidance. For instance, if some economic actors or activities are outside the scope of an environmental tax, circumstances are created in which circumvention of regulation is made possible. Therefore, environmental taxes should be as comprehensive as possible and the tax treatment should be uniform across polluters to prevent inappropriate measures for tax avoidance.

In both of the above-mentioned cases, innovation bias would occur: polluters do not adopt those measures, e.g. installation of pollution-reduction equipment which would reduce pollution, but such "innovations" as environmental tax "planning" which do not promote that goal. It is worth noting in this context that environmental taxes are more vulnerable to illegal and other inappropriate measures than direct regulation. We may assume that tax regulation is more problematic than direct regulation from this perspective. The reason is simple: under tax regulation, polluters have to pay taxes in addition to the costs caused by pollution reduction measures, whereas under direct regulation they only have to pay the latter-mentioned costs. Thus, the benefit from "circumventing" the tax regulation is larger, and also the incentive to do so is larger than under direct regulation. Taking this factor into account, it is impossible to say a priori that environmental taxes are a more appropriate instrument from the innovativeness point of view than direct regulation.

Stability of environmental taxation. The volatility of tax rates, as well as structures, essentially erodes the environmental effectiveness as well as efficiency properties of environmental taxes. This is emphasised by the fact that the actual rate of a tax is less important than the certainty of future tax rates (and structures). An extreme example of volatility is the Finnish carbon tax and other energy taxes. The carbon tax was introduced in 1990 with a low initial level. The tax rate was doubled in 1993 and, at the same time, an electricity tax introduced. At the beginning of 1994 the electricity tax was removed and the taxation reformed to include, for example, an energy tax component in addition to the carbon tax and the tax on carbon in fossil fuels used as inputs in electricity generation. In 1995 both the energy and carbon tax components were increased substantially. In the same year the planning of the new energy tax reform began, which was implemented at the beginning of 1997: an electricity tax was introduced, fossil fuels used in electricity generation were exempted from the tax and the energy tax component was removed. At the beginning of 1998 the scope of the electricity tax was amended and the carbon tax rate increased. And, finally, new energy tax relief was introduced in September 1998. In these circumstances it would be a miracle if the carbon tax and other energy tax components were dynamically

efficient. Moreover, in the inquiry made for this study some respondents cited the weak predictability of energy tax treatment. From this point of view, a critical question involves the sources of instability. One such explanation is that the financial burden of environmental taxes is usually heavier than that of direct regulation, and the heavier the financial burden is, the greater is the incentive of economic actors to pressure the legislator to amend legislation.

Mixed systems. Virtually none of the existing environmental taxes in OECD countries is designed as a substitute for direct regulation in the sense of providing incentives to reduce pollution (Määttä 1997). From this point of view, under the regulated field of environmental law we discuss complementary rather than independent environmental taxes, and, thus, the discussion concerning mixed systems is of great importance in practice. For instance, preparatory environmental taxes are used to speed up forthcoming direct regulation: environmental differentiation of the annual vehicle tax started in Germany in 1985/86 and declined until it was abolished totally in the early 1990s when, all new large and medium-sized cars had to meet specified air pollution norms (Opschoor & Vos 1989). Related partly to this measure, Article 3 of Directive 94/12/EC concerning measures to be taken against pollution emissions from motor vehicles allowed Member States to apply tax incentives to all new vehicles which comply in advance with the new requirements. This kind of catalytic converter discount has been applied in many EC countries and most removed it when catalytic converters were made compulsory (Määttä 1997). Preparatory environmental taxes — as well as subsidies — are appropriate, among other things, in circumstances in which certain products are to be phased out totally. This is explained by the fact that total prohibitions cannot be implemented immediately without huge adjustment costs.

Environmental subsidies

Polluter Pays Principle. The Polluter Pays Principle (PPP) can be understood as a non-subsidy principle. However, under certain conditions granting financial support to polluters is not incompatible with the PPP. More specifically, granting aid should then be limited to

- target groups, where severe difficulties would otherwise occur;
- well-defined transitional periods; and
- situations where international trade and investment are not distorted significantly.

It is particularly important that supporting development and experiments with new control equipment and clean technology is not necessarily incompatible with the PPP (Opschoor Vos 1989). For instance, Denmark has applied a scheme for subsidising the development of clean technology. Moreover, in France a small contribution has been directed to the development of new and improved technology in the field of air pollution. In the Netherlands, one important financial assistance

scheme is directed to industry to promote research on and introduction of pollution control equipment and clean technology. In Sweden, a financial assistance system has been applied in which the subsidy is an incentive for developing and introducing new environmental techniques (Opschoor & Vos 1989).

One problem — according to the German experience — is that subsidies have been granted without specific reference to the outcomes of the supported projects (Opschoor & Vos 1989). Of course, this consideration is important from the point of view of environmental effectiveness, but it is also important in regard to innovativeness: a scheme which does not influence the behaviour of economic actors in the static sense does not influence it in the dynamic sense either.

Environmentally-motivated tax subsidies. Tax subsidy for investment in pollution-control equipment is likely to prove quite ineffective in stimulating pollution abatement. For instance, if the equipment adds to a firm's costs and contributes nothing to its revenues, the absorption of some proportion of the cost by a government cannot make its acquisition profitable. So long as the proportion is less than 100 percent, the installation of the equipment will lose money for the firm, and its attractiveness will remain doubtful, except perhaps as a public-relations gesture or as a pure act of conscience by the businessman (Baumol & Oates 1988). More generally, there are no reasons to expect that tax subsidies (which are less than 100 percent of the costs of equipment) would promote pure social innovation, i.e. innovation which does not generate any profits to the firm. Another matter is whether such tax incentives would promote market innovations. In this case, we can only assert that the equipment would contribute nothing to the firm's revenues. Therefore, if process equipment — in addition to pollution-control equipment — were the target of the tax incentive, it could spur innovations, more specifically market innovations. Nevertheless, the problem is that the Finnish corporate income tax law covers only pollution-control equipment, i.e. a source of social innovations. Consequently, one can ask whether the legislation should be developed to make process equipment a target of the tax subsidy as well. The problem of insufficiency is not only characteristic of tax incentives; a general condition for direct environmental subsidies has been that the subsidy can represent no more than 50 percent of the total cost and no more than 30 percent of the investment (Hilden et al. 2001).

Moreover, tax subsidies directed at pollution-abatement equipment can be criticized because this kind of arrangement rewards only particular types of equipment, e.g. treatment equipment, and, hence, may not induce the adoption of the most efficient pollution-control methods. In order to avoid such distortions, which also concern dynamic efficiency, tax subsidies, among them accelerated depreciations, should be as neutral as possible. The *neutrality principle* is one of the leading principles if the intent is to promote dynamic efficiency in a very appropriate way. In addition, the problem related to environmentally-related (tax) subsidies is that they are granted on the basis of installing equipment: the equipment it is not required to work. In practice, it has been noted that a large share of those investments do not work satisfactorily (Tietenberg 1996).

Energy R&D. According to the OECD (1995), governments should be directly involved in energy R&D only if:

— the research is not likely to be performed by private industry;
— public funding is the cheapest and most efficient method.

There is a need for public funding, if the research has a long-term time horizon and is of general (non-applied) character. Governments may then have to support the research because of differential public and private risk aversion and differences in public and private discount rates (OECD 1995).

5 CONCLUSIONS

Regulatory problems in regulatory reform

As mentioned at the beginning of the study, Wienert (1997) has distinguished four types of regulatory problems: whether to regulate; the problem of design; the problem of timing; and he level at which regulation should occur. These problems are essential in regulatory reform but they are not sufficient if we want to analyse comprehensively the interaction between regulations and innovations. First, goals of legislation should not be taken as given, but are an essential part of regulatory reform. It is a question of the content of the objectives as well as the time in which they must be accomplished. Second, regulations are not perfect and, thus, their enforcement and problems of interpretation should be taken into account, too. It is critical here that the court system is to some extent a closed system in which the use of arguments based on substantive reasons, like the promotion of dynamic efficiency, is limited. Third, there is a clear-cut need for systematising regulations in such a way that serves the studies related to the innovations. For instance, dividing regulations into economic, social, and administrative regulations is not of great help. Instead, classifying them according to technological flexibility as well as their external flexibility have been useful in this respect.

Finally, *regulatory impact analysis* should be taken seriously in regulatory policy if we want policy to be more than "shooting in the dark". A trend toward more empirically-based regulation is an essential part of the change required. The costs of regulation can no longer be viewed in the following way: "It's a legal requirement, so the costs are not important." However, the approach should not be a static cost-benefit analysis but the dynamic effects should be analysed carefully, too. In principle, it is possible that the regulation which is most appropriate from the static point of view is not the most appropriate when dynamic

considerations are taken into account. Thus, ignoring dynamic benefits and costs may provide misleading conclusions about the appropriateness of regulation.

Today, in government bills in Finland different kinds of legislative impacts have to be considered. More specifically, economic impacts, impacts on equality, environmental impacts and organisational impacts are analysed. It is worth noting here that impacts on innovations are omitted. Because this feature has great significance for the whole legal system, it is easy to recommend that impacts on innovations be included to in government bills concerning the reform of legislation. This could happen, for instance, within the context of the economic impacts mentioned in preparatory drafts.

Regulatory principles in an innovative world

The analysis of competition and environmental legislation clearly shows the different regulatory problems confronting us. This also means that we should be cautious in making generalisations about the results. In other words, every field of legislation deserves its own study concerning the interaction between regulations and innovations. Moreover, much has to be done at the theoretical level and as previously mentioned, the role of empirical studies should be emphasised in the future. In addition, conclusions are often too categorical. This is strongly evidenced by the analysis of economic instruments for environmental protection. For instance, it is far from clear-cut whether environmental taxes and environmental subsidies are dynamically more efficient than traditional direct regulation. What matters, among other things, is the detailed design of different policy instruments and how they are implemented.

In spite of the problems related to the generalisations, certain principles are worth noting in developing legislation in an innovative world.

One fundamental characteristic of rules concerns the *degree of precision* (or generality), the detail or complexity they embody: how finely are different sorts of behaviour to be distinguished? Such matters may arise e.g. in defining the scope of a specific law, providing for exceptions, and adjusting sanctions based upon aggravating and mitigating circumstances. Different sorts of regulations involve differing costs of formulation and application by private parties and adjudicators, and the character of law also influences how well parties actually will understand them and adapt their conduct accordingly (Kaplow 2000).

An important principle in reforming regulation in certain fields of legislation could be labelled the *flexibility principle*. Avoidance of detailed formulations is a benchmark of this approach and, instead, substantive standards should be expressed in broad concepts (Brodley 1990). The reason is simple: regulatory lags are very

long compared with the rapid technological progress. This is emphasised by the fact that laws are difficult to amend and, thus, legislating the details of today's best practice will almost guarantee years of bad decisions based on outmoded doctrines and methods (Schmalensee 1987). The need for external flexibility in regulation confirms this point of view. Or as Baumol and Ordover (1985) have stated: especially in circumstances in which technological development is rapid, categorical or schematic rules may be dangerous, i.e. they may hinder the technological development rather than spur it.

However, opinions about the appropriateness of the flexibility principle are not unanimous. For example, Easterbrook (1992) favours greater reliance on simple rules and less on flexible rules. For instance, under competition legislation per se rules conserve information and the costs of litigation. The same concerns the greater use of market power thresholds, says Easterbrook. And as we saw earlier, some firms in the sector of technical inspection services in Finland demanded more detailed rules for their field of business in order to reduce legal uncertainty.

The application of the flexibility principle requires that *de facto* legislative power be delegated to enforcement agencies. From this point of view, it is appropriate that legal decision-making is managed by expert organisations, not by general courts, as has already been the case in the fields of competition and environmental policy to a large extent. On the other hand, it is impossible to move all of the tasks of legal enforcement out of the courts. Thus, there is an obvious need in the courts for new way of thinking. Arguments based on substantive reasons should be taken into account more seriously than before. For instance, the problem of interpretation should be approached by analysing, among other things, the consequences of the decisions with respect to innovative activities, not by searching for old preparatory drafts or old decisions of the Supreme Court and Supreme Administrative Court. This means that the members of the courts should develop their expertise in social issues, too. Courts should no longer be closed systems but in close interaction with the surrounding society. This is also the biggest difficulty of reform. Courts follow their own laws and societies their own. In any case, courts get more and more of those tasks which were previously handled by the legislator.

Nevertheless, there are still fields of legislation in which the flexibility principle may not have so much relevance. For instance, under criminal law and tax law the so-called legality principle is emphasised. Criminal actions as well as the punishments meted out have to be determined carefully under criminal law; tax liability, tax base, tax rates and taxpayers have to be determined carefully under tax law. Because of the legality principle, these fields of legislation may not necessarily be the best candidates for steering the behaviour of economic actors in an innovative world. However, certain viewpoints are also worth noting here. Under criminal law, essential elements of new types of crimes, such as economic crimes and environmental crimes, have been defined in a rather flexible way compared with the traditional crimes. In the context of environmental taxes, as previously noted, the external flexibility of taxes is not only the function of the flexibility of the

norms, i.e. many issues related to the design of taxes affect the external flexibility of environmental taxes.

Another important question from the regulatory point of view is whether to apply regulations in an unmodified form to markets where innovation is important and where innovations are not so important. One possibility of solving this regulatory problem is to apply unmodified regulation but to allow exceptions e.g. based on reasons of dynamic efficiency. On the other hand, some researchers advocate differentiated regulations e.g. under competition law (Brodley 1990).

One difficulty with respect to the specific regulation of innovation collaboration or other innovation-enhancing measures is that the requirements could be loosely defined. While there could be measures which benefit from "innovation relief" even though they do not deserve it, there could be genuine innovative activities which fall outside the specific regulation. An example of this kind of *targeting problem* has been the tax incentive enacted to encourage spending on R&D activities. For instance, in Canada, Sweden and the United States there has been substantial evidence that these tax incentives resulted in a considerable redefinition of activities like R&D (Mansfield 1986; Geroski 1995). Moreover, the critique has been directed at amendments in U.S. antitrust legislation because those permissive provisions may extend beyond the industries to which they are aimed (Brodley 1990). In any case, defects in regulation are always inevitable: perfect laws cannot be enacted. Therefore, a critical question is whether the benefits of specific regulation are greater than the disadvantages of the specific regulation. The pragmatic point of view should be emphasised here, too, not categorical regulatory optimism or pessimism.

One important benchmark in regulatory reform is that legislation and enforcement should not distort the choices between innovative activities, and legislation should not distort the arrangements by which innovative activities are organised. These two points emphasise the importance of the *neutrality principle*. Two dimensions of the principle can be distinguished: firstly, according to *neutrality in innovation*, legislation should not affect the choices between innovations. For instance, in respect to the legal treatment of different investments in environmental protection, legislation should be indifferent to process investments and end-of-pipe technologies. Secondly, according to *neutrality in organisation*, legislation should not affect the choices between organisational forms by which innovations are planned and implemented. For example, competition policy should treat vertical restraints of trade and vertical mergers consistently to permit the firm to choose the mix of strategies that is most appropriate. This is because different restraints of trade and mergers are substitutes for one another. In environmental policy, neutrality between established firms and newcomers as well as between large enterprises and SMEs should be guaranteed.

The *principle of comprehensiveness* is an important standard in developing regulations in every field of legislation. For instance, under competition legislation deficits in comprehensiveness may cause neutrality failures, and thus innovation failures. Moreover, deficits in comprehensiveness under environmental law may

cause cross media effects and other undesirable consequences. Innovation failures may be a result of this kind of regulation, too.

The *continuity principle* should also be followed in reforming legislation (Määttä 1997). In other words, concepts, procedures and organisations under existing legislation should be used as extensively as possible in a regulatory reform. This is because each new concept introduced into the legislation becomes a source of elaborate argument and uncertainty as to what the legislator precisely intended. Moreover, radical reforms of legislation may rest on a highly uncertain basis, especially if the theoretical basis for amendment is not well established. North (1990) strongly emphasises the role of the continuity principle *de facto,* when he mentions that "institutions typically change incrementally rather than in discontinuous fashion".

A final point is that the study must go on. Studies concerning the relationship between regulations and innovations have only taken first steps and there is much to be done. For instance, empirical studies are rare, and conceptual disorder still characterises them; there are numerous areas of research which are not studied at all from the point of view of innovativeness, and economic studies concerning regulation have concentrated on static efficiency, not dynamic efficiency. All these issues reflect the fact that much has to be done at the theoretical level as well.

SUOMENKIELINEN TIIVISTELMÄ

Oikeudellisen sääntelyn uudistaminen ja innovaatiot:

Voidaanko näkymättömään käteen luottaa vai tarvitaanko näkyvää kättä?

Alustavia näkökohtia

Periaatteessa kaikki oikeudellinen sääntely vaikuttaa välittömästi tai välillisesti innovaatioihin. Tavallisesti tässä yhteydessä on kiinnitetty huomiota immateriaalioikeuksiin, so. erityisesti patentteihin, tekijänoikeuksiin ja tavaramerkkeihin. Tämä huomion kohde on kuitenkin aivan liian kapea, ja senpä vuoksi käsillä olevassa tutkimuksessa onkin painotettu muiden oikeudenalojen, erityisesti kilpailuoikeuden ja ympäristöoikeuden, analyysiä. Kyseiset oikeudenalat edustavat kuitenkin vain esimerkkitapauksia. Kattava tutkimus edellyttäisi tarttumista koko oikeusjärjestelmään, muun muassa sopimus- ja vahingonkorvausoikeuteen, rikos- ja prosessioikeuteen sekä vero- ja hallinto-oikeuteen. Kattavaa lähestymistapaa puoltaa esimerkiksi se, että erilaiset oikeusinstituutiot ovat useinkin substituutteja toisilleen samoin kuin se, että perin erilaisia oikeusinstituutioita sovelletaan toinen toistensa komplementteina. Tutkimusekonomisista syistä käsillä olevassa tutkimuksessa on jouduttu kuitenkin tinkimään näin laajasta näkökulmasta.

Samalla on syytä huomata, että innovaatioiden ja oikeudellisen sääntelyn välinen suhde on nimenomaan vuorovaikutussuhde. Toisin sanoen oikeudellinen sääntely ei yksinomaan vaikuta innovaatioihin, vaan innovaatiot vaikuttavat oikeudelliseen sääntelyyn. Jälkimmäisestä olkoon esimerkkinä sähköisen kaupankäynnin yleistyminen, minkä seurauksena on jouduttu pohtimaan muun muassa sopimusoikeuden ja vero-oikeuden kehittämistarpeita. Tällöin on tavallaan kysymys siitä, että oikeudellinen sääntely joudutaan sopeuttamaan teknisessä kehityksessä ja muissa innovaatioissa tapahtuneisiin muutoksiin.

Tutkimuksessa hahmotetaan, minkälaisia epäkohtia ja kehittämistarpeita eräillä oikeudenaloilla tänä päivänä vallitsee arvioitaessa asiaa nimenomaan innovaatioiden näkökulmasta. Tässä yhteydessä puhutaan myös dynaamisesta tehokkuudesta.

Oikeudellinen sääntely voi vaikuttaa kolmella tavalla epätarkoituksenmukaisesti innovaatioihin. Tällaisia tilanteita voidaan kutsua yhteisesti innovaatiohäiriöiksi. Ensinnäkin sääntely voi johtaa innovaatiovajeeseen: innovaatioita tehdään vähemmän kuin olisi optimaalista. Alan kirjallisuudessa innovaatiohäiriöt onkin tavallisesti nähty juuri innovaatiovajeina. Toisaalta voidaan ajautua päinvastaiseen tilanteeseen, so. liikainnovaatioihin. Tällöin innovaatioihin uhrataan resursseja enemmän kuin yhteiskunnallisesti olisi optimaalista. Innovaatioiden kehittäminen ei ole siis mikään itseisarvo, jota pitäisi hinnalla millä hyvänsä edistää. Lisäksi innovaatiohäiriöt voivat ilmetä innovaatiovääristyminä. Tässä tapauksessa oikeudellinen sääntely ohjaa innovaatiot "vääriin" kohteisiin. Merkittävyydestään huolimatta tämä innovaatiohäiriöiden ryhmä on usein kirjallisuudessa sivuutettu.

Mikäli lainsäädännössä voidaan havaita innovaatiohäiriöitä, niiden korjaamiseksi on aiheellista tehdä ehdotuksia lainsäädännön muuttamiseksi. Käsillä olevassa tutkimuksessa tehtävät de lege ferenda -tyyppiset suositukset ovat kuitenkin luonteeltaan alustavia, ja ne on tarkoitettu enemmän keskustelualoitteiksi kuin vaatimuksiksi siitä, että lainsäädäntöä on muutettava juuri ehdotusten viitoittamalla tavalla. Tästä huolimatta innovaatioiden ottaminen vakavasti varteen luo uudenlaisen näkökulman siihen, miten oikeudellinen sääntely olisi tarkoituksenmukaista konstruoida.

Oikeudellista sääntelyä uudistettaessa törmätään yleensä oikeudenalasta riippumatta samoihin periaatteellisiin kysymyksiin. Aluksi pitää ottaa kantaa siihen, onko oikeudellinen sääntely ylipäänsä tarpeen. Jos päädytään siihen, että oikeudellinen sääntely on tarpeen, joudutaan analysoimaan kysymystä, miten sääntely on rakenteellisesti ja muutoin toteutettava. Tämä on erittäin tärkeä kysymyskokonaisuus, koska innovaatioitakin silmällä pitäen ongelmat palautuvat usein lainsäädännön yksityiskohtiin. Oikeudellisen reformin ajoitus on sääntelyongelma, joka usein unohdetaan, mutta johon on myös otettava kantaa. Lisäksi tärkeässä asemassa on se, mikä työnjako on paikallisen, kansallisen ja ylikansallisen sääntelyn välillä.

Oikeudellista sääntelyä on jaoteltu kirjallisuudessa monin tavoin. Yksi yleisimmistä luokitteluista on jako taloudelliseen, sosiaaliseen ja hallinnolliseen sääntelyyn. Tämänluonteisesta jaottelusta ei ole kuitenkaan sanottavaa hyötyä innovaatioita koskevassa tutkimuksessa. Kysymys ei ole tältä osin suinkaan pelkästä esitystekniikkaan palautuvasta kritiikistä. Vastedes olisi näet tarpeen konstruoida normiryhmittelyjä, jotka samalla palvelisivat myös innovaatiotutkimusta, ja tällöin erityisesti sitä, että tietyn sääntelytyypin osalta olisi tehtävissä yleistyksiä siitä, miten tarkoituksenmukainen se on innovatiivisuuden näkökulmasta. Kysymys olisi siis eräänlaisen käsitteellisen viitekehikon kehittämisestä, jonka puitteissa oikeudellisen sääntelyn vaikutus innovaatioihin olisi tutkittavissa nykyistä paremmin.

Tutkimuksessa on metodologisesti hyödynnetty oikeustaloustieteellistä (law and economics) lähestymistapaa. Tälle metodille on käytännössä ollut tyypillistä staattisen näkökulman painottaminen, so. ainoastaan allokatiivinen tehokkuus ja tuotannollinen tehokkuus (kustannustehokkuus) ovat olleet ratkaisevassa asemassa analysoitaessa oikeudellisen sääntelyn tarkoituksenmukaisuutta ja kehittämistar-

peita. Käsillä olevassa tutkimuksessa lähestymistapaa on jouduttukin muokkaamaan siten, että staattisen näkökulman sijasta dynaamiselle näkökulmalle on annettu perinteistä keskeisempi asema. Yleisemminkin puollettavissa on näkemys, jonka mukaan staattisesta oikeustaloustieteestä siirryttäisiin enemmässä määrin kohti dynaamista oikeustaloustiedettä, so. argumentointia, jossa innovaatioiden kehittäminen ja diffuusion edistäminen, saisivat keskeisen aseman.

Tutkimuksen läpiviemiseksi on jouduttu kiteyttämään premissejä, joiden valossa analysoidaan sääntelyn vaikutusta innovaatioihin:

1) Teknisellä argumentilla viitataan siihen, että innovatiiviseen toimintaan on sitä paremmat edellytykset, mitä vähäisemmässä määrin lainsäädännössä rajoitetaan niitä teknisiä ja organisatorisia keinoja, joilla lain velvoitteet ovat noudatettavissa. Esimerkiksi ympäristönsuojelun hallinnollisessa ohjauksessa rajoitetaan edelleen mitä moninaisimmin teknologiaperusteisin normein kuormittajien valintamahdollisuuksia, jotka samalla rajoittavat valintamahdollisuuksia innovaatioita kehitettäessä. Innovaatiovääristymien välttämiseksi tärkeässä asemassa on myös se, että lainsäädännössä kohdellaan erilaisia teknisiä ja organisatorisia keinoja tasapuolisesti.
2) Kustannusargumenttiin kiteytyy puolestaan oletus siitä, että toiminnanharjoittajien edellytykset innovaatioiden kehittämiselle ja käyttöönotolle ovat sitä paremmat, mitä vähemmässä määrin sääntely aiheuttaa heille kustannuksia. Kustannuksina tulevat huomioitaviksi paitsi erilaiset transaktio- ja hallintokustannukset sekä kustannukset lakisääteisten velvoitteiden noudattamisesta myös tulonsiirrot julkisvallalle/julkisvallalta.
3) Kannustinargumentissa huomio kiinnitetään siihen, miten lainsäädännössä palkitaan uusien innovaatioiden tekemisestä ja käyttöönotosta. Toisaalta on pakko todeta, että lainsäädäntöön sisältyy elementtejä, joiden vaikutus on pikemminkin päinvastainen: sääntely rankaisee innovatiivisuudesta. Sen sijaan erityisesti taloudellisia ohjauskeinoja on puolustettu sillä, että niillä olisi positiivinen vaikutus innovatiivisuuteen.
4) Epävarmuusargumentilla viitataan siihen, että innovaatioita tehdään sitä enemmän, mitä suuremmassa määrin oikeusjärjestelmään liittyvä epävarmuus onnistutaan kitkemään pois. Epävarmuutta ovat omiaan aiheuttamaan muun muassa lain tulkinnanvaraisuus sekä tempoileva oikeuspolitiikka.

Vaikka edellä mainitut premissit vaikuttavatkin selkeiltä, aivan ongelmatonta niiden soveltaminen ei ole. Esimerkiksi kannustinargumentti saattaa puoltaa hyvinkin toisensuuntaista sääntelyvaihtoehtoa kuin kustannusargumentti, mikä on ilmennyt esimerkiksi teoreettisena erimielisyytenä ympäristöverojen dynaamisesta tehokkuudesta. Tällaisessa tapauksessa onkin viime kädessä empiirisen tutkimuksen asia selvittää, ovatko ympäristöverot innovatiivisuuteen kannustavia vai eivät.

Oikeudellista sääntelyä kehitettäessä on toki otettava huomioon muitakin näkökohtia kuin dynaaminen tehokkuus. Näitä näkökohtia kutsutaan yleisemmin sääntelystandardeiksi. Erityisesti sääntelyn vaikuttavuus on keskeinen standardi, ts. se, että sääntely toteuttaa sille asetetut yhteiskuntapoliittiset tavoitteet toivotussa

aikataulussa. Myös hallinnollinen tehokkuus on tärkeä sääntelystandardi: ääriesimerkkinä olkoon se, että sääntely voi olla kaikin puolin muutoin ihanteellinen vaikkapa dynaamisen tehokkuuden näkökulmasta, mutta se on hallinnollisista syistä toteuttamiskelvoton. Toisaalta on syytä painottaa, etteivät sääntelystandardit aina ja vääjäämättä ole toistensa kanssa ristiriidassa, vaan esimerkiksi vaikuttavuus ja dynaaminen tehokkuus voivat puoltaa hyvinkin samansuuntaisia sääntely- ja tulkintavaihtoehtoja.

Kilpailunrajoituslaki ja innovaatiot

Kilpailulainsäädännöstä tutkimuksen kohteeksi on nostettu erityisesti laki kilpailun rajoituksista. Yleisellä tasolla mielipiteet kilpailun vaikutuksista innovatiivisuuteen jakautuvat kahtaalle. Schumpeterilaisen näkemyksen mukaan keskittyneet markkinat luovat parhaat edellytykset innovaatioiden tekemiselle muun muassa siksi, että tällöin yrityksillä on enemmän tarvittavia resursseja. Sen sijaan arrow'lainen lähestymistapa on luonnehdittavissa lähinnä kilpailuoptimismiksi: kilpailullisilla markkinoilla yrityksillä on kannustin kehittää ja ottaa käyttöön uusia innovaatioita, koska ne eivät muutoin menestyisi kilpailussa. Empiirinen tutkimus ei tue selvästi kumpaakaan edellä mainituista näkemyksistä. Toisaalta molempia yllä mainittuja lähestymistapoja voi luonnehtia liian kategorisiksi. Ne eivät ota lainkaan huomioon kilpailulainsäädännön yksityiskohtia, kuten sitä, missä määrin kilpailulainsäädäntö mahdollistaa yritysten välisen yhteistyön innovaatioiden kehittämisessä.

Kilpailulainsäädännön vaikutus innovaatioihin onkin monivivahteinen asia, kun huomio kiinnitetään lainsäädännön yksityiskohtiin. Käsillä olevassa tutkimuksessa onkin erikseen tarkasteltu seuraavanlaisia teemoja:

1) horisontaaliset kilpailunrajoitukset eli rajoitukset, jotka on toimeenpantu samalla tuotanto- tai jakeluportaalla toimivien yritysten kesken;
2) vertikaaliset kilpailunrajoitukset eli rajoitukset, jotka on toimeenpantu eri tuotanto- ja jakeluportaalla toimivien yritysten kesken;
3) määräävän markkina-aseman väärinkäyttö, kuten sitominen ja saalistushinnoittelu;
4) yrityskaupat.

Eräs perustavaa laatua oleva painotus kilpailupolitiikassa on kaikkia edellä mainittuja teemoja silmällä pitäen se, priorisoidaanko kilpailupolitiikassa hintakilpailua vai innovaatiokilpailua. Perinteisestihän kilpailupolitiikalla on pyritty edistämään erityisesti hintakilpailua, mutta uudessa taloudessa ja varsinkin sen leimaamilla toimialoilla on paikallaan ottaa huomioon myös innovaatiokilpailu. Viimeksi mainitun kilpailumuodon painoarvoa korostaa se, että varsin laajalti vallitseva mielipide on se, että innovaatiot ovat omiaan kohentamaan hyvinvointia paljonkin enemmän kuin hintakilpailulla saavutettavat hienoiset hinnanalennukset. Tähän kokonaisuuteen liittyy sekin kilpailupoliittisten ongelmien lähde, että elinkeinoelä-

mä on perin heterogeeninen. Hyvin karrikoiden voidaan puhua yhtäältä savupiipputeollisuudesta, jolla teknologia on jo kypsässä vaiheessa, kun taas informaatioteknologian puolella innovaatiot ovat arkipäivää ja mitä olennaisin kilpailukeino. Pitäisikö siis soveltaa kahdenlaista kilpailupolitiikkaa: yhdenlaista savupiipputeollisuuteen ja toisenlaista informaatioteknologiaan?

Kilpailulainsäädännön kehittäminen on lukuisista muistakin syistä ongelmallista. Ensinnäkin teoreettiset näkemykset siitä, miten kilpailulainsäädäntöä olisi kehitettävä, ovat vasta valinkauhassa ja osin toistensa kanssa ristiriidassa. Tämä koskee esimerkiksi verkostoulkoisvaikutusten sisältöä ja painoarvoa kilpailupolitiikassa. Tosin Suomessa sanotunlaista keskustelua ei ole edes sanottavassa määrin käyty. Toiseksi kilpailua rajoittavalta vaikuttavat menettelytavat saattavat lopulta olla hyvinkin hyödyllisiä. Verifiointiongelmaa ei helpota se, että elinkeinonharjoittajilla ei ole välttämättä halukkuutta paljastaa sitä, onko heidän toimeenpanemansa kilpailunrajoitus tosiasiassa paljas, vaan pikemminkin heillä on kannustin korostaa rajoituksen tehokkuusetuja vaikkei niitä tosiasiallisesti olisikaan. Lisäksi ongelmien lähteenä on se, miten ripeä tekninen kehitys ja hidas lainsäädäntöprosessi ovat nivelettävissä toisiinsa. Ellei tätä ongelmaa pystytä ratkaisemaan, seurauksena on lainsäädännön ainainen jälkijättöisyys. Kyseiseen probleemaan törmätään tosin lähes kaikilla oikeudenaloilla.

Ennen yksittäisten kilpailunrajoitusten lyhyttä läpikäyntiä on paikallaan eritellä, kuinka alttiita innovatiiviset markkinat ovat kartellisoitumiselle. Yleisenä johtopäätöksenä tältä osin on esitettävissä, että näille markkinoille ei synny kartelleja välttämättä kovinkaan helposti, vaikkei se toki mahdotonta ole. Innovatiivisilla markkinoilla hyödykkeet eivät yleensä ole täysin samanlaisia, mikä hankaloittaa kartellin toimeenpanoa ja ylläpitämistä. Sama vaikutus on ollut myös sillä, että innovatiiviset markkinat ovat jo määritelmällisesti dynaamiset.

Nykyisin voimassa oleva kilpailunrajoituslaki mahdollistaa dynaamisen tehokkuuden huomioon ottamisen oikeudellisessa ratkaisutoiminnassa. Ensinnäkin tämän mahdollistaa se tosiasia, että po. laki on kirjoitettu varsin joustavasti. Toiseksi lakiin sisältyy nimenomaisia säännöksiä, joiden perusteella innovatiivisuuden edistäminen voi olla sallittua. Tässä voidaan viitata erityisesti tehokkuuspuolustussääntöihin. Kilpailunrajoituslain 19.1 §:n mukaan kilpailuvirasto voi myöntää poikkeusluvan lain 4—6 §.ssä viitatuista kilpailunrajoituksista, "jos se osaltaan tehostaa tuotantoa tai hyödykkeiden jakelua taikka edistää teknistä tai taloudellista kehitystä ja jos hyöty pääosaltaan tulee asiakkaille tai kuluttajille". Kilpailunrajoituslain 6 §:n 2 kohdassa säädetään lähes samasanaisesti ns. legaalipoikkeuksesta horisontaalisia määrärajoituksia koskien. Tästä huolimatta kilpailunrajoituslaki soveltamiskäytäntöineen voi johtaa innovaatiohäiriöihin.

Yksi innovaatiohäiriöiden lähde kilpailupolitiikassa on se, jos laki tai sen soveltamiskäytäntö johtaa yhteistyöhäiriöihin. Näillä häiriöillä tarkoitetaan tapauksia, joissa markkinaosapuolet (esimerkiksi erilliset yritykset) välttelevät yhteistyötä, vaikka se olisi hyödyllistä paitsi osapuolille myös yhteiskunnallisesti. Yhteistyöhäiriöiden välttämiseksi onkin helppo suositella sitä, että kilpailuoikeudessa suhtauduttaisiin sallivasti yritysten keskenään toimeenpanemiin kilpailunrajoituksiin. Toisaalta edel-

leen on syytä panna merkille, että tällaisten kilpailunrajoitusten ainoana tarkoituksena voi olla kilpailun rajoittaminen, jolloin niitä ei tietenkään pidä hyväksyä.

Kotimaista kilpailupolitiikkaa leimaa hintarajoitusten määrärajoituksia ankarampi kohtelu niin vertikaalisten kuin horisontaalisten kilpailunrajoitusten kohdalla. Esimerkiksi määrähinnoitteluun sovelletaan kieltoperiaatetta, kun taas muihin vertikaalisiin kilpailunrajoituksiin sovelletaan (käytännössä huomattavasti lievempää) väärinkäyttöperiaatetta. Jo johdonmukaisuussyyt puoltavat sitä, että kilpailunrajoituslakia tältä osin uudistetaan, koska hinta- ja määrärajoitusten vaikutukset ovat kuitenkin samanlaiset. Samalla on syytä huomata, että vallitseva oikeustila on omiaan johtamaan innovaatiovääristymiin.

Mielenkiintoinen kilpailuoikeudellinen kysymys on myös se, murtaako ripeä tekninen kehitys määräävässä markkina-asemassa olevien elinkeinonharjoittajien asemaa nopeammin kuin mikä tilanne olisi muutoin. Jos näin on, määräävään markkina-asemaan ja sen väärinkäyttöön ei tarvitsisi puuttua yhtä tiukasti kuin perinteisesti on tapahtunut. Samansuuntaista toimenpidesuositusta puoltavat innovatiivisille markkinoille tyypilliset verkostoulkoisvaikutukset ja kasvavat skaalatuotot. Tutkimuksessa onkin päädytty siihen, että esimerkiksi sitomista ja saalistushinnoittelua tulisi innovatiivisilla markkinoilla arvioida toisenlaisista lähtökohdista käsin kuin perinteisillä hyödykemarkkinoilla. Vastaavanlaisiin näkökohtiin törmätään arvioitaessa yrityskaupan sallittavuutta.

Kilpailunrajoituslakiin sisältyy muitakin muutostarpeita. Esimerkiksi kilpailunrajoituslain tavoitteita luotaavaan 1.2 §:ään olisi harkittava mainintaa innovatiivisuuden edistämisestä; lain 12.1 §:ssä mainittuun de minimis -sääntöön olisi harkittava vastaavanlaista mainintaa varsinkin ellei lain alkuun sisällytetä mainintaa dynaamisesta tehokkuudesta; lain 19 a §:n mukaisen puuttumattomuustodistuksen soveltamisalaa voitaisiin hyvinkin laajentaa koskemaan kieltoperiaatteen alaisten kilpailunrajoitusten ohella määräävän markkina-aseman väärinkäyttöä ja lain 9 §:ssä säädettyä väärinkäyttöperiaatetta. Näiden "kotikutoisten" toimenpiteiden ohella kilpailupolitiikan vakautta olisi omiaan lisäämään tiiviimpi yhteistyö EU:n puitteissa. Tältä osin suositeltavaa olisi kilpailuoikeudellisia ongelmakohtia koskevien ohjeiden laatiminen.

Taloudelliset ohjauskeinot innovaatiokannustimena

Lukuisa joukko tutkijoita on korostanut, että taloudellinen ohjaus ympäristönsuojelussa edistäisi innovatiivisuutta paremmin kuin perinteinen hallinnollinen ohjaus. Hallinnollisen ohjauksen dynaamisen tehottomuuden on katsottu johtuvan etupäässä epäsymmetrisen informaation ongelmasta: lainsäätäjällä sen paremmin kuin ympäristöviranomaisilla ei ole tarvittavaa tietoa ympäristönormien virittämiseksi tasolle, joka edistäisi innovatiivista toimintaa. Toisaalta kuormittajilla ei ole kannustinta paljastaa tätä informaatiota: jos he nimittäin kertoisivat viranomaisille uusista innovaatioista, se "palkittaisiin" ainoastaan kiristämällä ympäristönormeja.

Sen sijaan taloudellisessa ohjauksessa kuormittajilla on katsottu olevan intressi

innovaatioiden kehittämiseksi ja käyttöönottamiseksi. Esimerkiksi ympäristöveroohjauksessa uudet, kuormituksen vähentämiseen johtavat innovaatiot merkitsevät kuormittajille sitä, että heidän ympäristöverorasituksensa vähenee. Vastaavanlaisen kannustimen on katsottu sisältyvän muihinkin oikeaoppisesti laadittuihin taloudellisiin ohjauskeinoihin, kuten päästökauppaan ja ympäristötukiin.

Taloudellisen ohjauksen dynaaminen tehokkuus ei ole kuitenkaan läheskään niin yksinkertainen asia kuin yllä kuvataan, kun otetaan huomioon oikeudelliset yksityiskohdat ja ohjauskeinojen täytäntöönpano. Asia on hahmotettavissa hyvin Suomen ympäristöverokäytännön valossa. Samalla useat tällöin esille nousevat näkökohdat tarjoavat viitteitä siitä, minkälaisiin sudenkuoppiin muussakin lainsäädännössä saatetaan törmätä.

Ensinnäkin tärkeässä asemassa on se, millä aikavälillä ympäristöverouudistus pannaan täytäntöön. Hyvin lyhyen aikavälin soveltaminen on omiaan johtamaan siihen, että kuormittajat omaksuvat vanhoja teknisiä ratkaisuja. Toisaalta aikavälin venyttäminen johtaa helposti siihen, ettei uudistus kannusta kuormittajia lainkaan toimenpiteisiin, koska kuormittajat eivät välttämättä enää usko, että ympäristöveroja säädetään voimaan. Näin ollen lainsäätäjän on tasapainoiltava näiden kahden vaihtoehdon välillä.

Toiseksi ympäristöverouudistuksessa ongelmia on omiaan aiheuttamaan oikean verotason löytäminen. Tässä yhteydessä on varsinkin taloustieteilijöiden taholta suositeltu iteratiivista menettelyä. Se johtaisi kuitenkin tempoilevaan verotasoon ja epävarmuus kuihduttaisi kannustinta innovaatioiden tekemiseen ja käyttöönottoon. Niinpä esimerkiksi progressiivinen aikataulustrategia, jossa vero nostetaan vaiheittain aiotulle tasolle, on suositeltavampi vaihtoehto.

Osin verotasoon liittyen ongelmallisena on pidettävä eräissä tapauksissa verokantarakennetta. Suomen energiaverotus sisältää tältä osin useita kritiikille alttiita elementtejä. Esimerkiksi teollisuuden sähköverokantaa on alennettu muihin toiminnanharjoittajiin verrattuna; energiaintensiiviselle teollisuudelle on suunnattu oikeus merkittävään veronpalautukseen maksetuista energiaveroista; lisäksi eräiden energiahyödykkeiden verokannat eivät ole ainakaan ympäristöpoliittisesta näkökulmasta johdonmukaisesti määrättyjä.

Liityntäperiaate on yksi kulmakivi ympäristöverotuksessa. Sen mukaan ympäristöveron suuruuden ja perusteen tulisi olla kytketty elimellisesti säänneltävään ympäristöhaittaan. Tässäkin suhteessa suomalainen energiaverotus kaipaisi uudelleenarviointia, jos verotus halutaan todella säätää ympäristöperusteiseksi. Esimerkiksi sähkövero ei ota parhaalla mahdollisella tavalla huomioon sitä, kuinka paljon yksittäiset sähköntuotantotavat aiheuttavat päästöjä ympäristöön. Toisaalta aikaisemmin Suomessa sovellettu sähköntuotannon panosvero osoittautui siinä määrin ongelmalliseksi, ettei tähän — paremmin liityntäperiaatetta seuraavaan — lainsäädäntömalliin liene paluuta. Ympäristöveron määräytymisperusteeseen liittyvä sääntelyongelma on myös se, miten ympäristöverolla kannustetaan kierrätykseen. Tähän seikkaan on tartuttu Suomessa onnistuneesti esimerkiksi öljyjätemaksua koskevassa laissa.

Kattavuusperiaate on myös yksi hyvän ympäristöverojärjestelmän kulmakivistä. Toisin sanoen vero-ohjauksen on katettava kaikki ympäristöongelmien lähteet tie-

tyllä sektorilla. Tällä seikalla on toki merkittävä vaikutus muiden sääntelystandardien kannalta. Suomessa sovellettavista ympäristöveroista jätevero on tältä osin kritisoitavissa helposti. Jäteveron piiristä on nimittäin vapautettu merkittävä osa jätteistä siksi, että veron soveltamisalaan eivät läheskään aina kuulu teollisuuden yksityiset kaatopaikat. Tältä osin lainsäädännön muuttamisen tarve on akuutti.

Ympäristöverotuksen yhteydessä nousee esille myös kysymys oikeudellisen sääntelyn ja innovaatioiden vuorovaikutussuhteesta. Kysymys ei ole siis pelkästään siitä, että ympäristöveroilla kannustettaisiin uusiin innovaatioihin, vaan myös ympäristöverolainsäädännön sopeutumisesta ja sopeuttamisesta uusiin innovaatioihin. Erityisesti liikennepolttonesteiden veroporrastukset edustavat tilannetta, jossa ensiksi polttonesteiden kehityksessä tehdään ympäristön tilaa kohentavia teknisiä ratkaisuja, minkä jälkeen lainsäätäjä on säätänyt ympäristöystävällisemmälle polttoainelaadulle alennetun verokannan puhtaamman polttoaineen käytön edistämiseksi. Kysymys ei tällöin ole siis siitä, että lainsäädännöllä kannustettaisiin itse innovaatioiden tekemiseen vaan pikemminkin näin pyritään edistämään uusien tuotteiden diffuusiota.

Hyvin keskeinen ongelma kotimaamme ympäristöveropolitiikassa — erityisesti energiaverotuksessa — on ollut lainsäädännön tempoilevuus. Energiaverolainsäädäntö muuttui viime vuosikymmenellä lähes vuosittain ja aika ajoin kysymys oli erittäin merkittävistäkin rakenteellisista muutoksista. Jos ympäristöverotuksella halutaan ohjata toiminnanharjoittajia innovaatioihin, tarvitaan huomattavasti vakaampaa oikeustilaa. Tämä vaatimus on luonnollisesti relevantti koko oikeusjärjestelmää ajatellen.

Ekskursio: Immateriaalioikeudet

Tutkimusta varten tehdyssä kyselytutkimuksessa ilmeni, että yritykset ja etujärjestöt pitivät immateriaalioikeuksia koskevaa oikeustilaa pääosin tarkoituksenmukaisena. Toisaalta kriittistä huomiota kiinnitettiin eräisiin lainsäädännön yksityiskohtiin:

- työsuhdekeksintöjä koskevaa lainsäädäntöä olisi aiheellista kehittää; toisaalta kehittämissuositukset olivat osin ristiriitaisia;
- tietokoneohjelmien suojaamiseen kiinnitettiin myös huomiota; osa vastaajista oli sitä mieltä, että nykyinen tekijänoikeus on riittävä suojakeino, kun taas osa vastaajista vaati, että tietokoneohjelmat olisi säädettävä patenttilainsäädännön alaisuuteen;
- patenttilainsäädäntöä vaadittiin yhdenmukaistettavaksi yritysten ja yliopistojen välillä;
- lisäksi immateriaalioikeusjuttujen käsittelyä varten vaadittiin oman erityistuomioistuimen perustamista.

Yllä mainitut yksityiskohdat osoittavat jo osaltaan sen, että immateriaalioikeuksia koskeva tematiikka muodostaa siinä määrin laajan kokonaisuuden, että niitä varten tarvittaisiin oma innovaatiotutkimuksensa.

Kokoavia näkökohtia

Lakeja säädettäessä on aikaisempaa enemmässä määrin kiinnitettävä huomiota siihen, miten sääntely vaikuttaa innovaatioiden kehittämiseen ja leviämiseen. Politiikkasuosituksena onkin, että lainvalmistelun yhteydessä otettaisiin mainittu seikka aina huomioon osana lain taloudellisten vaikutusten erittelyä. Nykyisinhän tähän puoleen esitetyn lainsäädännön vaikutuksia on kiinnitetty huomiota vain sattumanvaraisesti. Näin ollen hallituksen esityksissä uudeksi lainsäädännöksi tai lakien muuttamiseksi olisi esimerkiksi taloudellisten ja organisatoristen vaikutusten ohella analysoitava, mikä vaikutus uudistuksella on innovaatioiden kehittämiseen ja diffuusioon yhteiskunnassa.

Lisäksi on pyrittävä seuraamaan lain voimaantuloon jälkeen ainakin yksittäistapauksissa sitä, miten lainsäädäntö tosiasiallisesti on vaikuttanut dynaamisen tehokkuuden näkökulmasta. Ylipäänsäkin vastedes on paikallaan korostaa empiirisen tutkimuksen roolia jo sen vuoksi, että tämä lähestymistapa on jäänyt tähän mennessä hyvin vähän viljellyksi osaksi innovaatiotutkimusta. Vaikutusanalyysin tarvetta korostaa sekin, että teoreettiset näkemykset puheena olevasta asiakokonaisuudesta ovat olleet useinkin ristiriitaiset.

Eräs tutkimuksessa keskeisesti esiin noussut seikka on optimaalisen työnjaon määrittäminen lainsäätäjän ja lain soveltajan kanssa. Huomioitaessa se, kuinka dynaamisessa maailmassa tänä päivänä elämme, lait jäävät vääjäämättä epätäydellisiksi, ja tuomioistuimet sekä muut lakia soveltavat viranomaiset joutuvat tosiasiallisesti vastaamaan lain säätämisestä. Yksi ongelmista palautuu tällöin maassamme sovellettavaan oikeuslähdeoppiin. Reaaliset argumentit eli seuraamusargumentit, joihin innovatiivisuuden huomioiminenkin kuuluisi, ovat vasta viimekätisiä oikeuslähteitä lakia tulkittaessa. Ennen reaalisia argumentteja sijoittuvat muun ohella lakiteksti, lainvalmistelutyöt ja tuomioistuinratkaisut. Huomioon on otettava myös, että reaalisten argumenttien kanssa samalla sijaluvulla on lukuisa joukko muitakin oikeuslähteitä, kuten oikeustieteessä esitetyt kannanotot ja oikeusperiaatteet. Lisäksi voidaan kyseenalaistaa, onko tuomioistuinlaitoksen edustajilla parhaat edellytykset tehdä oikeudelliset ratkaisut siten, että ne edistäisivät parhaalla mahdollisella tavalla innovatiivisuutta. Pikemminkin sanotunlaisten argumenttien ottaminen vakavasti varteen oikeudellisessa ratkaisutoiminnassa luo paineita siihen, että päätöksenteosta huolehtivat erityisasiantuntemusta omaavat viranomaiset. Näin on tapahtunutkin olennaisessa määrin esimerkiksi kilpailu- ja ympäristöoikeudessa.

Yllä mainittuun kysymykseen liittyy olennaisesti se, kuinka joustaviksi oikeusnormit säädetään. Mitä joustavampia normit ovat, sitä enemmässä määrin tosiasi-

allinen lainsäädäntövalta on delegoitu lakia soveltaville tuomioistuimille tai muille viranomaisille. Joustavia oikeusnormeja voidaan puolustaa erityisesti sillä, että ne sopeutuvat paremmin ulkoisissa olosuhteissa tapahtuviin muutoksiin, kuten tekniseen kehitykseen. Yksityiskohtainen lainsäädäntö laahaisi helpostikin teknisen kehityksen jäljessä ja voisi hyvinkin jarruttaa innovaatioiden tekemistä ja leviämistä yhteiskunnassa. Tässä valossa on ymmärrettävää, että esimerkiksi kilpailuoikeus rakentuu joustavalle sääntelylle. Jokaisella oikeudenalalla ei kuitenkaan pitkistä oikeudellisista perinteistä johtuen ole mahdollista siirtyä kovinkaan joustavaan sääntelyyn. Tämä koskee esimerkiksi rikos- ja vero-oikeutta, joilla aloilla legaliteettiperiaatteella on keskeinen asema.

Tärkeä sääntelyongelma on vielä se, pitäisikö oikeudellinen sääntely eriyttää innovatiivisten sektoreiden ja savupiipputeollisuuden välillä. Monista potentiaalisista epäkohdista johtuen tässä suhteessa lienee paikallaan olla varovainen. Näin ollen esimerkiksi kilpailuoikeudessa joudutaan luottamaan siihen, että kilpailuviranomaiset pystyvät ottamaan puheena olevat näkökohdat lakia sovellettaessa riittävässä määrin huomioon.

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