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Discourses of Ecology and New Biotechnology in the Finnish Forest Sector – Combining Old Structures and New Technologies

Marja Häyrinen-Alestalo, Karoliina Snell & Tuula Teräväinen
University of Helsinki, Department of Sociology, Research Group for Comparative Sociology

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1. Introduction

This paper examines the development and adaptation of new biotechnology in the Finnish forest sector by focusing on the changing role of this sector among the key national economic sectors, on the introduction of biotechnology into specific processes of forest industry and methods of forestry, on the old and new systems of governance, on the means of mediating various interests and on the enlarging responsibilities of the actors involved in the process. Forest biotechnology is a field where long existing structures, methods of forestry and technological processes of the paper and pulp industry are confronted by new challenges brought in by biotechnology. The interplay between old and new or existing and emerging is manifested in the use and adaptation of new technologies as well as in political and market relations, environmental public concern and activism and varying stakeholder relations. The paper provides an introductory analysis of the controversial public engagement in the issues of forest management that has pushed new ecological goals into forest policy. Thereafter an overview is presented of forest biotechnology, the actors involved and its governance. The study concentrates on three different spheres of governance: forest issues, forest biotechnology and hybrid uses of new technologies.

The analysis is based on written documents as well as interview data. The written material comprises documents produced by national authorities, universities and research institutes and industry primarily since the 1990s. Interviews have also been conducted among researchers, state officials and experts (including members of various biotechnology related boards, state financiers etc.) as well as representatives of the industry, business and NGOs. Some older data and interviews are also used to sharpen the story-lines in the goals of forest growing practices and forest industry. Current expertise and working areas of the interviewees are related to forest gene and bio-technology, biotechnology in general, as well as forest issues not directly linked to biotechnology.

2. The Interplay between Old and New Economy – the Changing Role of Forest Industry in Finland

Forests cover over 70% of the total land area of Finland. Customarily they have provided raw material for basic industries and formed the identity of the Finnish people. Forests have had an important impact on the early industrialisation and internationalisation of the national economy but they have also affected the social and cultural life of the inhabitants.

2.1. A Competition Between Old and New Industries

The forest industry was the leading export industry in Finland until the late 1990s when the ICT-sector took the lead. The structural transformation process has been very rapid in relation to international comparisons. In 1980 the pulp and paper industry share of of total industrial production was 30%, the respective figures being for the metal industry 23% and for electronics 4%. The ICT cluster started to rise in the 1990s, holding 18% of the total industrial production in 1995. The latest statistics illustrate the accomplishment of the structural change. In 2002 the forest industry share of production in Finland was 20% in comparison to 26% of the metal industry and 22% of the electronics and electrical equipment industry (Statistics Finland 1983; 1985; 1996; 2004). The statistics for export industries demonstrate an even more radical transformation: while pulp and paper industry dominated with a 44% share of

the trade with foreign countries in 1980, in 2002 the leader had become the electronic and electrical equipment industry with a 33% proportion.

Today Finnish economic and technology policy-makers tend to classify the most important sectors of production as clusters standing for centres of competence of producers, customers and competitors. The centres of competence have a strong economic and market orientation aiming at promoting efficiency, specialisation and competitiveness. They provide opportunities to step away from specialised lines of production and assist in the construction of national strategies for solving the problems of globalisation.

Even though the metal, ICT and forest clusters are considered the three supporting pillars of the Finnish economy, the technology policy-makers have doubts whether the forest and metal clusters are able to activate the establishment of the centres of competence in the future (Tekes 2002). Moreover, the new economy-type political explanations have introduced ICT-based visions of economic transformation where national economies are supposed to become more stable and less dependent on the fluctuations of the global markets (Castells 1996; European Union 1998). In the early 2000s the worldwide destabilisation of the ICT cluster also forced the Finnish policy-makers to reformulate the goals of national economic and industrial policy. Since then the idea of the knowledge-based economy has included aspirations of achieving a balance between the new and old economy (Mönkäre 2002). According to the revised goals of technology policy the share of innovations should be raised in the traditional industrial sectors. There is also a push to integrate mature technologies with new high tech fields through networks and collaboration between different types of technologies and areas of competence (Määttä 2001; Piironen 2003). Moreover, the representatives of industry have seen clusters cross over and the formation of new types of hybrid clusters to be necessary (Tekes 2002; Teollisuuden ja työnantajien keskusliitto 2000).

Despite the tendency to list the forest cluster into the old and mature industries, this cluster is still mentioned in the industrial and technology policy programs as one of the most promising productive clusters in Finland in terms of international competitiveness (Tekes 2002). In fact, its sphere is broad and in many cases highly modern, stretching from pulp processing, paper machine production, chemical industry, wood harvesting technology, construction from wood products, printing houses, automation, logistics and energy to research and development, automation and ICT, forest fertilisers, consultant services and risk management (Tekes 2002). In specific areas of expertise the Finnish forest companies are the leaders in global markets. They have also had an important role in the worldwide structural change resulting in the growth of large multinational companies.

2.2. The Forest Sector in the Middle of Transformation

Today the forest cluster is undergoing transformation process that is related both to changes in the global markets and to the increasing gap between old and new products. There is evidence that machine shops, chemical industry and services have been able to grow and renew their functions more rapidly than the core of the cluster, forest industry and forestry. However, in a recent analysis by the Confederation of Finnish Industry and Employers of the future prospects in the field, 100% of the experts saw the markets of the forest cluster to be different in the future (Teollisuuden ja työnantajien keskusliitto 2003). Asia, Eastern Europe and Russia will pose new challenges but also new market de-stabilisations. The European Union is expected to become a more powerful partner in the regulation of the forest sector. Even though the EU has not yet a specific forest policy, it has a strong impact on member country

forest policies through its agricultural, environmental and regional policies and through prospects of labour force. According to the Finnish Minister of Foreign Trade and Industry (Forest Academy of Finland 2003):

> The enlargement of the European Union will strengthen the forest sector, and the renovations in the core structures and tasks of the Union will have an effect on how the decisions of the forest sector issues will be made.

According to the Finnish analysis of the future prospects of forest industry, the basic materials and products are expected to remain mostly the same. The expected changes are in higher processing as well as in better quality and responsiveness to customer demands. Customer demands are mostly related to achieving a better paper surface and working out new fibre combinations. Also multi-colour printing and new digital printing techniques have been mentioned as new customisation possibilities. The large internationalised Finnish companies have increasingly concentrated their R&D on aspects such as development of paper surface, raw materials, runnability [is this a production or consumption feature?]and the environment (Stora Enso 2003a). They have not accepted criticisms from some foreign biotechnologists that the pulp and paper industry is not an innovative industry. They also have demanded that the enzyme bleaching technology should be controlled by EU directives in order to increase the innovativeness of the industry at the European level and to introduce cleaner manufacturing technologies (Ebeling 1998). The representatives of Finnish companies have also pointed to the advancing applications of biotechnology in the mechanical methods to produce papermaking fibres. Accordingly, biotechnology research today is carried out in order to decrease the expenditure of electrical energy in mechanical pulping.

The environmental issues that have penetrated the core of the cluster in the 1990s are also regarded in Finland as important in respect to production technologies, re-cycling of forest products and sustainability. Sustainability means in this case not only ecologically more advanced processing technologies and new innovations in the re-cycling processes, but also knowledgeable and ecologically responsible customers. These customers are conscious of the risks of the traditional rationalised forest growing methods and chemical processing.

Even though there is a growth of specialised small companies, the forest sector's main core in Finland is composed of three forest product companies: Stora Enso, UPM and M-Real. They are all large companies, Stora Enso and UPM being among the largest companies in the world. For example UPM has factories in 16 countries of which Finland, Germany, France, UK, Austria, USA, Canada and China are the most important. One notable aspect in the global structural reform of the 1990s is that due to centralisation and internationalisation over half of the research and development expenditure of the cluster occurs outside Finland. It seems also evident that this development will continue. Among others Stora Enso has five research centres that are located in Falun and Karlstad, Sweden; Imatra, Finland; Mönchengladbach, Germany and Biron, USA. In the view of the head of research of the Swedish group, Yngve Stade (Stora Enso 2003b):

> Even though the products being made of paper and board are not hot issues in the everyday life of the people, they make a huge contribution to the well-being and quality of life. They are based on renewable raw materials. The research group works in a very broad register. Both paper fibre and chemicals are on the nano scale and they are combined to make products on the macro level, kilometre long reels of paper produced at extreme speeds. This is a process that includes a range of high tech in biotechnology and ICT.

Customer demand becomes evident also in the shift towards a more functional structure in research. This change of focus indicates that aside from the demand for a greater efficiency

the researchers have a more intensive look at the products and at how they work in the customers´ processes.

3. The Story-lines of Goal Controversies in the Forest Sector

Currently there is a strong political agreement about the socio-economic value of the knowledge-based economy in Finland. Within this frame it is acknowledged that specific efforts are needed to guarantee the vitality and competitiveness of the forest cluster (Tekes 2002, Ministry of Agriculture and Forestry 1999). Policy-makers expect that the forest cluster is able to invest heavily on R&D, new products and services, and that the new technologies like biotechnology will serve as a key component in these efforts (Tekes 2002). Together with the representatives of industry they have noted that new biotechnology has not reached its major breakthroughs, even though the pulp and paper industry has made biotechnology innovations in bleaching, production of bulk enzymes and mechanical pulping since the late 1980s and forestry has applied biotechnology for the various phases of forest growing.

Before going further in our analysis of the actual and potential uses of new biotechnology in the Finnish forest sector and of their effects on the issues of governance and interest mediation between the various actors, it is worth paying attention to the changing idea of rationalised forestry and forest cultivation and to the agreements and tensions that have arisen between economy-driven techno-centric demands of rationalisation and softer eco-centric aims of sustainable development (Häyrinen-Alestalo 1998; O´Riordan 1981). These story-lines reflect conditions for a corporatist interplay but also forms of disagreement between the national political and economic systems and scientific community as well as critical queries for sustainable development from the side of forest owners, wider public and international customers. They also demonstrate how the Finnish tradition of consensual decision-making and top down educational programs can be shaken when the scientific community starts to disagree on the common goals and when the private forest owners and NGOs become sensitive to ecological issues. These controversies tend to push policy-makers and representatives of industry to search for ecologically reliable certifications for cleaner technologies and valid estimates for long-term effects of rationalised forestry. In this respect we can identify five major story-lines:

1. The Rise of Rationalised Forest Management and Manipulative Biological and Technological Forestry

The core of forestry is in applied science. The major developments have, however, been dependent on the advancements of natural and technical sciences. Originally the applied character of forest research has been strengthened through the demands of rapidly developing industrialisation and its increasing needs for woody material. In this respect the fear of a shortage of raw material has been the driving motive to rationalise forest cultivation and to add to raw material production. Therefore industrialisation redefined the tasks of forestry, and the use and investment value of forests suppressed the earlier values of recreation and culture.

In Finland rationalised forestry has been a long, state-led process that started in the 1880s with the aim of financing public forest research. Due to the opening of the Finnish industries to international markets the rationalisation efforts were used to apply the results of scientific research to forest products in order to collect capital and to manipulate and speed up the growth process of the trees that was slow due to its biological and genetic character. Also the

working processes of forest management were underdeveloped due to their low-tech content. Thus the biological and ecological roots of forest sciences started to move towards instrumental and technical knowledge aiming at minimisation of risk and regulation of production processes (Alestalo 1981; Häyrinen-Alestalo 1998). Market oriented rationalisation of the Finnish forest sector was a concept that was increasingly used by the policy-makers and representatives of industry. The first public authorities and interest organisations agreed also on the primary aims of rationalisation. These organisations were established to construct educational programs for the private forest owners to be able to fulfil the goals of the rationalisation process. In principle the farmers as the primary forest owners did not oppose the consensual ideas of rationalisation. Instead they were slow and lacked information on how to adopt the basic ideas and strategies.

2. Stabilisation of the Trust on the Goals and Methods of Rational Forestry

In the post-war period from the 1950s up to the 1970s Finland became increasingly responsive to international market demand. The war-debts to the Soviet Union pushed the pulp and paper industry to modernise its processes and its rise towards being the leading Finnish export industry began. Intense forestry was the primary strategy for action. A techno-centric intensification was seen to be necessary by all relevant actors. The state tried to meet the market demand and to promote the competitiveness of the forest sector by making short-term programs for rationalisation. The government launched among others the MERA-program in 1964 (MERA-ohjelma 1964) that was distilled from old ecological elements. It defined the principles and goals of intensification in the context of strained international competition. The public advisory organisations constructed their educational programs and guidelines for intensified methods of rationalisation for individual forest owners. Finally all partners had a strong trust in the new scientific methods of rationalisation in forest clearing, planting, fertilization and harvesting. The growing tree production was used as a criterion of effective implementation.

3. The Beginnings of Destabilisation: the Goals of Intensification Meet the Demands for Softer Technologies

The legitimisation of the rationalisation program of the forest sector became increasingly insecure in Finland in the 1970. Part of the mistrust was related to the growing criticism on the short-term goals of the overly rationalised methods of forestry that ended in many failures. Still the main policy goals emphasised efficiency in relation to international market demand. Market governance confronted, however, new demands from the welfare state ideology emphasising forest policy and forest economy as parts of a general state regulated social and economic policy (Metsäntutkimuskomitea 1960; Palo 1974). At the same time the collapse of the “green revolution” in the developing countries implied the first severe signs of a disorganised knowledge (Bertilsson 2002) and activated worldwide scientific and public discussion of the goals of an imperialistic science that is ready to destroy old local cultures and practices.

In the 1970s the Finnish forest policy-makers also started to discuss soft technologies, the necessary elements of human health and risks of over-rationalisation to the environment. The worldwide energy crisis forced both the policy-makers and forest researchers to re-evaluate the goals of forestry. As a result concepts such as “a comprehensive forest system”, “forests as renewable natural resources” and “destructive changes in the environment” were introduced in the terminology of forest policy (Academy of Finland 1973, 2). However, when

the energy crisis was felt to be over, techno-centric demands of rationalised forestry became evident once again. This led to a bitter scholarly battle between the Finnish techno-centric and eco-centric forest researchers. The battle continues even today. The representatives of rationalisation have accused the other side of producing wrong, heretical and affected research results and of making the scientific community dirty and a source of mystical populism (Kilkki 1983). The ecologically minded researchers in turn have paid attention to the many failures of techno-centric forest policy and to the links that technocratic researchers have to market-oriented forest industry (Lähde 1994; 2004).

The Finnish scholarly battle weakened the public trust in rational science and on its arguments of effectiveness. The critical scholars representing forestry, social and biological sciences started to get more visibility in the media and references were made to "the technological bluff" (Ellul 1990) and to the irrational characteristics of rationality (Beck 1994). The environmental NGOs started also to activate and to discuss the meaning of ecological rationality and the value of culture and nature. In this respect the national ecological and cultural value of forests became a key issue. It fused with moral and normative arguments for the limits up to which nature can be manipulated and its growth processes regulated (Häyrinen-Alestalo 1998). Aside from the ecologically minded researchers, NGOs and some forest owners began to oppose the artificial fertilization of forests and poisoning of forest insects, resulting in a cancellation of some large government poisoning efforts and the passing of new laws to regulate the use of these methods (Alestalo 1981).

4. The Growing Validity of Green Knowledge

Even though there is still turbulence between the rational and irrational elements in forestry and forest industry, many deliberative and responsive enlargements of policy began to find their place in the 1990s in Finland. The Finnish forest industry exports met overcapacity in the international markets and the economic depression had an effect on their competitiveness. These turbulences pushed these industries to become sensitive to the demands of ecological competitiveness. International agreements on environmental protection also forced the Finnish government to set regulations for re-cycling and to introduce environmental taxes (e.g. the Rio de Janeiro meeting in 1992). Moreover the European Union defined its guidelines for future policy by paying attention to the role of the European forests as one of the most important natural resources (European Commission 1996). Aside from a hardening pressure to produce products and services through a market centered approach and the primacy of the commercial utilization of forest products, the EU mentioned multidimensionality, multiple use and ecological, economic and social sustainability among the main aspirations of forest policy.

Concomitantly green knowledge (Jamison 2001) became a hybrid concept that in the form of sustainable development began to indicate a modern moral and ethical awareness. When it was brought into forest policy the tension between the techno-centric market-orientation and the idealized eco-centric future was not, however, solved. The Forest 2000-Program (Ministry of Agriculture and Forestry 1985) listed the following attributes that the policy-makers regarded as important to achieve the new moral requirements: sustainable development, sustainable competitiveness, sustainable development of forest resources, a balanced environmental protection to become more competitive and a significant enlargement of the forest economy (Ministry of Agriculture and Forestry 1995, 31-32).

The disorganization process of rational knowledge and the rise of green knowledge into a competitive factor were so powerful that both the Finnish government and industry took them seriously. Aside from new eco-labels and certifications, both the public and private sector actors accepted the pluralist demands of international and national NGOs and started to speak of environmental issues as a remarkable part of forestry and of the need to integrate economic thinking into the internationalization process and environmental knowledge.

5. Social and Ethical Responsibility Opening New Structures of Governance

In the beginning, the institutionalization of green knowledge strengthened the role of environmental NGOs and set demands for deliberative [?] bottom up models of policy-making. As in Denmark the institutionalization process helped to neutralise the most antagonistic activities from the citizen side (Jamison 2001) and made the decision-making processes move towards a more corporatist and consensual practices.

The latest developments in Finland demonstrate that despite the still continuing controversy between the pure market demands and their sustainable variations, the policy making process has become more open, responsive and deliberative in the forest sector. The National Forest Program 2010 (Ministry of Agriculture and Forestry 1999) has been made in cooperation with "all interested actors". There are also plans to implement, follow and develop the goals and recommendations of the program in the same democratic way. Moreover the program defines the roles of the state and industry. Concomitantly, the state is responsible for the promotion of the conditions of forestry, pulp and paper industry, environmental protection, R&D, education and the relevant infrastructure (energy and roads). Industry in turn is responsible to utilize the forests so that the long-term goals of sustainable development and the protection of forests can be guaranteed. As the multiple uses of forests are among the primary goals, the recreational activities of citizens have once again been brought into the agenda.

The rise of social and ethical responsibility has become evident especially in the industrial sector that under the pressure of sustainable market demand has started to elaborate programs of corporate social responsibility. The large Finnish forest companies serve as an example of how the process is going on today. A look at the yearly report of company social responsibility of UPM (2004) demonstrates how the Finnish forest companies are becoming more global and willing to engage in public dialogue. According to UPM, corporate social responsibility means that the activities and production of the firm are profitable and do not risk the well-being of people and environment. This kind of responsibility is a quality factor and part of everyday work. Highly qualified products and services tend to create customer satisfaction. Corporate social responsibility at UPM is reflected by the fact that the company is involved in Dow Jones´s World and EuroStixx indexes of sustainable development, accepts the guidelines of United Nations´ Global Compact Initiation, searches for possibilities of joint projects with UN´s developmental organization UNDP and takes part in the activities of the World Commission on the Social Dimension of Globalisation of the ILO. The efforts to be deliberate and aware of moral issues have been noticed internationally. In the words of David Kaimowitz, the head of international forest research institute Cifor (Iivonen 2004):

> The internationalization of the large forest companies, such as Stora Enso and UPM has advantages in the battle against the destruction of world forest. These companies are more responsible than the Indonesian and Chinese companies that act destructively themselves or buy wood from countries that destroy the forests.

The new corporate social responsibility seems also to indicate a responsive action to the national NGOs being worried of the wood material that is not produced in a sustainable way.

As such, UPM declares in its report to support the dialogue that took place in 2003 between the WWF Finland, the Finnish Association for Nature Conservation, local people and Metsähallitus (a state forestry enterprise). The hot issue was the protection of old forests in the northern part of Finland.

4. New Biotechnology Challenging and Disorganizing Knowledge of Forestry

In the forest sector green knowledge has been an integral part of both agonistic and deliberative public concern that is capable of changing the mode of governance and stabilizing interest mediation. Despite the longstanding division of forestry into techno-centric and eco-centric schools, green knowledge has comprised generic elements that through the principle of sustainable development have penetrated into different policy areas. Even in the context of increasing market demand, these generic elements have become increasingly important.

The applications of new biotechnology have many potential uses in different phases of production in forest, pulp and paper industry. The forest industry represents simultaneously old and new economy and utilises old and new technologies. However, according to the progressive idea of new technologies, biotechnology is generic by its nature. Biotechnology is also expected to enable cheaper, safer and more ethical products on a broad scale. In the context of growing market pressure policy-makers have regarded biotechnology as the next wave of the knowledge-based economy (European Commission 2002). It is thought to be a revolutionary productive force being global and generic at the same time. Due to many kinds of risks and complicated ethical problems, the issues of real and potential markets and true market value of biotechnology are, however, difficult to estimate (Häyrinen-Alestalo 2003). In fact, the markets cannot provide answers on how to balance risks with benefits. There is also evidence that due to public concern, the potential risks of genetic manipulation and gene transfer are dysfunctional for market demand. Due to the difficulty to regulate and estimate the final outcome of biotechnology applications, customer satisfaction becomes easily an irrelevant issue.

The applications of new biotechnology in the forest sector can be grouped into three different areas:

1. *Genetic manipulation of trees.* Manipulation is done in order to a) resist hazards and diseases or b) improve quality for production of paper (lignin, cellulose) or c) speeding up growth and improving yields.
2. *Modification of micro-organisms and enzymes* that are used in the industrial processes of removing lignin. The aims can be both in increasing efficiency as well as decreasing environmental harm and energy consumption.
3. Development of totally *new products* that are based on wood or by-pass products of industrial processes (biodegrading plastic, lubricants, edible vaccines).

All of these areas imply different risks, concerns and steps for responsible development and use of technology. The different risks are apparent for example because both the deliberate release of GM-organisms and the contained use of GM-organisms are involved. New enzyme biotechnology, which involves the contained use of GM-organisms, is being used relatively a lot in Finnish forest industry compared with many other countries (Laestadius 2000), but has

received little public attention. Because it is mainly dealing with contained use of GM micro-organisms, it is considered more acceptable than the deliberate release of genetically manipulated trees. Also the motives for using modified enzymes are more easily accepted as they include conserving energy and reducing hazardous waste.

In comparison to agriculture, genetic modification has been applied in forest breeding more rarely. Genetic manipulation of forest trees in particular is lagging behind. This delay is related to technical reasons. Forest trees have a long growth process from 50 to 80 years and woody plants are more difficult to manipulate with gene and biotechnology than those with a grass stalk. This applies especially to conifer trees that are the main resource utilized by the Finnish forest industry. The long-lasting experiments that are needed to find out the economically important properties of -trees have also had an effect to the slow use of gene technology. Moreover the application process from research findings to practice takes a long time (Mikola 2002). It is not possible to modify or regulate the living environment of forest trees to the degree that is possible in the case of grain and vegetables. All in all new biotechnologies are not able to provide any quick and radical solutions to the problems of forestry and forest improvement. Despite these peculiarities Finnish policy-makers have seen gene technology as providing new promises to speed up the breeding process of the forest trees and to make trees resistant to destructive insects (Ministry of Agriculture and Forestry 2002, 6).

The policy guidelines for the uses of biotechnology in the forest sector resemble those that have been launched for the environmental protection. In the principles of governance the issues of environment, human health and safety, customer demand, highly sophisticated products and sustainable use of natural resources are mentioned as the primary aims (Ministry of Agriculture and Forestry 2002). Much attention is also paid to the openness of the relevant activities and to the need for effective regulation.

The possibility to calculate the actual profit only after a minimum of 50 years has reduced the interest of the large Finnish forest companies to invest into the improvement of GM-trees. The expenses of biotechnological applications tend also to be expensive, making the industry sceptical of their commercial value. Therefore it seems that there is a growing gap between scientific results and their applications. During the institutionalisation of green knowledge the forest industry also became sensitive to public concern and since then is eager to speak of customer satisfaction. Up until today Finnish customers have been slow to discuss the problem of GM-trees. Therefore in this case customers are not so much Finnish but international customers like German and UK publishing houses that do not want to use paper made from GM-trees.

According to the GMO principle of Stora Enso (2004):

> Stora Enso has decided to refrain from any commercial use of controversial genetic engineering techniques on trees or any other organisms. Nevertheless, Stora Enso will continue to take part in basic research in this area in order to keep up to date with developments. This research will not lead to any commercial applications, however.

Aside from Stora Enso all major Finnish paper and pulp producers are refraining from the commercial use of genetic engineering of trees because of customer demand, but encourage or in some cases even conduct research in the area. M-Real has stated that it is not using GMOs or transgenic technologies in its products and is not doing research in the field. In a statement by UPM (UPM 2001) on the use of genetically modified organisms:

UPM will not use genetically modified wood raw material in its products until the safety of both the production and use of such material has been established by the authorities.

The statement mentions the modification of enzymes but does not take a stance on it. The company also encourages research in the field.

Even though Finnish forest companies have been rather uninterested in pursuing genetic technologies, they were involved in the introduction of genetic technologies to Finland. In 1980 a group for recombinant DNA technology was established in Finland. The aim was to introduce the new technology to the country and create a knowledge base for research. It was a state led effort that was hoped to be of utility to many fields. The research group included members from universities, the Technical Research Centre of Finland and the National Public Health Institute (Kuusi 1991: 22). The research that centred on the bacteria *bacillus* resulted also in the establishment of the first Finnish biotechnology company, Genesit. Here the forest industry comes into play as Genesit was owned by seven big state companies from a wide range of fields (forest industry, pharmaceuticals, chemical industry, food industry). The company, however, did not succeed. Its closedown in 1991 has been attributed to a number of factors: the bacteria's disappointing performance to produce enzymes, rapidly ageing work processes, over-emphasis on applicable results instead of basic research and the emergence of contradictions between commercial and scientific interests (Kettunen 2002, 22; Kuusi 1991, 22-23).

5. Forest Researches Facing New Responsibilities

Customer demand has led to a situation where the forest industry is encouraging universities and research institutes to do research on gene technology and take the responsibility for the field's future, but without getting their own hands dirty. While the industry seems to be responding to customer demands and concerns by abstaining from the applications of gene technology the research side is not expected to do so.

There is an ambivalent situation in Finland where future possibilities of forest biotechnology are highly valued and promoted and at the same time they are being pushed into the shadows and camouflaged. The scepticism towards forest related biotechnology is complemented by the hope it presents for Finnish industries, research and the national economy by both private and public investors. For example Tekes (the National Technology Agency) emphasises the importance of cooperation between forest and biotechnology cluster for the survival of forest industry (Tekes 2002) and private investors see high potential in the existing know-how of forest research and industry for the development of the Finnish biotechnology industry. Recent studies point, however, to a low success rate of Finnish biotechnology companies and to the need to establish coalitions between small and large enterprises and between international and national companies. For a better commercial success some authors have proposed hybrid production fields composing of forest, pharmaceutical, food production and environmental industries (Luukkonen 2004).

As for many applications, the realisation of products at least on a 50 years time horizon, the use of forest biotechnology is minimal and its issues have only slightly penetrated public discussion. The issues of forest biotechnology are hidden or shadowed in the political arena as well. The system of research financing provides also an example of the difficulties to raise

forest biotechnology to the agenda and create debate concerning it. The two main financiers of research – the Academy of Finland and Tekes - both have financed projects dealing with forest biotechnology. However, this research area falls at the margin of their systems. The Academy of Finland often considers forest related biotechnology projects to be too applied, but is at the same time wonders why there are so few project applications on gene modification and its risk evaluation. Tekes on the other hand requires industry cooperation and commercial potential of applications of research projects. Recent experiences that have also been of interest to the media indicate that the commercial potentialities have often been overestimated.

Researchers interested in GM-trees meet the issue of risk evaluation very early. In principle they agree on the attractiveness that genetic transformation offers to conventional tree breeding. They refer to the possibility to transfer specific traits into selected genotypes without time consuming breeding programs. However, several native tree species in Europe are threatened by alien gene introgression (Project proposal Meragen 2002, 4). Due to weaker reproductive barriers than many other plants, forest trees are prone to genetic pollution. Moreover, genetic manipulation of wind pollinated and wind dispersed forest tree species can have a great potential to disrupt natural community dynamics. Therefore the Finnish researchers point to a more acute need than in the case of many crop species to develop valid methods and procedures for the evaluation of ecological and environmental risks that are associated with the [such releases?]. Even though for example the European Council has launched a directive on deliberate release into the environment of GM-organisms, there is a lack of common risk assessment methods and the harmonisation of national legislation has not been completed. The definition of risk is also difficult resulting in scientific disagreement over which types of risks should be counted?and how sound [the releases?] are ecologically.

In the case of GM-trees researchers are confronted with an ethical framework that is normative and value-laden and not so much scientific in nature (Project proposal Meragen 2002, 23). Moreover, the requirements to preserve biodiversity, wild areas of nature and to accommodate the sustainable use of resources are ambiguous concepts and their exact links to the ethical and moral issues are difficult to identify.

In risk assessment Finnish forest researchers have been internationally recognised. They see as their national obligation to study national variations of forest trees that aside from the northern countries no other researchers can do. They also say that the increasingly strict regulations may prevent the development of basic research. Our interviewees ask for a wider understanding from the side of the government and the public for their efforts to find out something very basic that, however, can be validated only 50-60 years later. This national task leads to a problem of the national expertise that is needed to understand the new scientific advances in the field and take part in international discussion of the challenges and problems of these advances.

6. The Governance and Interest Mediation of Forests and Forest Biotechnology

It is rather difficult to construct a picture of the existing governance of forest biotechnology in itself. Therefore the governance of forest biotechnology is explored here firstly more indirectly. The (possible) stakeholders and issues of forest biotechnology belong not only to the system of governance of forest biotechnology but to two other, different but intertwined systems of actors, interests, processes, legislation and issues that can be grouped under the *governance of biotechnology* and the *governance of forests*. Forest biotechnology falls somewhere in between these two systems of governance and also outside both of these systems.

Governance of these two fields or domains is approached in this paper from various dimensions: Is the governance influenced by international or national initiatives? What are the roles and responsibilities of the various stakeholders and the public and how are these reflected in the different cooperative practices? What kind of relationship is there between the public and the political arena? In conclusion the characteristics of the two domains are contemplated in relation to the governance of forest biotechnology.

6.1 The Governance of Biotechnology – International Initiatives and a Passive Public

Biotechnology means here mainly the "non-medical and green" side of new biotechnology (biotechnology related to forests, agriculture, environment, energy etc.) and deals much with biotechnology covered by the Law on Gene Technology (377/95). It is applied in use, production and sales of genetically modified organisms. The law, like the rest of the governance and regulation of Finnish biotechnology is very EU-dependent. All major laws and regulating boards in the field are the result of EU directives. Researchers and other experts are, however, very aware of the developments in their field and are involved in many international committees and boards. Still they together with the interviewed decision-makers recognise that Finland by itself is a small player and does not really have any possibilities of changing the direction of development in biotechnology or its regulation.

The examination of the functioning of the two specific bodies that are dedicated to gene and biotechnology – the Board for Gene Technology and the Advisory Committee on Biotechnology – provides an insight into the relationship between public and political arenas and the role of the public in the governance of biotechnology (Häyrinen-Alestalo & Snell 2004). The Board for Gene Technology's tasks include processing applications and notifications of the use of genetic technologies, giving rules of procedure for complying with laws on genetics and making decisions on specific cases. It is the highest national authority on gene technology with members from four related ministries and an obligatory member with ethical expertise.

During its eight-year existence the reputation of the Board has suffered several blows. It has been accused of not working openly enough. One member of the Board has also been deemed biased and forced to resign. These cases show that the new boards and organs have not necessarily created new and open forms of functioning or mediating public opinions. Another example of this can be read in the revised version of the Law on Gene Technology (490/2000, 36 a §) that refers to the Board for Gene Technology being enabled to hold hearings of the

public when it deems it appropriate, but does not encourage this or propose any form of citizen participation.

The Advisory Committee on Biotechnology has been more successful in relating to the public. Its mission is to promote co-operation between officials, researchers and others working in the field, to follow discussion on biotechnology and to develop education and distribution of information in biotechnology. Members of the Advisory Committee are composed of state officials, representatives of the academia and industry as well as representatives of consumer, environment and animal rights organisations. Because of the relatively broad representation and goals of the Committee, it functions as a mediating organisation more clearly than any other board or organ devoted to biotechnology. Other organisations do not include lay members. However, the composition of the Committee reflects the consensual and corporatist nature of governance where the public is left to a marginal role and radically opposing opinions are disregarded.

According to all of the experts interviewed, public discussion in Finland about genetics and biotechnology is regarded as weak. It was also thought that the discussion from the citizen side is mainly conducted by the only Finnish NGO dedicated solely to resisting gene technology Kansalaisten bioturvayhdistys (Citizens' Biosafety Association). Other NGOs have had some campaigns about biotechnology, but none of them have had any permanent activity on the issues. The association is generally seen to be more of a nuisance than a constructive party of discussion and it is not represented in the Advisory Committee on Biotechnology.

Despite lacking an active and public role, the NGOs play an important role as the mediators of public opinion in the issues of biotechnology and involving them in the Advisory Board is seen as the only possible way to exercise public engagement. This means that the public arena is integrated into the political and official arena by corporatist methods. But as noted, this corporatist form of governance is highly selective.

Increasing international and EU pressure to engage the public and incorporate them in decision-making is however reflected in Finnish biotechnology governance. The Law on Gene Technology is currently undergoing yet another revision. The directive (2001/18) that has caused the revision emphasises public hearing in the decision-making. How statutory public hearings – and more deliberative form of governance – would take place is still debated. There have been some attempts both from the side of NGOs and the state to create forums for discussion about gene technology in the public arena. These efforts have been sporadic events with little results. As the few organised public hearings have been seen unsuccessful by all of the actors involved, it seems to the experts that consulting NGOs might be the only possible way to proceed. Public attitudes are therefore more often mediated to the decision-makers through surveys and consultations of NGOs.

Even though new socio-ethical issues are being introduced to the field as a result of the new biotechnology, the evaluation of risks and possibilities is mainly done – both in the public and private sector – by biotechnology and business experts which means that social implications and ethics of research and development are assessed by "enlightened experts" without the help of for example bioethical experts or lay opinions. Ethical responsibility of experts is performed so that the public becomes a passive population, whose concerns and needs have to be assessed (Häyrinen-Alestalo & Snell 2004, Snell 2002). In this mainly discretionary form of governance, responsibilities are concentrated to the hands of a few, and the merger of the

scientific and the political arena is overshadowing the interaction between the public and the political arena.

6.2 The Governance and Interest Mediation of Forests and Forest Biotechnology

There are many different kinds of interest groups and stakeholders connected to the forest sector. This makes the governance of forestry a complicated and multidimensional process. It is also a wide ranging process dealing with for example environmental and forest protection, quotas for logging, sustainable use and securing the survival of nationally important branch of industry.

In general, forests are of a big importance for the Finns. There are over sixteen times more forests per capita in Finland than in European countries on average and the governance of forestry is organised by the state through a number of laws and regulations. As has been noted above, Finland is rather corporatist in terms of its forest policies. Despite the globalisation of forest industry and the increasing importance of the European Union as a regulator of biotechnology issues, the state in Finland still holds a strong position in defining and implementing national forest policies as well as in leading and controlling the hierarchical structure of forestry institutions. Being the hierarchically highest institution within the forestry sector, the Department of Forestry at the Ministry of Agriculture and Forestry is responsible for the overall management of forest policies. In the last years it has had to strengthen co-operation with other ministries on biotechnology issues although the attempts to elaborate any coherent national biotechnology policy have been weak. There is, however, a common view of the different problems that biotechnology applications meet in industry, agriculture and forestry. The Ministry has also prepared a strategy for gene and biotechnology for the whole ministry in 2003 (Ministry of Agriculture and Forestry 2003). In the process NGOs and other interest groups were able to express their opinion. The process was criticised by the NGOs as they felt the time for preparing statements was too short and the impact of their opinions was seen to be too limited.

Finland has a special structure of forest ownership as private ownership accounts for over ¾ of the wood raw material used by the industry (Suomen Metsäyhdistys 2004). Roughly every fifth Finnish family owns some forest. The private ownership is divided over a broad spectrum of the population but the privately owned forests are mainly relatively small. Family ownership has also gone through a generational change that has brought along a change to the occupational structure of private ownership. Today about 80% of private forest owners are entrepreneurs, wage earners and pensioners and a growing part of them live in the cities. Other big forest owners are the state (about ¼ of the total forest area) and industrial companies (less than 10% of the area) (The Central Union of Agricultural Producers and Forest Owners 2004).

The structure of forestry governance is stated in a law in Finland. Institutions operating within the administrative sector of the Ministry of Agriculture and Forestry are Metsähallitus (a state enterprise responsible for the state holdings), the Finnish Forest Research Institute and the Forestry Development Centre Tapio (providing expert services to different organisations and institutions). The interests of private forest owners are run by 158 regional Forest Management Associations (FMAs) having nearly 330 000 members. The regional unions of FMAs form a link to the Central Union of Agricultural Producers and Forest Owners mediating between the Forestry Council and FMAs. Even though the private forest-owners

finance and administer the FMAs, their responsibilities are also stated in the law (Act 1998/1227). Also the duties of the Regional Forest Centres are defined in the same way (Act 1995/1474).

In comparison to other potential fields of biotechnology applications the variation of the stakeholders in the forest sector is broad including private forest owners and their interest organisation, state-led institutions, researchers and research institutes, companies, NGOs, entrepreneurs, the media and consumers. Various stakeholders have different positions in relation to forest biotechnology, depending on whether their operating environment is mainly within political or public sphere and whether they are involved with biotechnology directly or indirectly (Hagendijk & Kallerud 2003; MERAGEN 2002). The role of the public and the experiences of public engagement also differ from the specific biotechnology governance because the public is recognised to have many different roles in the forest issues. In the governance of biotechnology the attribution of different roles to the public does not mean that these different roles are taken as separate viewpoints in decision-making. Instead in the forest sector the needs and therefore the activity of the public – whether regarded as forest owners, citizens, consumers, human beings or as a population – are managed in an uniform way.

In the governance of forests, the public is placed in multiple roles that mean multiple interests. The interest organisations in the field are very well established. Finnish forest policies and regulations are regarded at the international level as progressive and Finland is seen as a forerunner in the field. Policies are influenced by international development and customers but much of the initiatives come from inside the country. Forest governance is also an established issue. The industry has had to deal with foreign as well as national NGOs and customers interested in environmental issues for decades. There are also many existing systems and structures created for the purpose of evaluating environmental risk and responsibility. In addition to established corporate, deliberative and educational forms of governance the agonistic tendencies are also established practices.

In addition to comprehensive national forest programs a number of local programs has been developed and the role of the public is emphasised especially in the local programs. Due to the varying interests of the stakeholder groups the preparation of Regional Forest Programs has, however, included some controversies. According to a recent survey (Metla 2004), especially environmental organisations, reindeer owner associations and representatives of tourism have criticised the Regional Forest Programs for not representing their interests well enough. The forest industry, the Forest Management Associations and the Forest Owner Unions, on the other hand, have seen these programs as being able to promote important objectives in forest issues. The representatives of forest industry and environmental organisations did not, however, consider each other as co-operative (Tikkanen *et al.* 2004).

Even though the participation of NGOs (especially environmental NGOs) and other interest parties in policy formation has been increased in the 1990s, this has not necessarily reduced conflict (Rantala 2002: 65-66; Hellström 2002; 2001). The controversies between the environmental organisations and "traditional" forest organisations (industry, forest owners and government) are even considered to have increased as a result of the process of making the National Forest Program (Kivinen & Paldanius 2002, 74). Citizen activism has however, created a system of governance, where the public and especially environmental NGOs play an important role and the responsibility becomes more dispersed than in the governance of biotechnology in other sectors. The issues at stake reflect the needs of many actors and a kind

of merger between the political and the public arena can be seen. However, this also means that the cooperative practices are very consensual.

Even though environmental organisations have been involved in the process of governing biotechnology much more actively in the issues of forestry than in the biotechnology sector and there are more deliberative forms of governance in use, there is a lack of public discussion on issues related to forest biotechnology. Controversies in the perceptions of biotechnology are mainly found within the scientific debate. In the political sphere, there are certain arenas for discussions on forestry and forest biotechnology. For example Päättäjien metsäakatemia (Decision-makers Forest Academy) has been a forum of discussion for decision-makers since 1996. However, the public discussion is still primarily focussed on forest management and utilization from an ecological point of view. Neither the forest management associations that promote the interests of private forest owners, nor Metsähallitus, representing the state´s interests, have expressed a clear position in relation to biotechnology in forestry. It seems that the issue has not yet gained enough attention in Finland to become a subject of wider public discussion.

7. The Problem of Democratic Representation

As forest biotechnology and its governance lies in between (and outside) the two spheres of governance, the issues of interest overlap those of biotechnology and more general-oriented forest sector. There are also many common stakeholders for the two systems that therefore should potentially belong to the governance of forest biotechnology. However even though in theory the issues of forest biotechnology should overlap the two spheres, forest biotechnology has not penetrated deep into the two systems of governance or formed a separate and coherent system of governance.

In relation to citizen representation the situation is still in a process of development. The increasing processes of law and regulation making are seen by the relevant authorities to belong to the frame in the representative democracy. Only a selected number of actors need to be invited to the preparation process. The authorities also wonder how the citizen hearings on the EU- and national level will actually be realised when the new law of biotechnology will be passed. Despite the efforts to make the participatory forms of democracy more stable, the non-existence of the discussion on biotechnology can be noted in the forest sector. For example the National Forest Program (Ministry of Agriculture and Forestry 1999) sets the main national goals for a number of issues for the following ten years: i.e. logging, forest protection, societal responsibility and sustainable development. However, although these elements have also been mentioned in the EU and Finnish documents as the intervening components in forest biotechnology, biotechnology or genetic technologies are not mentioned in the program. As part of the program a “Future Forum“ has been established where stakeholders in the relevant biotechnology sectors can discuss future scenarios of the forest sector. Even here the discussion has not yet reached biotechnology. The actors involved in the discussion explain the lack of gene and biotechnology debate first of all by consensual cooperative practices – the issues are not brought on the table because everyone knows a consensus would be difficult to reach. Another reason is that the applications of biotechnology are regarded to be so far in the future that there are more pressing problems to debate.

Especially in the Finnish forest cluster, the dependency of global markets and export industries together with the experiences of the Finnish forest industry of international expansion have forced the major companies to re-evaluate their attitude towards new biotechnology. In the global markets the decline of market demand has become visible during recent years. There is also a tension between the attempts of the government and labour union to keep the industrial labour force in Finland and the increasing efforts of major Finnish forest companies to establish companies in Asia, Russia and South America. Currently there is talk about a China phenomenon in Finland, where the Finnish forest companies can serve as an example of what forms of participatory democracy this structural change in national and global economies might mean.

When the Finnish forest industry is reluctant to participate openly in projects dealing with gene technology especially, the industry is highly responsive to international public concern. On issues of globalisation, the international NGOs have taken power from official supranational organisations and nation-states and the move from environmental issues of forestry to the issues of forest biotechnology is only a question of time. There are new combinations of international and national public concern that makes the position of the NGOs increasingly powerful and the discussion of the relevant global and local forms of democracy more acute.

Two examples from the public mistrust that the large Finnish forest companies have met in the course of globalisation can serve as an illustration. The first case refers to the efforts of UPM to acquire shares in the local paper and pulp industry in Indonesia. Very soon the international Friends of the Earth became interested in this plan and took local Indonesians to Finland to tell them about the local environmental damages and human rights problems. In the company yearly meeting in Helsinki the Finnish activists demanded UPM to withdraw from this project for moral reasons. Even though UPM in the beginning resisted these demands, it finally cancelled the project because of accountability problems and the unstable political situation in Indonesia.

Another case is the story of Stora Enso and its desire to buy half of the local Veracel-company in Brazil. A part of the agreement comprised the eucalyptus-tree plantations. At once the World Rainforest Movement intervened in the project starting a campaign against single-tree species plantations. Later on it required the postponement of the project until there is evidence for an open citizen discussion of its effects on the environment and local people. Soon a group of international citizen associations demanded that the European Investment Bank should not to finance the Brazilian factory. Also a local citizens association resisting the “green desert” requested the Brazilian government to freeze the project (Baer 2003).

These examples demonstrate very well the power of global strategies for citizen mobilization that go beyond the traditional conceptions of international market demand. The Finnish forest companies have been among the forerunners in the complex issues of participatory democracy. Therefore they know from experience the process of public concern and have been slow to start the discussion of shared responsibilities in the case of forest biotechnology. The examples above also illustrate the small scale where the national forums can be active without forming coalitions of other local and international distrust channelling groups. As such the characteristics of a modern scientific citizenship are therefore not only related to a growing mistrust in the advancements of new technologies. They are in a complicated way linked to the process of globalisation and reflect a tension between the international pressure

for market expansion and the practices of local cultures that can be progressive or totally destructive.

On the national level it is, however, important for the decision-makers and industry to discuss common objectives and the relationship these objectives have to a global awareness of the advantages and disadvantages of new biotechnology. When GM-trees are mentioned as a potential focus of biotechnology, the social and ethical aspects should be integrated into the scientific, environmental and economic dimensions of forest biotechnology in order to elaborate new goals for forest policy. On the other hand, it remains to be seen what kind of scientific citizenship is needed in Finland where there is the legal right for every citizen to move about freely in the forests and to pick up wild berries and mushrooms on somebody else´s land. How can the Finnish people know what will happen to this everyman right of recreation in a forest that is growing GM-trees?

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