University Culture – Quo Vadis?
Prospects of Environmental Science–Policy Interface up to 2020

Petri Tapio, *Finland Futures Research Centre, University of Turku, Korkeavuorenkatu 25 A 2, Fin-00130 Helsinki, Finland. Corresponding author's e-mail: petri.tapio@utu.fi*

Johanna Kohl, *VTT Technical Research Centre of Finland, Technology Foresight and Assessment*

Sarianne Tikkanen, *Department of Social Research, University of Helsinki, Finland.*

Sofi Salonen, *Finland Futures Research Centre, University of Turku, Korkeavuorenkatu 25 A 2, Fin-00130 Helsinki, Finland.*

Abstract: *From the environmental point of view, science has, basically, had a three-fold role. First, the use of scientific research and knowledge in techno-economic development is one of the reasons for environmental problems. Second, scientific knowledge is needed to detect environmental changes and, third, science can innovate and produce ways of ameliorating the problematic changes. Each role has something to do with the relation of science (research and education) to the rest of society and to nature itself. Currently, the roles of science and universities are becoming increasingly complex as the traditional autonomy of universities seems to decrease. We define four possible roles – observer, sub-contractor, agent of societal change and a context dependent, changing role. Different roles are nourished in different university cultures which seem to be in a transition. Is the university moving from an autonomous and hierarchical Temple of knowledge to an open, client-oriented Bazaar? Or are we heading from an autonomous and open Oasis of free thinking to a production-based Factory? A Delphi study consisting of interviews with environmental experts in Finland suggests that the university culture operated in the Temple manner in 1990 and had moved towards the Factory by 2005. The study also reports the environmental experts' views of the probable and preferred future development up to 2020. We grouped the views with cluster analysis of the responses. The images of the future differ strongly, since one cluster of responses projects the strengthening of the Factory mode, three clusters envision variations of the Bazaar and two the Oasis. The paper concludes by making a Strengths Weaknesses Opportunities Threats (SWOT) analysis of the different university cultures. We conclude that environmentally best practices are generated in the borderline between the Bazaar and the Oasis.*

Key words: *Science-policy interface; university culture; transdisciplinarity; Delphi method; environmental policy*

1. Introduction

1.1 Science as Contributor, Detector and Mitigator of Environmental Problems

From the environmental point of view, science has, basically, been a double-edged sword (see e.g. Yearly 2004). On the one hand, the use of scientific research and knowledge is one of the reasons for environmental problems. Indeed there have been claims by powerful philosophers of science such as René Descartes and Francis Bacon concerning human mastery of nature. Indeed nature has been seen primarily as a source of material production. Indeed scientific progress has had a huge impact on technological development which together with economic incentives has led to both a more extensive and intensive use of natural resources throughout the globe with no concern about the ecological impacts (e.g. von Wright 1986).

On the other hand, scientific knowledge is needed to detect environmental changes and ameliorate the problematic changes or risks of problematic changes in the future (Yearley 2004). A massive research effort has led to the discovery of the ecological problems of many chemicals, acidification, and ozone depletion or making the theory of climate change plausible, to mention but a few. Moreover, especially technical and social scientific research have been performed to get knowledge on ameliorating environmental problems. Hence, many science-based inventions are now widespread, such as developing less harmful chemicals, ozone neutral compounds, sulfur emission reduction machinery, carbon dioxide emission trade systems and the like.

Research is, of course, only one side of the coin. The second task of universities, i.e. education, also has an important role to play concerning how professionals are trained and reconstructed. How are environmental issues dealt with in education: Are they seen as a discipline of environmental scientists or belonging to every discipline? The question is crucial in two ways: First, the daily routines of universities can be more or less environmentally sound, such as energy or paper consumption, the acquisition of materials, construction plans etc. Second, environmental issues can be more or less integrated into course materials. There may be courses and sub-disciplines of, for example, environmental anthropology, environmental economics or environmental biology. Going further, the basic axioms of the specific disciplines might be questioned and reconsidered on environmental grounds, the discussion between environmental and ecological economics is a good example (for an empirical study, see Illge & Schwarze 2008).

The roles of contributing to, detecting and ameliorating environmental problems have all something to do with the relation of science (research and education) to the rest of society and to nature itself. If and since science contributes to the production and solving of environmental problems, where will it find, derive or discover the goals and means to do so? (See Yearly 2004.) Is it the concern of each researcher and teacher, university administration, the students or stakeholders outside university? Currently, the roles of science and universities are becoming increasingly complex as the traditional autonomy of universities seems to decrease. We will first turn to examine this development. Thereafter, we will review the internal pressures for increasing participation and democracy within universities. The external and internal pressures are drawn together in the theoretical framework presented in section 2. It consists of four different university cultures based on Beckman's (1989) categories. In the results section, we present views about the future development of the university culture expressed by environmental professionals in Finland. We conclude by making an environmental Strengths Weakness Opportunities Threats (SWOT) analysis of the different university cultures.

1.2 External Pressures to Universities

Beyond the environmental debate, other pressures for change in the traditionally autonomous role of universities[1] have increased during the last couple of decades. Calls for increasing the returns on investment have been made also in the case of the previously more autonomous institutions: If tax-payers' money is allocated to academic research and higher education, there should be efficiency improvement over the years, that is to say more output in terms of Master's and Doctoral degrees, and more scientific publications per monetary input. Simultaneously, funding comes increasingly from other sources than the basic government budget allocated by the Ministry of Education (or the like). Privately owned universities and increasing student fees are one solution, external funding for projects another. More and more project based funding is gathered from the foundations, the European Union and

national research funding organizations. These pools are a field of tough competition. As for education, employer-paid courses and seminars have increased (Beckman, 1989; Hölttä and Malkki, 2000; Nowotny, 2005; Czinkota, 2006).

In addition to the quantitative output of degrees or publications, calls for retargeting the qualitative content of scientific work to societal purposes have been made. Science[2] is one of the factors of production in the information society and a better utility value of education and research would serve the economy (Czinkota, 2006). The other side of the economic emphasis is represented by increasing calls for science to be more responsible. Scientific progress in certain areas of technology and the medical sciences has raised a number of ethical questions for example whether some limits to academic freedom or economic utility seeking should be set by environmental and other legislation. (Verbitskaya, 2002; Yearley 2004; Nowotny, 2005).

1.3 External Influence and Environmental Sciences

There is more to the ethical discussion than simply hindering the progress of science. It is about the values and more practical goals which are to be strived for in knowledge construction. These values and goals need not to be economic. Indeed, the environmental research and education provide information for practical and strategic tools for environmental protection as has been stated above. Cost-benefit and cost-efficiency analyses are only some criteria for choices. How should we take the diverse values, theories and interests into account? How should we 'import' and 'export' relevant environmental policy aspects into and from research and education? (Tapio, 1996; Sarewitz, 2004; Yearley, 2004; Lövbrand and Öberg, 2005; Tapio and Willamo, 2008).

Four basic ways of seeing the relations between the environmental sciences and society may be outlined (Table 1; see also Jasanoff, 1990; Heiskanen, 1999; 2006; Nowotny et al., 2001; Oreskes, 2004; Yearley, 2004; Lövbrand and Öberg, 2005; Pohl, 2007). First, science and society may be seen as categories which are mutually exclusive and isolated. For example, basic research may be made about the effect of increased carbon dioxide emissions from transport to radiative forcing inducing climate change. Second, environmental science can be regarded as an agent changing society towards more environmentally sound practices. It may, for example, reveal the power structure maintaining the transport sector's dependence on fossil fuels. Third, environmental science may be considered a subcontractor of studies giving direct input into decision-making (Quevauviller et al., 2005). For example, alternative strategic transport scenarios may be constructed including various policy measures to reduce emission levels. Fourth, the borderlines between science and society are seen to diminish so that scientifically relevant knowledge is created not only by scientists but also by other actors, such as politicians, administration, mass media, lay-people, indigenous people, etc. (Brown, 2002; Sarewitz, 2004; Heiskanen 2006; Coburn, 2007; Pohl, 2007; Kohl, 2008). In the last view it becomes very complex and case-specific as to who is producing knowledge, who takes part in policy-making; who is on the demand side and who on the supply side. For example, futures workshops and Delphi studies engaging various academics, other experts and lay people to express their views on transport emissions in a dialogue might be organized (e.g. Tapio et al. 2009).

It seems that the demand and supply sides of knowledge production have become more complex: we have different roles in different contexts and knowledge is weakly or strongly context-dependent (Nowotny et al., 2001; Yearley, 2004; Kohl, 2008). This is where a core challenge hides in sustainable development: from segregation to integration where there is room for both specialists and generalists. The challenge calls for cross-sectorial functions, inter-

Table 1: *Four possibilities in the target setting and information flow of the environmental science – policy interface.*

Role of environmental science	Environmental policy target setting	Direction of information flow
Outsider	Outside science	No information flow
Agent of societal change	From science to society	From science to society
Subcontractor	From society to science	From science to society
Changing role	Complex, context dependent	Complex, context dependent

disciplinary connections and networked education where all parts of sustainable development are taken into account. Legitimizing knowledge in expertise has been losing ground to a variety of expert roles (Bauman, 1987).

1.4 Internal Pressures

Above, we reviewed the common external pressures on universities to encourage them to have a more open and interactive role with the rest of society and the discussion regarding environmental sciences in particular. It seems that there has been an evolution from traditional autonomy towards an increasing mixture of contextual case-specific roles. This seems to be the case especially in Western Europe and applies well to our case, namely Finland. According to Karran (2007), Finland has maintained academic freedom because of the constitutional autonomy of universities.[3] However, the criteria were based more on formal legislation and less on informal socio-economic relations, such as actual freedom of speech, and budgetary and external funding. It seems that the latter has been changed as will be shown in the results section. Leaving this discussion aside for a moment, we now move on to the internal pressures found in universities which seem to be less often discussed within environmental sciences.

An important norm in science since Merton's declaration of "universalism" has been that everybody has the right to express their views. However, there has been an internal hierarchy among scientists which has only been reduced in recent decades (Yearly, 2004). One of the megatrends in Western societies has been increasing citizen participation in planning and decision-making (Naisbitt, 1982; Bell, 1997). According to the proponents of discursive (or later, deliberative democracy), citizen participation is a crucial part of environmental policy (Dryzek 1994; 2005; Baber 2004). Universities have not been immune to this development either - claims and steps towards the democratization of the decision-making processes within universities have been stated. The stakeholders that should be taken into account vary according to the authors. Some would have a leading group of senior professors instead of a single university chancellor, this has happened at Nottingham University (Boyett, 1996); some wish more to give power to the faculty professors over deans in the U.S.A. (Willing et al., 2004); some emphasize each professor's and each department's rights to decide upon their own use of funding and school of thought, examples can be found in Canada, the USA and Sweden (Egron-Polak, 2002; Goldfarb and Henrekson, 2003); some report backlashes of gender equity in Sri Lanka (Gunawardena et al., 2006).

But if all this were to happen would it be enough? In some countries, democratization has gone further by incorporating other groups than professors on department boards, faculty councils and university senates. For example, the University of Helsinki has a three level decision system in which the professors, other staff and the students all have votes on each level. The highest decision-making body is the University Senate consisting of five professors, two other teachers, two other staff members, four students and an invited outsider. This empowerment was made in the early 1990's after the students conquered the administrative building of the university as they were frustrated by a series of inconclusive negotiations. However, the University of Helsinki was the last Finnish university to acknowledge students' right to participate in decision-making.[4]

According to our own experience, engaging students in planning environmental education clearly pushes the field forward. Students are experts in making the lectures more interesting and illustrative. They also put forth ideas for new, topical, courses. The same may happen in research as well – students and junior researchers provide seniors with fresh ideas since they are not afraid to lose face for asking 'dumb questions'.

2. Four University Cultures

2.1 Definitions

In sum, there are discussions about the external pressures relating to the goals of universities and internal pressures to increasing participation to university decision-making and freedom of individual thinking. The *problematique* can be roughly illustrated on two axes, where the vertical axis describes the degree of university autonomy in its own goal setting, and the horizontal axis describes the degree of internal openness (i.e. participatory democracy and individual freedom) within the organization. Four archetypal fields of the university culture emerge (Beckman 1989; modified a little in Figure 1).

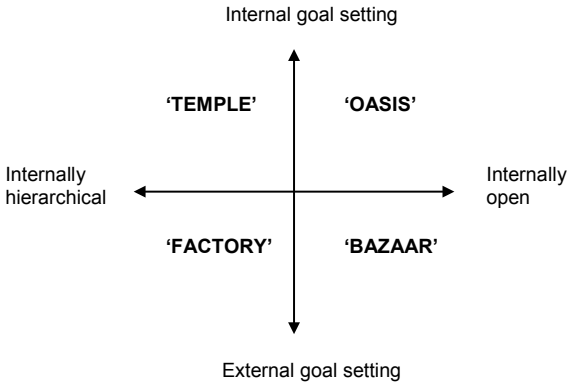

Figure 1: *Four university cultures (modified from Beckman, 1989; Eronen and Tapio, 1997).*

A university culture having a great deal of autonomy in goal setting and being internally hierarchical (or authoritarian) can be illustratively called the *Temple* of knowledge. If there is more external influence and the internal hierarchy remains, the university culture may be called the *Factory* that efficiently produces experts and expertise to meet the needs of the rest of society. A university culture which is strongly influenced by external actors but is internally more open can be called the *Bazaar*, it is a flexible marketplace where diverse demand and supply meets on bottom-up basis. Finally, an internally open and externally autonomous university culture can be called the *Oasis* of free critical thinking. (Beckman, 1989; Luostarinen and Väliverronen, 1991; Eronen and Tapio, 1997.)[5]

2.2 Actors within the University Cultures

Various actors in the science – society interface have different roles within the four university culture archetypes. At least the following stakeholders may be considered: Professors, other teachers, others than the teaching staff and students who all act within university. Governmental administration, business and the wider public act outside the university but may (or may not) have an interest in internal university activities (Table 2).

In the *Temple*, the central actor is the professor of a scientific discipline, he or she defines the goals, organizes the curriculum and research program. The professor acts like a bishop having the best access to the truth based on scholar superiority. Lecturers are like priests guiding the students, the congregants, on the pathway to good life. Graduation is a ritual equivalent to confirmation. Other employees, the vergers run the facilities. External actors are more or less taken for granted and there is not much interaction: the government guarantees the facilities and a constantly rising budget, business has the role of a tax-payer and the wider public is regarded as pagans not knowing the truth.

In the *Oasis*, the university hierarchy has been abolished towards maximum equality. Within the university all actors, including students, are considered colleagues and members of the scientific community. In this think tank, everything can be and is questioned and the curriculum as well as the research agenda is constantly critically reflected and rephrased. The government works as the patron supporting his/her artists and paying the bills. Business has the self-evident tax-payer's role as is also the case in the Oasis. The wider public serves as the audience.

In the *Factory*, the university is a Fordist production unit in the service sector. The tasks of the university are imported from the government, the industrial

Table 2: *Actor roles and information flow (dashed arrows) between the actors in the four university cultures.*

University culture	Temple	Oasis	Factory	Bazaar
Internal actors				
Professor	Bishop	Colleague	Controller	Manager
Teacher & researcher	Priest	Colleague	Labor	Entrepreneur
Other employee	Verger	Colleague	Service staff	Facilitator
Student	Congregant	Colleague	Raw material	Client
MSc	Confirmed	Colleague	Product	Client
External actors				
Government	Patron saint	Patron	Investor	Client
Business	Tax payer	Tax payer	Consumer	Client
Wider public	Pagan	Audience	Consumer	Consumer

investor, expecting profit for the investment. The professor is reduced to a controller calculating input and output. Others form either the productive labor (teachers and researchers) or the service staff keeping the machinery in order (other staff). Students are raw material which is manufactured to new products to the labor market. Business and the wider public are the consumers of employees and research results.

In the *Bazaar*, everything is constantly under negotiation. The professor acts like a manager having a team of teachers and researchers who are similar to entrepreneurs. They acquire external funding from a variety of sources and negotiate courses with business and the administration which are the clients. Students are regarded as clients, as well, mostly concerning courses where the number of students in the course, the demand, is crucial to the funding decisions (supply). Other staff have the role of transforming the equipment, methods and university administration to adapt to the current market situation. The wider public is also seen as a client, whose wishes and interests should be taken into account. The Bazaar kind of initiative can be seen, for example, in the league of the traditional and the technical universities of Manchester (Wolfenden, 1995). The authors' home institute, Finland Futures Research Centre is also a typical Bazaar acquiring over 80% of funding from external sources.

3. A Delphi Study on Finland's Prospects

Our case study focuses on the future of the university culture in Finland looking from the environmental experts' point of view. Is the university moving from an autonomous and hierarchical *Temple* of knowledge to an open *Bazaar*, where all the research projects and courses are constantly negotiable depending on the client's wishes and ability to pay? Or has the university been an autonomous, open and communicative *Oasis* of free thinking, now turning into a *Factory* characterized by increasing external bureaucratic control and an accelerating rate of producing degrees, study credits, publications and index citations? In this paper, we show the results of a Delphi study of the development of the university culture in Finland between 1990 and 2005 and prospects for the development up to 2020 with regard to the four hypothetical university cultures.

Views on the development of the university culture were solicited as a part of a wider Delphi study on the future of environmental and sustainability education (Tapio et al., 2007). The Delphi method is an expert view based method of envisioning the future of a complex issue. Key characteristics of the Delphi method are: at least two rounds of inquiry, feedback from previous rounds, anonymity of statements and the goal that the best argument should win (Linstone and Turoff, 1975; Ziglio, 1996; Kuusi, 1999; Tapio, 2003).

The Delphi method is not a survey aimed at finding the average expert opinion or differences in opinion between statistically representative groups. It is rather an expert based method aimed at making sense of alternative scenarios for the future (Ziglio, 1996; Kuusi, 1999; Tapio, 2003). Thus, the choice of respondents is crucial to the understanding of results (Kuusi, 1999; Cuhls, 2000). In this study, special attention was given to reaching a wide range of expertise, which was contemplated in two meetings within the research group and two meetings of the project board. The panelists' educational background included the natural sciences, social sciences, engineering and interdisciplinary education. Their background organizations included education, research, administration, enterprise, media and a non-governmental organization. There were eleven women and twelve men in the panel, and the junior panelist was below 30 and the senior over 60 years old. There were professors as well as students, directors as well as lower post experts. Respondents were labeled in random order in alphabet.

There were two Delphi rounds where the first round was conducted having semi-structured face to face interviews on the future of environmental education and the second round with a paper and pen questionnaire including feedback from the first round. The environmental experts expressed their views of the position of Finnish university culture in 1990, 2005 as well as of the probable and preferred future in 2020 in the scheme of Figure 1. Twenty-two out of 23 respondents answered this question in the first round and fifteen out of 18 respondents in the second round.

We grouped the cases by hierarchical cluster analysis (Figure 1; Table 1) on both rounds. Cluster analysis does not require random sampling unless it is used

to verify a theory (Dubes and Jain, 1979).[6] In the first round, seven clusters were formed. These were reported to the respondents as seven arrows in Figure 1 in the second round questionnaire. In the second round, the respondents could change their opinion if others' responses had convinced them. They were also asked to mark the first round cluster which described the development they considered the least preferred.

We used the Furthest Neighbor method for the grouping and the normal Euclidean distance as the measure of dissimilarity (see Everitt et al., 2001). Six clusters were chosen based on the hierarchical tree output of the SPSS12.0 software (see Appendix 1). Choosing five clusters would have grouped Clusters 1 and 2 together. Choosing seven clusters would have disconnected one outlier from Cluster 3. Furthermore, there is a limit to the number of illustrative scenarios and seven is often considered a maximum (Robinson, 1990; Tapio, 2003).

In the next section, the clusters are illustrated by qualitative statements provided by the panelists during the tape-recorded interviews of the first Delphi round and the written comments to the questionnaire in the second Delphi round. The interview material was transcribed to text by condensing the key message, the content, not word by word. Using Graneheim's and Lundman's (2004) vocabulary, we express the qualitative material as 'condensed meaning units' of the content of the speech reflecting the two 'subthemes' – degree of autonomy and degree of internal openness of the 'theme' of university culture.

4. Six Future Images of the University Culture

Each cluster regarded the situation in 1990 as the Temple and considered that the development between 1990 and 2005 was characterized by increasing external influence and internal openness. This is supported by the mean values of the whole material (Table 3) and is in line with the literature review of our study.

Views on the future development up to 2020 varied a lot in the Delphi study, especially concerning the openness towards external influence (Table 3). The clusters can be displayed in three groups based on the end points (Figure 2). Each group of clusters is further illustrated by key arguments expressed as condensed meaning units.

Towards Bazaar – Respondents in Clusters 1-3 saw that the future of university culture would be organized in the Bazaar mode. The views of the current state of affairs slightly differed, ranging from the Temple to the Factory. Cluster 1 is close to the Factory and Cluster 3 close to the Oasis whereas Cluster 2 is a stronger version of the Bazaar culture. Central condensed meaning units compatible to these views were:

- Open discussion will increase everywhere in society, also at the university.
- Environmental education does not exist for itself but for society.
- Environmental innovations are best created when universities interact with other organizations.
- Due to outsourcing of environmental jobs from large firms, there will be a high demand for subcontractors having both environmental expertise and business-orientation.

Table 3: *Mean values and standard deviation (SD) of the degree of autonomy and internal openness in universities by year according to Finnish environmental experts*[a]

Time	Degree of autonomy		Degree of internal openness		Overall interpretation
	Mean	SD	Mean	SD	
1990	1.50	0.70	-1.50	0.52	Temple
2005	0.30	1.08	-0.33	1.08	Temple/Factory
2020 probable	-0.93	1.18	0.20	1.05	Bazaar/Factory
2020 preferred	-0.27	1.84	1.93	0.57	Bazaar/Oasis

[a] Interval scale from -3.0 to +3.0; n_{1990}=28, n_{2005}=30, $n_{2020probable}$=15, $n_{2020preferred}$=15.

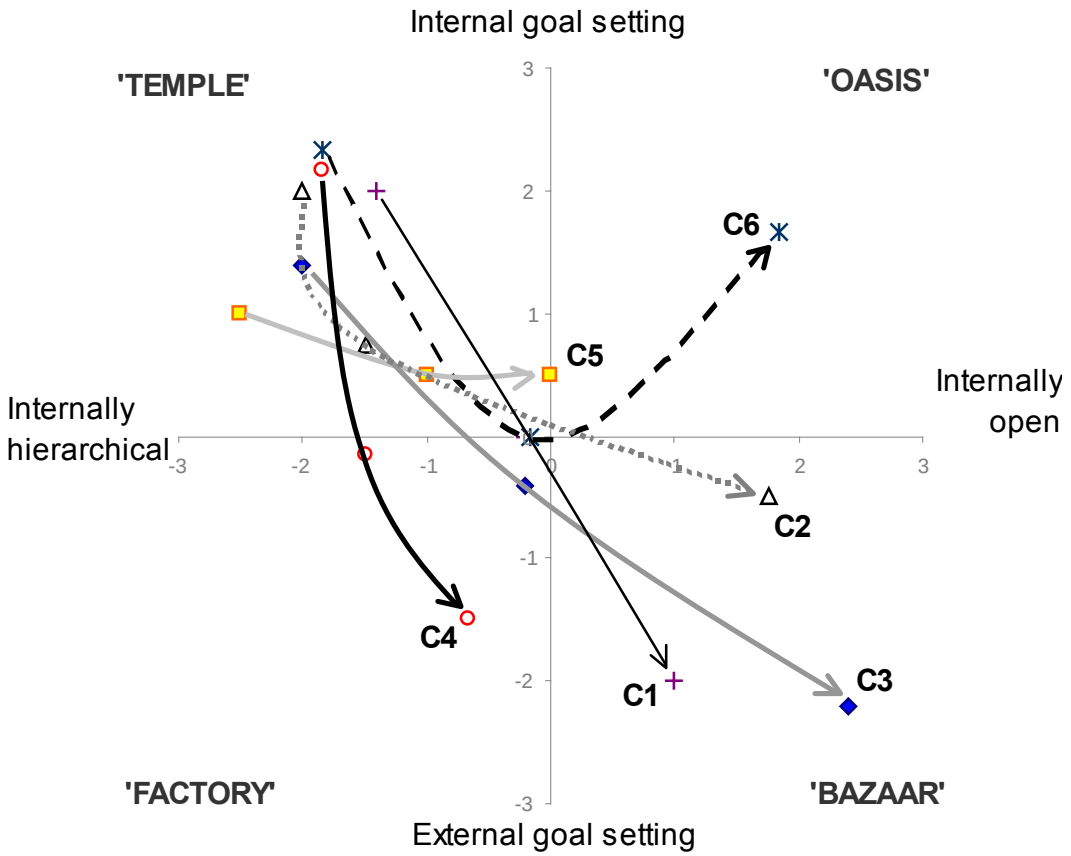

Figure 2: *Out of the Temple but in which direction?*
Beckman's four university cultures filled with six clusters (C1…C6) of views of the development in Finland. The initial point of each arrow corresponds the year of 1990, the middle point 2005 and the end point 2020.

- Environmental issues are so important that expertise at all levels of society are needed.
- All kinds of environmental experts are needed – generalists as well as specialists.

Towards Factory – As the other clusters, Cluster 4 began from the Temple but proceeded towards the Factory more clearly than the others. The respondents thought that the Factory culture would prevail and even strengthen in the future. Cluster 4 included only responses of the probable future. However, some qualitative statements bearing a preferring tone were compatible with this view:

- Academic freedom would lead to the abandonment of the students. They need guidance.
- Universities can serve society best by adapting to the demands of the environmental labour market.
- Practical environmental workers are more important for protecting the environment than highly educated theoretical ones.
- In addition to specialized environmental expertise, managerial and marketing skills are needed – general environmentalism is not.

Towards Oasis – Clusters 5 and 6 departed from the Temple culture and regarded the current situation still as the Temple. Both envisioned the future as the Oasis, although Cluster 5 in a weaker form. Most responses in Cluster 6 described the preferred development, whereas Cluster 5 included only responses of the probable development (see Figure 4 in Appendix 1). Key qualitative arguments:

- Ethically conscious critical people are needed in order to understand the environmental problems and their connection to lifestyles and societal drivers.
- Creativity and environmental progress is best achieved through open and equal discussion.

- Dominant values must be questioned.
- Applied approaches are used enough in environmental education; there is no need to go further in this direction.
- Generalists are needed in order to understand the big picture.

Staying in the Temple – No quantitative clusters envisioned, explicitly, the prevalence of the Temple, but some qualitative arguments might be attached to this view:

- Old disciplinary boundaries have the tendency to prevail. They are strong and when universities search for cost savings, the unestablished subjects, such as trans- and interdisciplinary environmental studies, will be first on the list.
- Instead of current trends and fashionable applications, one should teach the students environmentally relevant invariant basic truths in higher education. Daily politics change but today's students should receive education that should be applicable in 2040, when they will still continue to work.

5. Discussion

5.1 Summary of Results

The traditional autonomy of universities has recently been questioned. The universities have been criticized for economic inefficiency, long study times, poor response to the needs of employers, poor societal applicability of results, negligence of values and a high dependence on government funding without any guarantees for the investment to pay off. Universities are also subject to increasing ethical concern with regard to environmental problems, animal ethics, medical ethics and military ethics (Vincent-Lancrin, 2004; Leshner, 2005; Yearley, 2004; Nowotny, 2005).

When the externally autonomous but internally hierarchical Temple has been pushed towards the business rationale of the Bazaar, external autonomy has been reduced but internal openness has perhaps not increased accordingly. The mean values of our material suggest that the current state of affairs in Finland is on the borderline of the Temple and the Factory. Beckman seems to have been right in his forecast made as early as 1989, that the strive for reducing inefficiency in the Factory manner in fact reduces efficiency owing to increasing bureaucracy and non-motivating control. In order to achieve a real Bazaar, more degrees of freedom should be maintained on the department and individual level.

On the other hand, we invite the reader to ponder whether the Bazaar is a preferred goal for the university (see Beckman, 1989; Eronen and Tapio, 1997; Leshner, 2005)? After all, academic freedom is still highly valued which is indicated by the fact that two clusters envisioned the Oasis as the future mode.

5.2 Environmental SWOT Analysis of Each University Culture

"It depends much on the faculty and the topic of study. Philosophy is best learned in the Oasis, toxicology in the Factory." (Written comment.)

Finally, rather than declaring a single university culture more desirable than other we would like to argue that each culture has its benefits as well as pitfalls from the environmental point of view. These are gathered in Figure 3 using the *Strengths Weaknesses Opportunities Threats* (SWOT) analysis. The strength of the Temple is that environmental problems gaining a lot of media attention or political attention would not be automatically considered as the most important areas of education and research. But the weakness is that bad news (or good news all the same) would not be sufficiently reflected. The professor-based elitism could also hinder scientific progress by strengthening unidisciplinary thinking unopen to new ideas.

As for the Oasis, its strength is the free formation of ideas that could be more interdisciplinary but on the other hand it might lead to 'ivory tower' exclusion and diminishing impact on the actual environmental problem generating processes of the society. The strength of the Factory might be the efficient use of resources, natural resources being an important part of these. But in terms of research programs and curricula, doubts of bureaucratic control of ideas, suitable research projects and adequate education hang heavily over the Factory. The Bazaar is more flexible and transdisciplinary but it may lead to running after the latest headlines in the media and loosing knowledge of scholar history.

From the environmental point of view, there are some things to keep in mind. First, environmental problems have been usually discovered by rather

	subject	
TEMPLE		**OASIS**
Strength The ones who know best make the decisions.	**Opportunity** Knowledge economy.	**Strength** Free flow of ideas leading to new solutions. Interdisciplinary.	**Opportunity** Innovation economy.
Weakness Lack of reflection of development outside own scientific field.	**Threat** 'Ivory tower' exclusion. Lack of funding.	**Weakness** Re-inventing the wheel.	**Threat** 'Ivory tower' exclusion. Lack of funding.
FACTORY		**BAZAAR**	
Strength Efficient use of resources.	**Opportunity** Diminishing critique of using public funding.	**Strength** Increased funding from external sources. Transdisciplinarity.	**Opportunity** Applied sciences more valued.
Weakness Increasing bureaucratic control.	**Threat** Loosing academic freedom and therefore novelty of ideas.	**Weakness** Loosing knowledge of scholar history.	**Threat** Loosing independence. Classified research.

Figure 3: *The SWOT analysis of the four university cultures*

independent researchers or research groups, not by government authorities, business nor the wider public. Second, new ideas seldom arise from the establishment but require an open mind and contemplation. These features would suggest the superiority of the Oasis.

However, environmental problems are not new issues on the societal agenda any more. Governments are making progress, green business has become more popular and citizen awareness has been awaked. This situation calls for new alliances, new forms of environmental research and education design, new funding instruments as well as new ideas. Best practices seem to emerge in the borderline between the Oasis and the Bazaar. For example, a university department, a private firm, an administrative office and a non-governmental organization might construct a common course or a research project which is the Bazaar activity. However, one should maintain an open and critical mind in the Oasis manner in order to prevent business to dictate the research results.

All in all, the university culture is under change in a way that is relevant to environmental research and higher education. Quo vadis – where are you going? We leave the final answer to the reader. It is clear that the answer is related to the changing role, diverse requirements and expectations of universities posed by other actors. And this is closely interdependent with the role of knowledge and expertise in general in societies.

Acknowledgements

The paper is a co-product of the *Agora 2020* and the *SIGHT* projects run by Finland Futures Research

Centre. The European Social Fund, the Ministry of Education Finland and the Academy of Finland are gratefully acknowledged for funding.

Notes

1 We use the term university covering all institutions providing higher education. In our case country, Finland, these include 'traditional' universities, technical universities and polytechnics (also called 'applied universities').

2 We use the term science in the activity sense meaning both research and education and the third mission activities (i.e. civil service) of the universities.

3 Karran (2007) attributed the highest levels of university autonomy in 23 European Union countries to Finland, Slovenia, Czech Republic, Hungary and Spain. The lowest levels were observed in the UK, Netherlands, Denmark, Malta and Sweden.

4 This integration diminished student protests in Finland but a formal position in decision-making bodies does not necessarily diminish student activism as the South-African case demonstrates. Koen et al (2006) report that student representatives may also lack trust and be considered as a part of the administration rather than real student representation.

5 Recently, Stevens et al. (2008) have created an almost similar classification, including Sieve (similar to the Factory), Incubator (somewhat similar to the Oasis), Temple (equivalent to the Temple) and Hub (equivalent to the Bazaar).

6 The interviews were carried out in 2006, but we labelled the year 2005 as the current situation, because it was the last full year, and the three dates form a linear scale. The respondents were exposed to a blank form of the four university cultures (Figure 1), where they filled in the years. The figure consisted of an interval scale of 7x7 matrix including the zero point of both axes, and three cells towards each direction. The panellists filled in a cell for each date. We then organized the material in six variables: internal and external openness of the university in 1990, 2005 and 2020. Four respondents responded incompletely in both rounds and were therefore left out from the cluster analysis. Views of the probable and preferred development were treated as two separate cases, thus the fourteen complete responses totalled 28 cases. Since the values of the past development variables were equal in both cases, the 1990 and 2005 values were weighted by 0.5. This way the past weighed as much as the future development in the analysis.

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Appendix 1. Methodological details

The process of clustering the cases can be seen in the hierarchical tree output of cluster analysis (Figure 4). One can see, whether a single respondents' view of the probable and the preferred future has ended up in the same or a different cluster. It is also interesting, how many responses of the probable and the preferred future there are in a cluster.

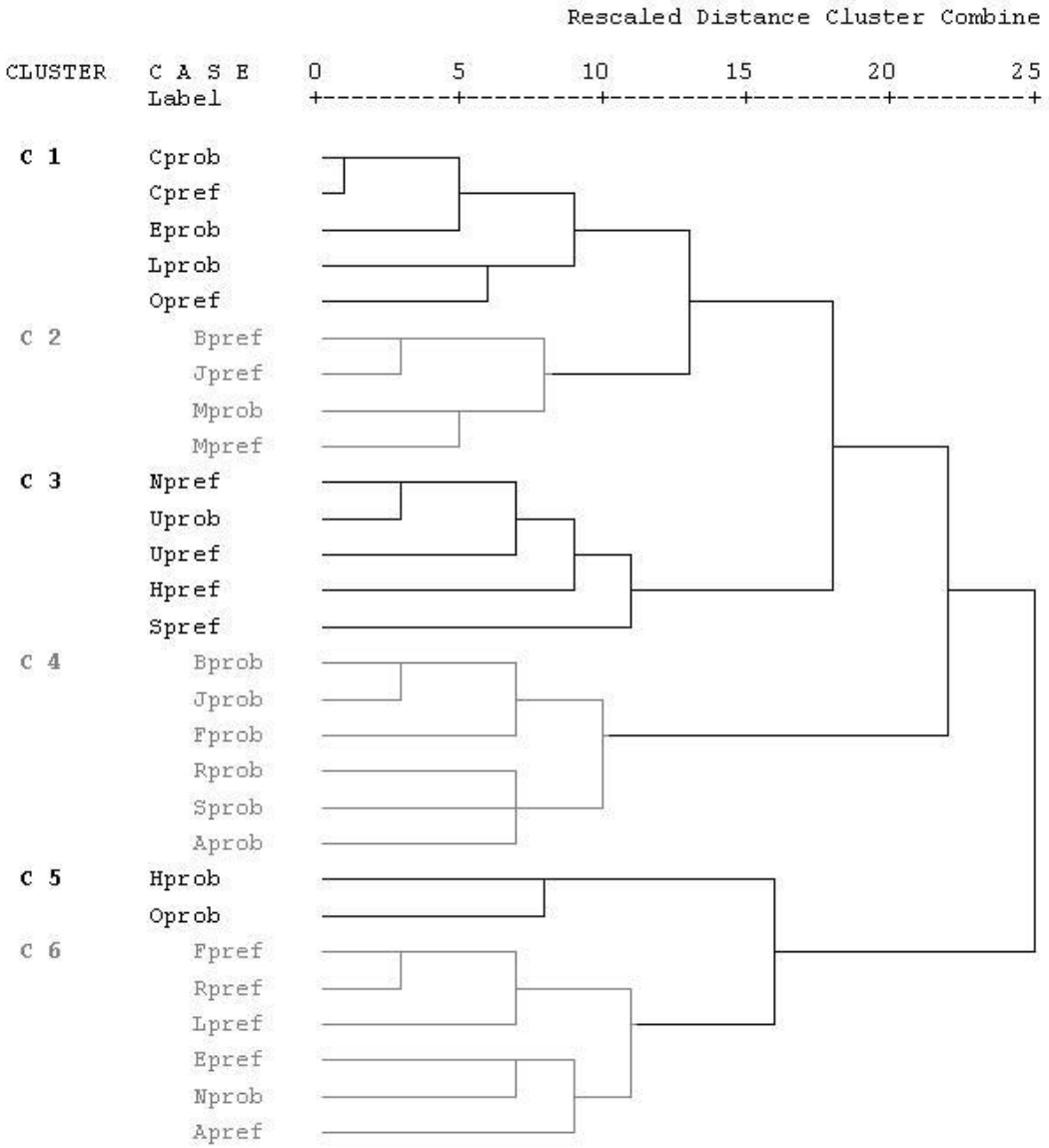

Figure 4: *Hierarchical tree describing the structure of the second Delphi round material. Similar cases are near each other. Each capital letter stands for an individual respondent. The postfix "prob" stands for the respondent's view of the probable future and "pref" the preferred future.*