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Technology Education in Finland

Abstract

The idea of 'handicrafts education' has a long history in Finland: it was introduced by Cygnaeus in 1866. At that time, around the world, practical subjects were taught to encourage a more productive and adaptable workforce. 'Technology' in education was also introduced into the Finnish system by Cygnaeus in this period (in 1861).

Technology education underwent considerable change in Finland again in the 'technical work education' texts at the beginning of the 1980s. The reasons for change were more or less the same as in many other countries: to reform and modernise the old reproductive handicrafts; to try to make the subject academically relevant; and to follow general technological developments. Teachers did not adopt the new subject title easily. They had experienced the Comprehensive School reforms of 1971, when design and creativity were strongly emphasized; they were afraid about the changing essence and status of the subject; and they had practically lost confidence in all curriculum innovations. The resistance of textile work teachers was particularly strong. Efforts were made to involve Science teachers in the new subject. It did not succeed because neither the Science nor the Handicrafts teachers wanted to collaborate. Teachers in Finland are nowadays usually well-trained. They retain a great deal of independence regarding the way in which courses are taught: They devise curricula on the basis of broad governmental guidelines ('Basics for the Curriculum') and their associations can influence the curriculum decisions.

So the present title for a technology subject in Finnish schools is still 'Handicrafts Education'; some of us say 'crafts education' in English. In practice it is divided in grades 3 – 9 (age 10 – 15+) in 'technical work' and 'textile work'. This is due to tradition, the existing workshops and teachers' expertise. Technology Education according to the 2004 curriculum is a cross-disciplinary topic, 'thematic entity', in grades 1 – 12. It is taught in lower comprehensive school (primary, grades 1 – 6) by the class teachers, who have training in technical work or textile work, in higher comprehensive (grades 7 – 9) by technical work or science teachers, and in higher secondary school (grades I – III) by science teachers – crafts have no obligatory mandate at the upper secondary.

The current situation in Finnish schools is as follows:

- For the past 13 years 'technical work' has had no representative on the National Board of Education, which is responsible for the curricula. In practice Science seems to cover the TE; and the Handicrafts mandate is governed by the textile work.
- There is a smaller group of activists working for the TE. An association called 'FATE', 'Finnish Association for research in Technology Education' (>www.teknologiakasvatus.fi>) has been founded in order to activate and support teachers. Some meetings and conferences have been organised. Funding is, of course, a problem.
- Younger technical work teachers actually do TE in their work; they strive for gender equality, use computers, teach design techniques, construct electronics, and teach Control Technology. The older ones are happy to continue teaching the old industrial-arts-type of machine shop work and reproductive handicrafts.
- Industry understands the problems in TE and between S and T ?.
- The biggest problems are experienced at lower comprehensive level (primary), where the technical work teachers' association has had no interest and where Science has a mandate now.
- Technical work has recently lost a lot in period allocation and status…
- I have been recently proposed a 'division of labour', instead of teachers' collaboration…

Tapani Kananoja

Technological education in Finland

The text discusses the current state of Technology Education in Finland and its background (with reference to PATT from 1986 onwards).

1 BEFORE 1970

'Technology' was mentioned in Finnish handicrafts education texts for the first time in 1861 (Cygnaeus 1861). The idea was 'to educate for work'. At the same time the systematic general education was introduced to the whole of Finland (1866). Technology was a proposed subject title for teacher education in handicrafts [originally 'slöjd', a subject term used at first by Cygnaeus (Allingbjerg 1983, 28) and adopted by the Swedes later on; Swedish being at that time the official language in Finland].

Up to 1970, education of the 13 – 15 –year old pupils was divided in academic and prevocational schools. In the non-academic schools practical technological education covered about 50 % of the weekly periods.

2 FROM 1970 TO 1985

The Comprehensive school system was introduced in 1970. Non-academic and academic junior secondary schools were amalgamated. It lowered the status of practical education. The term "Boys' Handicrafts" was changed to 'Technical Handicraft', later on 'Technical Work' (TW).

This writer was personally interested in technology education in other countries for research purposes. I was engaged in a research project on handicrafts education from 1969 to 1975 (Kananoja 1975; 1980 – see 1987).

Over the years 1970 – 91 handicrafts education struggled to survive. The Government reduced funding, gave smaller machinery, etc., because the idea of the new school was 'general education', no longer vocational or prevocational. Teachers were unhappy with the comprehensive school reform (1970), where design and creativity were strongly emphasized. They were wary of new plans for technology education (TE) and feared the loss of status for – or even the existence of – TW in the possible new changes. Resistance was strongest among textile work teachers.

TE was first tried in one (academic) higher secondary school in 1972 – 74 (Kananoja – Rajamäki 1974). TE was mentioned in the national teacher education proposals as a replacement for TW in 1973 (Kananoja 1973), and in TW curricular texts in 1976 (Kananoja, 1976). The reasons for trying to launch the term were practically the same as in other countries: to reform and modernise the old reproductive handicrafts education; to try to get academic credibility for the subject; and to follow general technological developments. Of course there were also efforts to adopt the subject developments presented by UNESCO and CCC (Council of Cultural Co-operation of Europe), and developments in the UK and US (Olson, Eggleston, Harrison, etc.). One of the reasons was also to try to avoid the possible adoption of Norwegian art integrated handicrafts curriculum model. These efforts for reform began in 1971 in TW.

Adoption of the TE in TW began with adopting ideas from the German 'Technik' education. The elementary machine and electrical education in Germany were interesting: in 'Arbeitslehre'

(Deutsher Ausschuss 1964) and in the new curriculum in Hamburg (Richtlinien und Lehrpläne 1974). Swedish ideas in 'Teknik' education (1962) were also appreciated.

Efforts were also made to activate Science education in the new subject. For collaboration between Science and TE – from the point of view of TW representatives interested in TE – there was readiness and a great deal of progress made from the 1980s on. In-service training sessions, conferences and negotiations were organised, practical electronics construction for science teachers was disseminated, etc. Real collaboration did not succeed because the science and handicrafts teachers and some administrators did not support the scheme.

Later on I also found that in the Netherlands some intelligent reforms in Crafts education had been in the pipeline. These reforms were supposed to be realized in 1983 (Netherlands 1980). The emphasis was more or less on the Nordic Sloyd type of education.

3 FROM 1985 UP TO NOW

A new curriculum was published in 1985. A lot of work was done to get 'the simple machines' from science (environmental studies) in TW at primary level, in order to support the elementary level Technology Education. That became true in the curriculum. Problems arose, however, because there was not enough time to organize satisfactory measures, textbooks, etc., to help teachers. According to a questionnaire 5 years afterwards only 30 % of the primary teachers implemented the ideas (Kananoja 1990b).

TE curricula reforms were revived in an IIET (Institute International pour l'Education Technologique) Conference in Budapest in 1986. The Finnish research project had also covered pupils' attitudes, and meeting the IIET people encouraged a continuation of TE curricula reforms. In Budapest the first contact with the Jan Raat and the nascent PATT ideas were promising. In 1986 UNESCO had a TE symposium in Paris. It confirmed the necessity of TE.

In 1987 the first PATT Conference was organized in Eindhoven. The Finnish research was handled as an article (Kananoja 1987) in the report (PATT 1987). PATT speeded up the interests for the TE. To meet same kind of thinking all over the world was a step forward to important contacts.

A curriculum guide for TW was published (Kananoja 1988). Because of the eager participation of teachers in curriculum discussions the effort was to give more freedom and options to teachers. The guide emphasized industrial technology. This guide was well received by teachers.

In 1989 an OECD meeting for SMT (Science, Maths, Technology Education) took place in Florida. It was a comprehensive project ending with a final report (Black, Atkin 1996). Unfortunately the Finnish representative was a different one in every 3 – 5 meetings and so the continuity or impact was not as good as it could have been. So the meetings did not have so much impact on TE in Finland. Also the final report emphasized more 'S' and 'M' than 'T'. Maybe the national activities were also taken care of better by 'SM' than by 'T'.

In 1990 a seminar for Nordic sloyd education was organised in Sweden by German and Swedish enthusiasts. I was 'defending' Uno Cygnaeus as 'Numero Uno' in the meeting (Kananoja 1990a). Otto Salomon was also put forward as the founder of TE. After that we have organised some conferences on Finnish sloyd in Finland.

In 1991 a preliminary curriculum proposal for TE was written (Kananoja 1991).

In 1993 UNESCO organised Conference 2000+, where WOCATE was founded. That was another reason to feel oneself to be committed to TE. Unfortunately WOCATE seems to have disappeared; and the UNESCO ST Newsletter handles mostly Science (>www.unesco.org/education/educprog/ ste/ index.html>).

Basic PATT research has been carried out in Finland, the questionnaires translated and delivered to the teacher educators / researchers. However, the preliminary Finnish results were published only at an ITEA meeting in the US in 1992 (Kananoja 1992), handling also Zambian pupils' and teachers' attitudes. Some students both in Rauma – and later on, Oulu – teacher education departments in Finland have also written their Masters' theses on PATT research.

Rauma teacher training department under Turku University takes care of teacher education for TW. The program has not been changed much recently. There was an effort to get a full TW subject teacher program also in Oulu University; but because of resistance from Rauma it did not succeed. Instead of that Oulu (from 1996 on) had a primary teacher education program in 'TE orientated TW education', where TE had a 35 credit mandate. Oulu is the only university in the country with education and technology departments under the same roof, and could have been a good centre for a full program in TW and TE development. At the same time also a new a of the teacher education law was published stating 35 cr. studies to give the competence as a second subject for a teacher of primary classes or other subjects.

In about 1996 I was invited to be a member of a group of the Maths & Science teachers' association to work with 'FACTE', 'Finnish Academies of Technology', for TE. I had to join the club. So we wrote some articles (Kananoja & al. 2000a; 2000b), published a booklet for pupils about the importance of TE ('Who needs Technology?' [FACTE 2003]), made initiatives to the Government, Ministry of Education and the National Board on TE and translated the US Standards in Finnish (Kananoja & al. 2000c) and published them on the Internet. After that collaboration the status of S & M improved somewhat, and an increase in weekly periods and a practical monopoly for the TE in schools. After that there have been no more calls for collaboration in 2004 – 05. Nevertheless, the work done was of benefit to TE.

Details about the present situation

The end result of the TE experiments in higher secondary (Kananoja, Rajamäki 1974) was that the local higher secondary and vocational education moved closer to each other. Today it is possible to do both in a combined study programme, and also to have access to the universities through vocational studies.

In 1991 the 'National Board of General Education' was changed to be the 'National Board of Education. After that, since 13 years, TW has not had any representative in the Board, which is responsible for the curricula. In practice Science seems to take over for the TE; mandate for handicrafts is in hands of a textile work representative.

The present title for 'technological subject' in the Finnish comprehensive school in grades 1 – 9 (age 7 – 15+) still is 'handicrafts education'; some of us say 'crafts education'. It is integrated (technical + textile) in grades 1 – 2. It should be integrated also at 3 – 9 but is in practice divided (from age 10 on) in 'technical work' and 'textile work'. This is because of the tradition, the existing workshops and teachers. In grades 1 – 7 handicrafts is obligatory, in grades 8 – 9 optional, in some schools also in other grades. Integration of TW and textile work has brought some new problems.

Pupils' time allocation for technical work is half from the previous one, and there are not enough periods for subject teachers in many schools any more, especially not at lower comprehensive.

Technology education according to the 2004 curriculum is a cross-disciplinary topic, a 'thematic entity', in grades 1 – 12. It is taught in lower comprehensive school (primary, grades 1 – 6) by the class teachers, who practically all have short training in TW or textile work, in higher comprehensive (grades 7 – 9) by TW subject teachers or science teachers, and in higher secondary school (grades I – III) by science or social studies teachers. Neither Handicrafts nor TW have any mandate at the academic higher secondary level; generally there is not so much integration with vocational studies. The national (broad, basic) curriculum text for the 'thematic entity' in TE in Comprehensive school is as follows:
[An unofficial translation]

"M**an and technology**

The aim of the thematic entity 'Man and technology' is to aid the pupil in understanding the human relationship to technology and to help to see the meaning of technology in our everyday life. Basic education must inculcate basic knowledge about technology, about its development and impacts; it must be a guide to rational options and discuss the connected ethical, moral and gender-equality problems. Education must develop an understanding of the basic functions of tools, equipment and machines and teach to use them.

Aims:
Pupils will learn to

- understand technology, its development in and impacts on different areas of life, different sectors of the society and environment
- use technology in responsible ways
- use computer hardware, software and networks for different purposes
- take the point on decisions concerning technology and evaluate the impacts of the decisions on technology of today on the future.

Central contents:

- technology in everyday life, in society and in the local industry
- development of technology and the connected factors in different cultures, different areas of life in different times
- development of technological ideas, modelling, evaluation and the life circle of the products
- use of computer technology and networks
- connected questions of ethics, morality, well-being and gender equality
- future society and technology." (National Board 2004.)

For upper Secondary (academic) schools the TE 'entity' is:

"T**echnology and society**

The starting point for the development of technology is the human need to improve the quality of life and make life easier in work and leisure time. The basis for technology is to know the laws of nature. Technology consists of knowledge and skills to design, manufacture and use technological products, processes and systems. Teaching will emphasize the interactive process of technology and the development of society.

The aim is that the student

- can use knowledge from different sciences when considering the development possibilities of technology
- understands and can evaluate human relation to modern technology and has the skill to assess the impacts of technology on the way of life, on society and on the condition of the natural environment
- can evaluate the aspects of ethics, economy, well-being and gender equality and consider the technological alternatives
- understands the interaction of technology and economy and can evaluate the impact of technology on contents of work and employment
- learns entrepreneurship and becomes familiar with the local working life.

The thematic entity must guide the student to think over the development of technology in relation to the social changes from the historical, present and future viewpoints. The student is guided to understand, use and manage technology. He/She must learn innovation and problem solving skills, which belong to the technological development work. He/She must learn to consider the values as the starting point for technology and its impacts. The dependence of the modern man from technology must be discussed as questions of individual, working life and leisure time. Especially the necessary and non-necessary technology must be considered from the viewpoint of the basic human needs. The student is challenged to take the point to the development of technology and to participate in decision making as an individual and as a member of the civic society.

The questions connected with the thematic entity will be concretised by familiarising pupils with technologies from different fields. These are, e.g., well-being and health, information and media, design and music, environmental protection, production of energy, traffic and agriculture and forestry". (National Board 2003.)

The last passages possibly have impacts from the US Standards. Fortunately the texts are not only emphasizing theoretical approaches; hands-on activities are possible, if teachers want.

Concerning collaboration it must be mentioned that the TW representatives have been giving quite a lot TE ideas for science people: Being the pioneers in TE, writing 'the TE philosophy', organising discussions, translating the US Standards, etc. However, technology should according to the education authorities now be realized mostly on terms of science.

Younger TW teachers actually do TE in their work; they strive for gender equality, use computers and media, design, construct electronics, and do projects and Control Technology. The older teachers still are happy for their old industrial arts type of machine shops and reproductive crafts or handicrafts. Some schools have introduced TE as an option; some schools have a subject 'TW and technology'. In Jyväskylä and Savonlinna teacher training departments that title is also used for students' courses. In Rauma department for TW teachers' training the English title in the Internet is 'TE teacher education'. Oulu program continues. – In Rauma and Oulu both resistance and support for the new subject title was found. Unfortunately contacts abroad have not been very strong from Rauma and Oulu handicraft and TW program permanent representatives – except the Nordic contacts.

TW has recently lost a lot in period allocation and status. The problems at lower comprehensive level (primary) are the most serious, where the TW teachers' association has no interest and where Science has a mandate now.

There is a smaller group of activists working for the TE. An association called 'FATE', 'Finnish Association for research in Technology Education' (>www.teknologiakasvatus.fi>) has been founded in order to activate and support teachers, teacher educators and researchers. Jyväskylä University is the centre of the development now. Some meetings and conferences have been organised. Funding is problematic for such informal type of work of enthusiasts. FATE has been working now for 9 years. Today 'FATE' has a challenge to keep up the public and teachers' interest in order to be able to have a better status in the future. There is about 5 years time to make a better impact on the next curriculum.

Working together with TW association is approximately in order. FATE has a member from TW – teachers' association in the Board. The TW association has supported FATE to organize small conferences during the yearly TW –meeting. Around the Millennium the TW journal was quite actively marketing the new ideas for the subject. The TW –association has unfortunately interpreted its mission to be more union-type taking care of safety, salaries and re-unions for the higher

comprehensive teachers than pedagogy or development of the subject in the whole comprehensive school as it could and should be.

Collaboration with science and mathematics education has been in the pipeline according to the international models. Since 1991 the teacher training institutes have launched various projects to develop TE in collaboration with science and mathematics (Parikka 2000). For example:

- The 'LUONTI' project at Helsinki University, where technology is part of science and mathematics (Lavonen 1996).
- 'TOTY' at Joensuu University for RD of computers in education; for example, using LEGO kits and developing technological thinking.
- Jyväskylä University has a large project for RD in TE.
- Jyväskylä has several ongoing projects in educational technology with connections with TE, and separate TE projects. Licentiate and doctoral studies will be pursued in these projects.
- Since 1995 Oulu University has been done TE as a 35 cr. course as collaboration of faculties of education and technology and other interest groups. In Oulu TE is defined broadly consisting of opportunities for emphasis on educational technology, science, mathematics and entrepreneurial skills. A proposal for a 'TE Center' was made in 1995, and the plans were put into action in 2000. European Community is supporting the regional project.
- In 1996 Jyväskylä University has emphasized teaching technology as a large part of the future educational plans.
- In 1996 'FATE', Finnish Association for research in Technology Education' was founded by persons working in Oulu and Rauma TTIs (Parikka, Kananoja, et al.). Its aim is to help to develop technology education and the professional skills of the teachers in field and in the Teacher education institutes. Members of this association are comprehensive school teachers, teacher trainers and researchers. A few international meetings have been organized
- In 1998 Jyväskylä started the 'LUOTEK' (S+T) project to coordinate the local RD.
- In 1999 Jyväskylä University funded the LUOTEK coordinator for three years.
- Rauma TTI has for a longer time had a project for technological literacy with emphasis on information technology.
- In Savonlinna the TTI has been developing studies in collaboration with the regional opera company and local industry for a project on technology and technical work development.
- Kajaani TTI started EU project 'KYTKE' in 1997 for developing entrepreneurial skills and TE. The project was the continuation of an older project for developing TE (1989). The idea was to create a pilot network of teachers from every municipality in the region for versatile industrial and economic development.

The National Board of Education organized a program called 'LUMA' for science and mathematics development in 1995 – 2000. The Ministry of Education continued the project in 2000 – 2002. Also handicraft education was supposed to be included in the project from 2001 on. The project was supervised in 2002 (Allen, Black, Wallin 2002). Some success and some continuing problems were found. TE was not represented in the responsible group in the country or in the evaluation.

> In the beginning of the Millennium a government report about the needs of industrial Manpower was published. The message was that there were needs for about 3.000 engineers in information technology (mostly NOKIA) and about 40.000 professionals for industry (mostly metalwork). That should naturally have had impacts on education. The report has been interpreted generally so that science and mathematics had a better status and more weekly periods, and there is no focus or development of technical work or TE. However, most of the Finnish industry understands the problems in TE and between S and T. Unfortunately also at the employers' union's central body the education relations are taken care of science people today.

4 DISCUSSION

David Layton sees the Finnish TE situation as 'another illustration of the recent introduction of technology as a component of general education' (Layton 1993, 14); comparing the developments in Finland, the US and The Netherlands. Layton describes 'the Finnish variant handicraft based and

connected with TW'. It is true. The effort was, like in the UK and US, to replace engineering, handicrafts and industrial arts with the new title and approach. The main ideas were not just to follow the technological development in society and industry, but also to satisfy the individual civic needs for new technology. The TE movement seemed to be the only realistic theoretical effort in the area from the 1980s on.

Layton continues: "This 'high-tech' and production-oriented version of technology education is in marked contrast to developments in several other countries where a greater emphasis is being placed on the process aspects of designing, making and appraising technological artefacts and systems, and on the cognitive development of pupils in ways which are unique to technology education."

That above is not exactly the whole truth. Finland began the reforming efforts in 1967 – 1970, when the only models for imitation were, in the beginning, from Sweden and Norway. The one-sided Sloyd emphasis in these countries was Design as 'Arts and Crafts'. We were not satisfied with that narrow approach but also wanted to have industrial education within. In Sweden there was another practical subject also, 'Teknik', which, however, was vocational, and we had not possibilities to realise that because of the tight education policy decisions.

During my responsibility as 'the leader of the reform' (1971 – 91) we got new ideas at first from German 'Technik' and then from the UK, US and The Netherlands. The application of the inputs has proceeded quite well with the younger technical work teachers. There are still big problems, e.g. with the role of science education, which has 'found' TE later on and now keeps it as a monopoly.

The comments of Layton may be drawn from my one-sided descriptions of the Finnish system. I am sorry for that. However, modernising technological education was the main purpose of the reforms from 1970 on. This approach was officially introduced in the curriculum in 1970 and is still there; and it is also connected with the old Cygnaeus tradition. The approach still is in the handicrafts tradition, more on making original objects for an individual than focusing on the Big Problems, e.g. the environmental problems of society, designing traffic junctions or checking airport noise levels – even if these also have been very interesting and successful projects in some countries.

The last 'Basics for curriculum' was published in 2004. It was written under the leadership of the textile work (handicraft) representative of the National Board. It is not satisfactory for TW or for TE. Moreover, possibilities for options have been diminished. Fortunately the TW teachers in the schools write the school curricula. They are, however, also under the same fashionable national (global?) stress of interpreting TE as Science, Maths and Computers.

Curricula usually have trends, which follow the international fashions. In 1980s and 1990s the Finnish national curricula in TW were quite broad and gave individual teachers a lot of possibilities to interpret them originally. It was a must, because there had been 13 different training programs for teachers. The subjects had no national tests. Freedom created an atmosphere for discussions in the schools. Also teacher education was developed and all teachers now have M.Ed. or M.S. and the programs are quite highly ranked by the best students. Today teachers' individuality has been limited and the national tests have come. Teachers do not like that so much (Juurikkala 2005). We will see if that all will have an effect on the next PISA.

I have been both happy and disappointed about the TE developments in Finland. Even if the development has not been as fast or as good as it could have been, some positive things have been happening. Best of these is naturally has been the possibility in conferences to meet colleagues who

have the same problems and to get new ideas. Another good thing has been the first footstep for TE in the Finnish curriculum. The subject title is there now, which was one of the primary needs. And all the development efforts have been a difficult but interesting time for us.

Now the feeling is that the Young Ones must show the way forward in Finland. We have about 10 doctors in TE, and some more in the pipeline. All these have grown from TW; from Science or textile work there is not so much; textiles have more than 10 doctors but only one on 'textile technology'; under the Science wings there are 2 – 3 who write or have been writing on TE. In our situation today it has been natural that the research efforts have been handling more or less the philosophical basis and the need for TE. What we older enthusiasts expect today is, on the one hand, experimental research and, on the other, development of practical activities in TE, public information and textbooks. These could solve some of the problems, especially at the lower comprehensive level, where the pupils' interests and options for higher comprehensive school are created and where the primary class teacher has too many subjects to take care of. Just at the last moment when writing this paper the latest issue of 'Primary teachers' journal' was published. Dr. Rasinen had an article about the primary TE (Rasinen 2005). That kind of thing will surely speed up the process of reform!

I would personally like to see TW and TE collaboration – or even amalgamation – in Finland. According to the basics of Philosophy of Technology 'making artefacts' is an important aspect of technological and social progress today.

> 'Cross-over' in music means efforts to combine different traditions. However, for example, the collaboration between the Beatles and Indian Ravi Shankar collapsed after some efforts. This may have a message. If we bring a curriculum from one culture to another, it may not work. TE needs to be constructed TE according to the local culture. It is, anyway, important for a teacher to know what is happening in other countries in the subject development. A teacher is also supposed to be a researcher.
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> 'Cross-over' between theory and practice has been emphasized in TE. It has also been done in engineering studies. In Oulu University the first professor of electronics in the 1970s, Matti Otala, later on a CD-expert at Philips, had an idea that every engineering student should construct the gadget he/she was designing. The students went on strike and wanted to have assistants to do this. The professor did not give up, because he thought that learning only theories was not enough. Finally, every student began to construct their gadgets. And today Oulu University has a big Technology Center and NOKIA development labs. Moreover, <u>in TE we should always practice what we teach!</u> With too much general and theoretical technological education we will lose the interest of the pupils. After some hard experiences I have recently proposed a 'division of labour' instead of teachers' collaboration…
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> Jean Monnet, one of the Fathers of the European community has said: 'Without people nothing would be possible, without institutions nothing would be permanent.' I think this means also us and at the same time thanks to the PATT community. 'Cross-over' also means to know other cultures (disciplines) in order to make an impact on the national and global decisions. Naturally that also means taking care of the leadership, with which we in Finland have had problems.
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> Innovations are seldom born in stable conditions. They also need tension, 'cultural friction', which is natural and to be expected in Conferences like PATT.

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