

## Networks of experts and municipal officials in the field of urban infrastructure development

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### Abstract

*In the late 19<sup>th</sup> century and early 20<sup>th</sup> century the accelerating rate of urbanisation meant new challenges for the decision makers in European and American cities: How to organize energy and water supply, drainage, hygiene and sanitation, building of suitable housing, control of traffic and arranging of health care system and how to secure fresh food stuffs. The broadening technical sector provided work for a new, highly trained professional group. The professional field became more scientific, and those with special training and/ or experience in a given trade controlled the admission of others to the groups. The exclusion process can be analysed also from gender perspective. In the decision making process municipal officials observed each other's activities and adopted what they regarded useful, thus facilitating the inter-city transfer of innovations, be it changes in municipal institutions or in technological applications. The development was further facilitated by the exhibitions and professional congresses that the officials and experts, like engineers and architects, attended, the professional journals they read and by the systematic records and statistics that they kept. In my paper I will analyse with some examples what has been the role of cooperation between cities across the state borders and the role of international networks of experts in diffusion of some infrastructural services.*

### Introduction

At the end of the 19th century and the beginning of the 20<sup>th</sup> it became evident that cities and towns had started to form their own ever-expanding network. Mutual co-operation across national borders was being established, first on regional, and then on national basis; soon it bloomed into an international phenomenon. Contributing to this process were the emergence of ever more specialized groups of experts and professionals, who were under the pressure of keeping up with the latest developments on their fields of expertise and with the improvement of communications. Moreover, European and American cities competed in demonstrating how progressive they were and how far they had adopted modern technology.

During the recent years, historians' interest to study international phenomena, contacts and meeting places and /forum has increased. The research has focused on the period from the end of 19th century to the First World War, which has been regarded the most international period in building of infrastructure. Today infrastructure means any important, widely shared human-constructed resource, not only "hardware". According Manuel Castells infrastructure means interplay among socio- technical infrastructures and the grand pattern of the twentieth-century cultural, economic, psychological and historical change. Thus infrastructure is best defined negatively, as without it the contemporary societies

cannot function. Paul N. Edwards who studied infrastructures on different scales of force, time and social organization defines “infrastructure as an invisible background, the substrate or support, the technological/natural environment, of modernity” (Edwards 2003, 191). Infrastructure includes several aspects: the material capital (e.g. land and buildings) and the immaterial capital (e.g. the level of education and health of population, research potentiality) as well as institutional infrastructure (Frey 1967; Johansen 1966, 103-146).

The co-operation and networks between municipal officials and policy-makers and the transfer of municipal knowledge in different parts of Europe and between Europe and America has been studied recently in the Yearbook of European Administrative History, a publication specialised on The Formation and Transfer of Municipal Administrative Knowledge (e.g. Saunier 2003, 267-288).

Researchers today pay attention not only to the transfer process itself but also to the cultural values as a part of the transfer process (see also Hughes 1989; Michelsen 1999, 163).

In my studies (Hietala 1992, 276-279; Bell and Hietala, 2002, 127-129) I have found out that municipal authorities in Helsinki and in other Finnish cities as well as the leaders of the Association of Finnish Cities (founded in 1912 under the name of the Municipal Central Office) developed a follow-up system of know-how, which consisted of reading studies and printed articles and international statistical comparisons, using experience of decision-makers in other cities obtained from documents of city councils and municipal boards, statements of experts and opinions of professional associations, personal experience and observation, travel reports, and foreign experts who were invited for discussion. Moreover, the newest literature on municipal administration was quickly translated into Finnish. Important international professional networks can be found not only among municipal authorities in Helsinki and abroad but also among the leaders of the Association of Finnish Cities and the leading figures in Danish, Swedish, Norwegian and German associations or organisations of towns and cities (Hietala 2003, 109-130).

During the autonomous period, (i.e. the years 1809-1917 when Finland was a part of the Russian Empire) one reason for municipal authorities', experts' and professionals' eagerness to keep up with the newest administrative knowledge was the national aspiration of seeing Finland as a civilised country that had a capital comparable to other European capitals. According to my research experts and professionals had their “national mission”. Moreover, City officials believed in the future of Finland and wanted to contribute to the building of the fatherland by dissemination of useful information to the general public.

Jonas Hallström has in his research emphasized the importance of actor-networks when looking at history of the water supply, sewerage, and excreta removal in Swedish Towns. The starting point for the actor-network theory developed by Bruno Latour is that science, technology and society interact in a “seamless web”. Hallström concluded that the building of water pipes, sewerage systems and excreta removal was easier when the main decision-makers had networks, for example, with the economic elite of the towns concerned (Hallström 2002).

In the decision making process, municipal officials observed each other's activities and adopted what they regarded useful, thus facilitating the inter-city transfer of innovations, be it changes in municipal institutions or in technological applications. The development was further facilitated by the exhibitions and professional congresses that the officials and experts, like engineers and architects, attended, the professional journals they read and by the systematic records and statistics that they kept. Fact-finding tours made by individual experts were of great importance. The destinations and determinations of those

tours can be analysed from a sociological perspective also by examining the reference groups the experts, institutions and cities defined for themselves. In other words, with which development they wanted to identify with.

I will analyse the role of international networks of experts in diffusion in the field of urban infrastructure development and give some illustrative examples. I will pay special attention to their activities and methods to follow up with the latest knowledge (congresses and exhibitions, studying abroad, study tours). My examples are mostly drawn from Finnish engineers and architects. In the end I will explore what was the role of women in the professionalisation process.

## Professionals

In the second half of the 19th century many new professions emerged as society was modernised and new laws, statutes and regulations were enacted requiring supervision by trained professional groups while the expanding paper work inevitably called for an increase in the number of clerical personnel.

Moreover, efficient experts in specialist fields were in demand for example in political and economic sectors, who in turn secured the status of highly trained professionals. In Germany, for example, the number of officials increased from 1.6% of the actively working population in 1882 to 6.1% in 1907 (Nipperdey 1990, 375). In Helsinki likewise, in 1870 the state, city and church employed 4.5 % of the inhabitants, in 1910 the share was 10.1% (The Statistical Yearbook of Helsinki 1915). The growth meant that the state and the city were becoming dependent on professionals and experts.

Municipal officials and experts faced the new challenges of providing the city proper distribution of electricity, water supply and sewerage and functioning traffic arrangements. In consequence a new branch of municipal inspectorates, such as inspectors of health, gas and smoke, was created to monitor the municipal developments. The widening technical sector in particular provided work for new, highly trained professional groups. The professional groups that were becoming increasingly scientific aimed at great efficiency, which often resulted in a system of supervision within the group by the leading experts. They controlled the inclusion of others in the relevant group. Consequently, the divide between the leading experts and others within the same professional groups became more emphasised (Perkin 1989, 14, 20-23).

Building technical schools and higher education in technology was not easy in Finland where two somewhat competing designs were prevalent: on one hand the leaders in the business sector rather recruited engineers with practical experience and on the other hand Finnish technological experts would rather follow the international models in which the scientific–technological education was emphasized. The international models, for example Technische Hochschule in Berlin- Charlottenburg, were utilised, and in 1908 the Helsinki University of Technology, the orientation of which was scientific-technological, was founded. However, even earlier Helsinki Technical School, later Helsinki Polytechnic College was training future experts in the field of technology (Michelsen 1999, 166-168, 184-185).

## Professional Associations

The process of establishing professional associations, which first occurred in Britain and the USA parallel to the development of industrialism, urbanisation and improving educational services, took place also in Finland to increase experts' professional identity. Furthermore, the associations also strengthened the

groups' credibility in relation to other groups and society (Larson 1977, 4-8). Such associations and organisations often developed further into real pressure groups.

In Finland it was the medical profession that was first to organise itself by establishing the Swedish-speaking medical Society in 1835, which systematically collected medical literature and library, and by 1885, had established an exchange of publications with 17 medical societies. As a result it regularly received 71 different medical journals, of which 62 were foreign (Hietala 1992, 27-29). Association of Finnish speaking physicians Duodecim was founded in 1881. However, it was in the 1880s and 1890s that the founding of professional societies began to become commonplace. The Association of engineers and architects, the Tekniska Föreningen för Finland (the Technical Association of Finland) was established in 1885. From onset it was primarily an association for Swedish-speaking engineers and architects, however, a number of Finnish-speaking engineers working in the cities, also joined in. The association arranged for its members lecture meetings, which became at first popular. At the end of 19th century demands for specialization and the ambitions of the Finnish-speaking engineers to break with the Swedish-speaking members, who were seen to be creating an elitist section that was predominantly fighting for Swedish-speaking engineers only, were the reasons behind the decrease in attendance. Furthermore, for example translation of the French and German technical vocabularies first into Swedish and only then to Finnish was creating frictions in the cooperation. The 1890s saw a disintegration of the Technical Association of Finland (Tekniska Föreningen för Finland) and the establishment of three different sub sections: the Arkkitehtiklubi (the Architect Club), a section for road, water and building engineers and another section for chemists and electrical engineers. The Technician Society (Teknikkojen seura) for the Finnish speaking engineers was founded in 1896 (Michelsen 1999, 193). Hypothesising on the effects of the competition, sometimes even conflicts or rivalry between Finnish- and Swedish-speaking engineers, it can perhaps be assumed that it speeded up the development of different infrastructural services.

From the early beginning both Swedish speaking and Finnish speaking societies had their own international networks that published their own journals. Tekniska Föreningen i Finland published Tekniska Föreningen i Finlands Handlingar and Teknikern and Suomen Teknikkojen Seura published Teknillinen Aikakauslehti in Finnish. Both technical journals followed up keenly what was recently published abroad. For example, in Teknikern in 1903 its readers were informed about the building of railways in India, on the statistical data of Germany's imported and exported iron, on reorganisation of the Technical University in Sweden and on the New York subways (Teknikern 1903; Reviews on Zeitschrift der Verein Deutscher Ingenieure, Centralblatt der Bauverwaltungen, Stahl und Eisen, Baumaterialienkunde, Fortschritte des Eisenbahnwesens, Teknisk Tidskrift, and Engineering).

One indicator for evaluation of the level of professionalisation is the number of professional periodicals and bulletins. Between the early years of professionalisation in the 1830s and 1917 when Finland became independent, a total of 81 professional journals and periodicals were established, the most numerous of which were the journals in technology (30%), health care (27%) and schooling (22%). In Finland, many newspapers and journals also gave voice to particular organisations which resulted in them having an impact in the decision-making processes (Hietala 1992, 33).

## Meetingplaces: Conferences and Exhibitions

Inter-city co-operation manifested itself at town congresses and meetings, where municipal officials discussed common economic, social and cultural questions while city exhibitions provided a forum for

demonstrating the progress made in various sectors of municipal life and in the implementing of public utilities.

At the end of 19th century English and German cities became wells of inspiration for other towns. The municipal Exhibition organised in Dresden 1903 showed according to observers a tremendous progress which had taken place in municipal development in Imperial Germany (The Municipal Journal 14.8.1903). Invited experts came from European Countries and North America. City of Stockholm sent several delegates and Helsinki sent her municipal engineer. The subjects of this exhibition covered a wide range of infrastructure a. town development, building regulations, b. communications, lighting, street making, drainage, bridges and harbours, tramways, c. general care of public health and well-being, d. schools and education, e. care of poor and sick, conduct of hospitals, f. rates, industrial undertakings belonging to towns, ground ownership, savings banks and pawnbroking (Hietala 1992, 33).

International Union of Local Authorities organised conferences from 1913, from its foundation. These conferences gathered representatives from all over of Europe and from Canada whether the conference was held in Amsterdam or in Lyon (Hietala 2003, 120-121). During the Interwar period co-operation between Nordic towns became more intensive and German municipal conferences (Kongresse des Deutschen Städtetages) offered a fruitful forum for discussions concerning city reform movement (Randeraad 2003, IX)

It has been estimated that from 1886 to the end of the century there were 853 international congresses, and 2 271 such conferences between 1900 and 1914 held on various fields (Hennock 1987). In his studies of urban planning Anthony Sutcliffe has called this increasing internationalism of the cities and towns “creative internationalism” (Sutcliffe 1991). A recent bibliography on International Exhibitions. 1851-1951 includes 100 different exhibitions held in more than twenty countries from Jamaica to Japan ( Geppert and Lau).. In the Victorian era progress was a definitive goal, and the aim of the municipal congresses and civic exhibitions was to show others how advanced and skilled the management of civic affairs could be. This in turn strengthened feelings of civic pride creating motivational environment for the spreading of innovations.

Chrystal Palace exhibition in London 1851 formed an arena where the latest know how was available and innovations were marketed. Altogether 17000 exhibitors, of whom half were British, came for the exhibition. In this exhibition American McCormick cutting machine/reaper, Colt revolver, Goodyear rubber goods, and horse racing carts proved to be ingenious innovations that quickly spread across Europe (Rönehholm 1945, 27-28). The first exhibition where the Nordic countries had an important role is the exhibition in Stockholm 1866 with its 3500 exhibitors and to which 276 attendants came from Finland. In this exhibition it was the textile goods that were especially renowned, linen and cotton manufacturing were both praised. Finlayson & Co which had been founded in Tampere by a Scotsman demonstrated the cotton processing stages all the way to the finest textiles.

In Paris 1878 exhibition Finns had a compartment of their own in the department of education. The Finns introduced their modern system of education, simultaneously proving to belong in the ranks of civilized countries (Smeds 1996, 151). Finns received 79 prizes from this exhibition. The nationalism grew stronger, especially in the Paris World Expositions in 1889 and 1900; in the first the Finnish industry was prominently displayed and in the second the Finnish so-called Golden Age artists and architects made their breakthrough. Architects Herman Gesellius, Eliel Saarinen and Armas Lindgren designed the Finnish

Pavilion, the ceiling frescoes were painted by Akseli Gallen-Kallela. The fame and reputation received in the 1900 exhibition lasted a long time; even today it still is strongly alive in the Finnish consciousness.

World Exhibitions and Industrial exhibitions attracted especially teachers at the Helsinki University of technology. From 47 professors and teachers of Helsinki University of Technology and its predecessors (Polytechnic College and Polytechnic School) 24 teachers had participated in world congresses and exhibitions during the period of 1849-1914. Among the professors and teachers the most popular had been Stockholm technological exhibition in 1897 and the Paris world exhibition in 1900. To the Stockholm exhibition traveled seven professors and teachers and to Paris eight teachers of the Helsinki University of Technology (Nykänen 2004). In Stockholm Finns did not have a compartment of their own, furthermore many Finns boycotted the exhibition because the Russians had a compartment whereas Finns themselves did not. Among the innovations introduced in Stockholm that the 27 Finnish architects and engineers got information on were roentgen/x-ray apparatus that was introduced for the very first time in the Stockholm exhibition, on T.W. Olander's calculator machine as well as on how "silk" could be made from wood (Rönehalm 1945, 72-74). Illustrative of the great interest for know how is that Professor of Architecture (1885-1915), Gustaf Nyström, in addition to attending the Stockholm technical exhibition in 1897 and in 1900 in Paris, he also traveled to exhibitions on other fields also. When Nyström studied in 1878 in Wien Polytechnicum, visited he during the same year the world exhibition in Paris, in 1883 he visited exhibition on hygiene (Hygienische Ausstellung) and art exhibition (Kunstaustellung) in Berlin, in 1884 and in 1903 London exhibition on hygiene. Two other important international hygiene exhibitions held in Dresden (I Internationale Hygiene-Ausstellung 1911) and (II Internationale Hygiene-Ausstellung 1930) can be compared with world exhibitions.

Gustaf Nyström's wide interest can be explained by his activities in municipal administration. He was a member of the Helsinki municipal council for twenty six years (1884-1910), for twelve years a member of the board for Health council, a member of the board for Helsinki primary education, a member of the board for port construction and in addition, a member of review boards in numerous architectural competitions, including the competition for the design of the Finnish Pavilion for the World Exhibition in 1900. Nyström's input in drafting the Helsinki City building code, as well as in defining the norms for suburbs, land, property, and traffic policies has been remarkable. Already in 1882 he drafted a building code through the Technical Association in which more healthy building methods and the renewal of the sanitation code were called for. Nyström's concerns ranged from the provision of inexpensive housing estates and the elimination of land speculations. On the housing reform Nyström worked with some other architects and engineers, for example with the city engineer G. Idström who had attended the Dresden exhibition in 1903, and with social politicians and hygienists. Nyström was well-informed about the ongoing continental European discussions on unearned increment on land. In a committee report on building Vallila workers' housing area, housing policies of public utility were supported for example by examples from Frankfurt am Main and Ulm social housing production. Already in 1900 Nyström had suggested, based on examples from abroad, that a board of city planning should be founded, which in fact finally happened in 1908. Nyström became the first chair of the board. The many positions of trust took him to numerous study tours, for example in 1880 -1915 he made more than ten study tours to Sweden, Denmark, Germany, France, Netherlands, Belgium, Austria and England. He subscribed to and read American, French, English and German journals of architecture. The most important colleagues for him were Austrian architects Camillo Sitte and Otto Wagner and German Joseph Stübben and Karl Henrici

(Kuusanmäki 1992, 84-85, 159, 167). Nyström's accomplishments illustrate how the diverse experience and acquired information and know how could be adapted.

City renewal exhibitions were specially numerous in the early 1900s. Examples include the Düsseldorf city exhibition of 1909 and the Berlin exhibition of construction held in 1910, which presented the results of the planning of Greater Berlin. The City of Helsinki sent participants to Berlin in 1910 as well as to the Royal Institute of British Architects Town Planning Conference in London in the same year as well as to the Municipal Exhibition held in Dresden in 1911. For the Berlin exhibition of construction architect Bertel Jung and City engineer Gabriel Idström constructed their own compartment of Helsinki which attracted so much attention that the City of Helsinki was invited to participate in similar exhibitions in Düsseldorf and London. The Berlin exhibition inspired Jung; especially the suggestions for the Greater Berlin city plan with their increment forecasts which are evident in Jung's general city plan for Greater Helsinki and in Helsinki central park plan. It has been argued that the Vienna City Park plans gave the idea for Jung's Helsinki Central Park plan. Jung compared Helsinki with other European cities and their increment forecasts. Berlin and London composed the reference group for Helsinki. It is evident that the historical areas of Helsinki would become quite efficiently built. Planning new traffic routes and traffic services and assessing the benefits of rail transport was new and revolutionary. Land policy became very important because the city had to acquire land areas for the needs of the growing city and to build the new traffic network. In 1912 Jung explored ports, parks and road constructions in Lübeck, Hamburg, Bremen, Bremerhafen, Rotterdam, Antwerp, and Stockholm with City engineer G. Idström. Three years later Jung travelled to Copenhagen, Malmoe, Gothenburg, and to Stockholm to investigate management of ports, handling of goods, and free port devices (Kuusanmäki 1992, 170-182).

## Studying abroad, Study tours

It is argued that attendance in congresses created good bases for studying abroad, and for making study tours individually. The picture can be, however, reversed: when looking at the international contact network of the teachers at the Helsinki University of Technology it is noticeable that participation in world exhibitions and specialised congresses is often connected to longer study tours. Altogether 33 of the professors or teachers of the Helsinki University of Technology (47 in 1849-1914) had studied in European technical Universities, of those 15 had studied in Zürich, 12 in Berlin, 6 in Hannover, 5 in Göttingen, one in Munich and 4 in Vienna (Nykänen 2004).

Furthermore, studying abroad was commonplace until the outbreak of the First World War and foreign know how was valued in Finnish companies. It was the beginning of the 20<sup>th</sup> century when Finnish engineers became the leading figures in companies. The aim of replacing foreign expertise with native talents was gradually achieved, so that Finnish engineers directed the construction work while foreign firms acted merely as sub-contractors. According to Pasi Tulkki's research, altogether 45 % of the engineers who graduated from the Helsinki Polytechnic College in the 1870s studied, and possibly worked abroad. From a table of the international contacts of the 1875 – 1895 graduates from the Helsinki Polytechnic College in Tulkki's research it becomes evident that the majority of students in each department visited Germany. Germany was especially important for the students of machinery of which 16 % visited Germany, 4 % Sweden, 7 % Britain, 5 % North America and 2 % Russia. Of the students at the department of engineering studies, 13 % visited Germany, 1 % Sweden, 13 % Britain, 1 % North America and 2 % Russia. Of the architecture students 18 % traveled to Germany, 22 % of students of

chemistry went to Germany, 8 % to Sweden and 3 % to Britain, and of land survey students, 2 % visited Germany and 1 % Sweden (Quoted in Michelsen 1999, 166 and footnote 125).

Minna Meriläinen has discovered in her research that a total of 215 Finnish students studied in German technical universities in 1900-1914. The most popular subjects were electrical engineering (55 students), machinery (45 students) and chemistry (55 students). Finnish students studied at the following technical universities: Karlsruhe, Dresden, Hannover, Berlin-Charlottenburg, Munich and Darmstadt. (Meriläinen 1990). For those who had studied abroad it was not difficult to work abroad. Of those who had graduated from Polytechnics in 1872-1895 two thirds found their first job abroad. Many of those returned to Finland when they found work as town engineers, in service of railways or as architects (Michelsen 1999, 166).

My data on officials and employees of the city of Helsinki (doctors, chemists, elementary school teachers, progressive librarians, architects, engineers and promoters of adult education and social work) illustrates that they carried out a total of 390 journeys which is an example of the active search for know how in 1875-1917. The reasons for travelling abroad varied. From 390 journeys mentioned 99 involved attending international congresses while the main aim of eleven was to visit important exhibitions (Table 1). Occasionally the initiative came from foreign sources in the form of invitations to attend international exhibitions or scientific congresses. A great many of the journeys were initiated, financed and even made obligatory by the city itself, which funded 158 of the trips. The state was also a very significant source of funds. The duration of these travels varied from a weeklong journey to a specific congress or exhibition to a year-long study tour. (Hietala 1992, 216-244; Bell and Hietala 2002, 184-185).

**Table 1: Nature of Study Tours of Helsinki Municipal Officials in 1875-1917. Sources: Printed papers of Helsinki City Council 1875-1917. Annual Reports of the Health Committee 1888-1917, Reports of the Municipal Elementary Schools in Helsinki 1902-1917. Marjatta Bell-Marjatta Hietala, Helsinki – the Innovative City, 2002, p.115.**

Service sector	Total	Including Congresses	Exhibitions
Health care	115	16	2
Elementary schools	187	67	3
Town planning	20	3	4
Social services	21	5	1
Adult education and training	31	-	1
Lighting	16	8	-
Total	390	99	11

Matters concerning elementary education were the concern of almost half of all journeys and they were the topic of over two thirds of the conferences attended by Helsinki teachers (Finns) (see Table 1). Travel related to health care amounted to some 30% while town planning, poor relief/social welfare and workers' education some 5-8%. Lighting accounted for less than 5%, perhaps because Finland itself had been a pioneer in the field of electric lighting. It is evident from the travel reports that the Nordic capitals, Stockholm, Copenhagen and Kristiania, as well as other large European cities formed the reference group

for the Helsinki municipal officials and experts and that such metropolises as London, Berlin, Paris and Vienna held special attractions for them.

Sources of information used in preparing study tours were comparative statistics, leading encyclopaedias and handbooks, conference reports and professional journals. In Central Europe and in Britain special periodicals were published for municipal officials and decision-makers, which provided information on developments in various sectors of municipal life (e.g. They included *Städte-Zeitung*, *Kommunale Rundschau* and *Kommunale Praxis* and *The Municipal Journal* and *Local Government Review*).

Finnish municipal officials and experts were certainly not the only ones who travelled in Europe. Significant channels for the spread of innovations were the visits of English and German municipal officials in search of information Germany. Anglo-American co-operation at the municipal level was mainly limited to the period 1905-1914 (Hollenberg 1974, 60-113), but the British were especially active in studying other countries' municipal activities. The British Committee for the Study of Foreign Municipal Institutions made visits to Switzerland, Germany, the United States and the Nordic countries. The English municipal experts were especially interested in the elementary school systems of municipalities in Norway and Sweden, where schooling was obligatory and open to all. In addition to the school system the visitors were interested in Stockholm's telephones and its gas and electricity works. In Copenhagen health care and the homes for the aged were admired (Hietala 1987, 365-381). However, the great public interest shown by Swedes in improving the city's services is demonstrated by the fact that in 1912 the newspaper *Aftonbladet* felt it worthwhile to send a special correspondent on a tour of European cities to study how traffic problems that were seen as the most relevant for the city of Stockholm could be solved. He submitted a total of 36 articles, published in the paper between November 1912 and August 1913 (Hietala 1987, 387-391).

## Professionalisation and networks – A gender perspective

Judy Wajcman has in her book *Feminism confronts technology* studied what did technology mean for women. Her book begins with an overview of feminist theories of science and technology, she studies the impact of production technologies on` sexual divisions in the sphere of paid work, growing supremacy of technology in Western medicine, sociological theories regarding the impact of technologies on the postindustrial homes and technology as masculine culture. According to her the very definition of technology has a male bias and the technical expertise is a source of men's actual or potential power over women (Wajcman 1991, VIII-X, 162-167). When we are looking only at the technology (like education at universities of technology), the picture can be very negative but if we look at building of infrastructure from wider perspective the picture is more positive. In my studies one result is that at least in Finnish towns women, like nurses and teachers could travel as much as their male colleagues. They received financial aid both from towns as well as from the state and they created their own networks (Frieborg 1920-1922).

What is the case of in the sector of engineering and architecture?. Among the above mentioned professors and teachers of the Helsinki university of technology there was no female teacher in 1849-1914 and it took till 1960s before the first female professor (in chemistry) was chosen to the Helsinki University of Technology. Can it be explained by the lack of female graduates? Answers to this question is no. In the following table (Table 2.) which is based on data collected from all graduates from the Helsinki University of Technology 1908-1948, you can see that the amount of female graduates was 175 (excluding 5

graduates from other institutions). The total of all graduates in this matrix is 3802 (Suomen insinöörejä ja arkkitehteja 1948).

Table 2:

Women graduates from Helsinki University of Technology in 1908-48*						
	Architects	Master of Science in Technology				
		land surveying	chemistry	electricity	machinery	other
1908-1919	17		1			
1920-1929	15	1	3		2	
1930-1935	18	2	1			
1936-1940	28	3	10		7	1
1941-1945	22	1	15	1	3	1
1946-1948	5		11		1	1
total	105	7	41	1	13	3

\* The matrix of Helsinki University of Technology includes also information on five women graduates from other insitutes of education.  
Source: Suomen insinöörejä ja arkkitehtejä 1948.

From the table we find that architecture has attracted women students already during the 1910s, 1920s and 1930s. In 1935-1940 the amount of female architect graduates increased, as did the number of students. For example in the fall term 1939 there were 147 students studying architecture, of which 61 were women. The amount of female students increased also at department of chemistry in which of the total 145 students 25 were women. During the same term, however, there were a total of 408 students studying machine engineering of which only eight were women; similarly at the department of construction engineering of the total of 166 students only one was female (Statistics on students at the Helsinki University of Technology). As the table 2 illustrates, the number of architecture graduates declined, as did the number of other women graduates during the continuation war (1941-1944) and after the war. The only exception was the department of chemistry where there were more female engineers graduating than during the years of peace.

Already after the Winter War (1939-1940) there commenced discussions about limiting the number of female students due to the continuing increase of women studying architecture. From the records of the teacher collegial body at the Helsinki University of Technology it becomes evident that women's studying was not seen as productive as men's were. Furthermore, it was complained that in the society women did not act in the same proportion as men as practical architects. Finally, however, it was doubted if the Ministry of Education would warm up to the proposal (Minutes of the meetings of teacher collegial body of the Helsinki School of Technology 28.5.1940 and 31.5.1940).

However, in the matrix of architects it can be found that female architects working in the public sector were numerous, for example in municipal administration and in different ministries. Moreover, for example in Ministry of Defence female architects designed garrisons. In the matrix it is also mentioned that many architects worked in architects' offices, however, only few women had established offices of their own. With regards to the memberships of different professional associations or societies it seems that female architects were more often members of these associations than the female engineers. Due to the missing systematic empirical research on career developments and professional activities of female architects and engineers it impossible to draw a general picture of their history.

## Conclusions

The active participation in international discussions, in study tours and conferences on the field of infrastructure can be explained not only with the need to follow up the latest developments, but also with language skills and organisational culture. In the central boards and administration of Helsinki many experts have studied abroad and appreciated the application of the latest knowledge. These well travelled people understood the importance of not only of acquiring other countries' experience but also taking regard of local conditions in the application of innovative ideas as opposed to merely directly imitating solutions used elsewhere.

In many professional fields in Helsinki or even in Finland the limited amount of specialists meant that contacts with their colleagues in Germany, and other part of Europe were necessary for active up-dating of their professional standards. However, for further research, more comparative data is needed on relationships between professionalisation and transferring know how.

## References

- Bell, M. & Hietala, M. 2002. *Helsinki – The Innovative city*. Helsinki: Finnish Literature Society.
- Edwards, P.N. 2003. *Infrastructure and Modernity: Force, Time, and Social Organisation in the History of Sociotechnical Systems*. In: Misa, T.J., Brey, P. & Feenberg, A. (Eds.), *Modernity and Technology*, Cambridge Massachusetts, The MIT Press.
- Formation and Transfer städtischen Verwaltungswissens/Formation and transfert du savoir administrative municipal/Formation and Transfer of Municipal Administrative Knowledge, *Jahrbuch für Europäische Verwaltungsgeschichte/Annuaire d'Histoire administrative Européenne/Annuario per la Storia Amministrativa Europea/Yearbook of European Administrative History* 15 (2003), Nico Randeraad (Ed.), Baden-Baden: Nomos Verlagsgesellschaft.
- Frey, R.L. 1967. Probleme der statistischen Erfassung der Infrastruktur. *Sweizerische Zeitschrift für Volkswirtschaft und Statistik*, Bd 103.
- Friberg, M. 1920-22. *Tieni varrella taapaamia 1-2*, Helsinki: Naisten ääni/Rosma.
- Geppert, A.C.T. & Lau, T. *History of International Exhibitions 1851-1951*, URL: <http://www.tu-cottbus.de/BTU/Fak2/TheoArch/Wolke/eng/Bibliography/ExpoBibliography.htm>.
- Hallström, J. 2002. *Constructing a Pipe-Bound City: A History of Water Supply, Sewerage, and Excreta Removal on Norrköping and Linköping, Sweden, 1860-1910*, Linköping: Dept. of Water and Environmental Studies.
- Henock, E.P. 1987. *British Social Reform and German Precedents: The Case of Social Insurance 1880-1914*, Oxford: Clarendon.
- Hietala, M. 1987. *Services and Urbanisation at the Turn of the Century: The Diffusion of Innovations (Studia Historica 23)*, Helsinki: Finnish Historical Society.
- Hietala, M. 1992. *Innovaatioiden ja kansainvälistymisen vuosikymmenet*. In: *Tietoa, taitoa, asiantuntemusta. Helsinki eurooppalaisessa kehityksessä 1875-1917 I (Historiallinen Arkisto 99:1/. Helsingin tietokeskuksen tutkimuksia 1992:5:1)*, Helsinki: Suomen Historiallinen Seura.
- Hietala, M. 2003. *Transfer of German and Scandinavian Administrative Knowledge: Examples from Helsinki and the Association of Finnish Cities, 1870-1939, Formation and Transfer städtischen*

- Verwaltungswissens/Formation and transfert du savoir administrative municipal/Formation and Transfer of Municipal Administrative Knowledge, *Jahrbuch für Europäische Verwaltungsgeschichte/Annuaire d'Histoire administrative Européenne/Annuario per la Storia Amministrativa Europea/Yearbook of European Administrative History* 15 (2003), Nico Randeraad (Ed.), Baden-Baden: Nomos Verlagsgesellschaft:109-130.
- Hollenberg, G. 1974. *Englisches Interesse am Kaiserreich: Die Attraktivität Preussen-Deutschlands für konservative und liberale Kreise in Grossbritannien 1860-1914*, Wiesbaden: Steiner.
- Hughes, T. 1989. *American Genesis: A century of Invention and Technological Enthusiasm 1870-1970*, New York: Viking.
- Johansen, R. 1966. *Theorien der Infrastruktur: Grundlagen der marktwirtschaftlichen Entwicklung*, Tübingen.
- Kuusanmäki, J. 1992. Sosiaalipoliittikka ja kaupunkisuunnittelua. In: *Tietoa, taitoa, asiantuntemusta: Helsinki eurooppalaisessa kehityksessä 1875-1917*, 2 (Historiallinen Arkisto 99:2/Helsingin tietokeskuksen tutkimuksia 1992:5:2), Helsinki: Suomen Historiallinen Seura.
- Larson, M.S. 1977. *The Rise of Professionalism : a Sociological Analysis*, Berkeley: University of California Press.
- Michelsen, K.-E. 1999. *Viides sääty: Insinöörit suomalaisessa yhteiskunnassa*, Helsinki: Tekniikan Akateemisten Liitto/ Suomen Historiallinen Seura.
- Minutes of the meetings of the teacher collegium of the Helsinki University of Technology 1940, Archives of the Helsinki University of Technology. Formation and Transfer städtischen Verwaltungswissens/Formation and transfert du savoir administrative municipal/Formation and Transfer of Municipal Administrative Knowledge, *Jahrbuch für Europäische Verwaltungsgeschichte/Annuaire d'Histoire administrative Européenne/Annuario per la Storia Amministrativa Europea/Yearbook of European Administrative History* 15 (2003), Nico Randeraad (Ed.), Baden-Baden: Nomos Verlagsgesellschaftpp
- Nipperdey, T. 1990. *Deutsche Geschichte 1866-1918 Erster Band: Arbeitswelt und Bürgergeist*, München: Beck.
- Nykänen, P. 2004. Unpublished manuscript of Panu Nykänen 2004. Helsinki University of Technology.
- Perkin, H. 1989. *The Rise of Professional Society: England since 1880*, London: Routledge.
- Rönehholm, H. 1945. *Markkinat, messut ja näyttelyt*, Helsinki: Suomen Messut Osuuskunta I.L.
- Saunier, P.-Y. 2003. *Les voyages municipaux américains en Europe 1900-1940. Une piste d'histoire transnationale*, Formation and Transfer städtischen Verwaltungswissens/Formation and transfert du savoir administrative municipal/Formation and Transfer of Municipal Administrative Knowledge, *Jahrbuch für Europäische Verwaltungsgeschichte/Annuaire d'Histoire administrative Européenne/Annuario per la Storia Amministrativa Europea/Yearbook of European Administrative History* 15 (2003), Nico Randeraad (Ed.), Baden-Baden: Nomos Verlagsgesellschaft: 267-288.
- Smeds, K. 1996. *Helsingfors-Paris: Finland på världsutställningarna 1851-1900* (Skrifter utgivna av Svenska litteratursällskapet i Finland, Nr 598), Helsinki: Finska Historiska Samfundet.
- Suomen insinöörejä ja arkkitehtejä 1948* (1948), Vaasa: STS/TFiF.

Sutcliffe, A. 1981. *Towards the Planned City: German, Britain, the United States and France 1780-1914* (Comparative Studies in Social and Economic History 3), Oxford: Basil Blackwell.

Teknikern 1903. Helsingfors.

The Statistical Yearbook of Helsinki 1915, Helsinki.

Wajcman, J. 1991. *Feminism confronts technology*, Oxford: Polity Press.

