

# VERA - Information Networking in the Construction Process

Arto Kiviniemi  
Senior Research Scientist  
VTT Building Technology  
[Arto.Kiviniemi@vtt.fi](mailto:Arto.Kiviniemi@vtt.fi)

Mika Lautanala  
Senior Technical Adviser  
Tekes  
[Mika.Lautanala@tekes.fi](mailto:Mika.Lautanala@tekes.fi)

Kari Kaitanen  
Research Scientist  
VTT Building Technology  
[Kari.Kaitanen@vtt.fi](mailto:Kari.Kaitanen@vtt.fi)

## **Introduction**

Tekes is starting a national technology programme on Computer Integrated Construction.

Tekes, Technology Development Centre Finland is a national organisation that promotes technological research and development and the co-operation of companies, universities and research institutes within Finland as well as internationally. Tekes primary objective is to promote the technological competitiveness in Finnish industry. Activities should lead to an increase and diversification of industrial production and exports and an improvement of well being in society.

Technology programmes are a mean of creating new technological know-how through the co-operation of companies, research institutes and universities. The programmes promote the technological development of a specific field of technology or industry. Technology programmes consist in part of the public research projects of universities and research institutes, and in part of confidential technology and product development projects of companies.

## **National R&D programme starting 1997**

The new programme is called "VERA - Information Networking in the Construction Process". The target will be to promote implementation and use of IT in construction process as an enabling technology to re-engineer construction process.

The programme is due to start in full scale August 1997. The programme will last six years, and its total volume is planned to be 170 million Finnish marks (34 million US\$), of which 40...50 % comes from Tekes and the rest from the industry. About 20% of funding is for applied technical research (public projects) and 80% is for industrial R&D projects. Some projects have already started.

## **Survey project in the programme planning phase**

In the planning phase a project group made a survey in Finland to analyse the industrial state of art and needs concerning the IT in construction process. The project group was:

- |   |                                       |
|---|---------------------------------------|
| • Kari Karstila, EuroSTEPsys Ltd        | Building industry                     |
| • Arto Kiviniemi, VTT                   | Design, structural engineering and FM |
| • Pekka Metsi, Granlund Engineering Ltd | Building services                     |
| • Riitta Takanen, NCC Puolimatka Ltd    | Main contractors                      |
| • Mika Lautanala, Tekes                 | Project Co-ordinator                  |

A questionnaire was sent to about 250 AEC/FM companies in Finland. The questionnaire address for example following questions:

- state of the current information systems
- main hinders to use IT effectively



- unused features in current technology
- development needs within different time spans
- vision of the IT in AEC industry

Also numerous interviews, two workshops and one open seminar was held to collect a total vision of the problems and expectations in the AEC/FM industry. The questionnaire was send also to a group of Finnish CAD-vendors to clarify the possible difference between the views and expectations of users and vendors. The preparation work started in November 1996 and ended in April 1997.

Additionally to this national survey professor Bo-Christer Björk from KTH made a brief report of the international state of art in IT R&D on AEC/FM field specially concentrating to find the most interesting and advanced research institutes in several items.

### Some survey results

Figure A shows the percentages of questions sent to different industry groups, the answering percentages and response rate of each group (percentage of answers/questions). The construction companies are not shown in this figure, because the questionnaire for them was made by a different method. All major construction companies in Finland were interviewed. Also the CAD vendor group is left outside this study, because the nature of business and response rate was very different than in building industry, over 70 %. This fact was quite obvious because the programme gives them directly new markets and possibilities to develop their products to the building industry market.

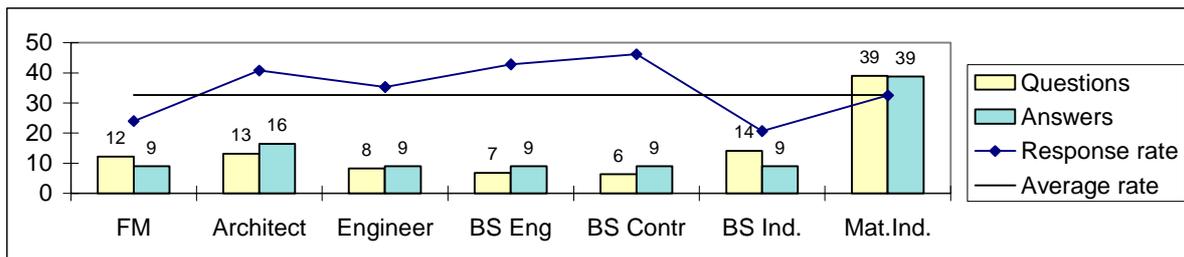


Figure A: The questionnaire (BS = Building Services)

The FM group and building service industry were not as active to answer as other groups. As total 33% (average response rate) of the sent questions were answered. The group that answered the questionnaire was evidently the most active companies in use of IT in their work. This is a common problem with studies in this field and it must be kept in mind when analysing the results.

### State of the current information systems

The use of IT in daily work is very common. figure b shows the average percentage of work done computer aided. The lowest estimation was in FM group, 64 %, highest in structural engineering, 88 %. The average value shown by the line is 72%.

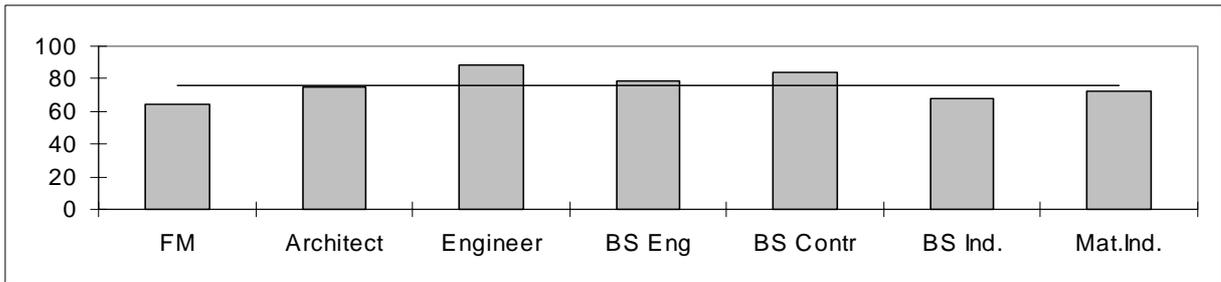


Figure B: Percentage of work done computer aided

One clear indication was that there is mainly a strong correlation between the satisfaction to the usability of current software, user's estimation of their own ability to use the software and the actual use of the software. This could of course be construed in several ways, but perhaps the right interpretation is that if software is used in the daily work, the users learn the right ways to use it and after that they are also satisfied to the properties of the software.

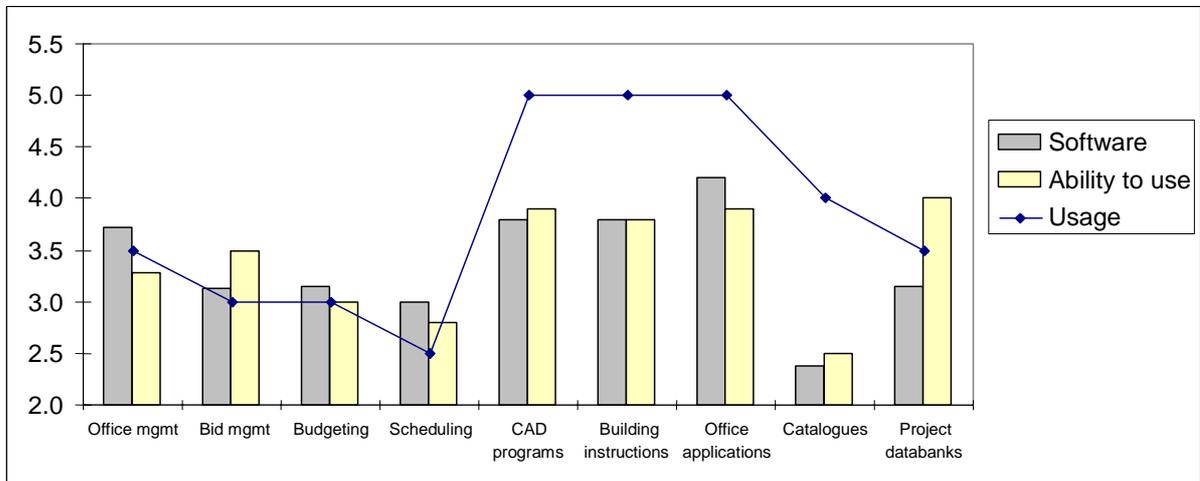


Figure C: Satisfaction and use of software in architectural offices

In Figure C is an example of this part of the questionnaire. It shows the correlation between the usability of software, ability to use it and its usage in architectural offices. There are only two items where is a major difference between these factors. The software producing the catalogues architects must do in Finland are of course widely used, but the users are not satisfied and feel also that they can not use the software well. If this is projected to the answers to development needs, a very interesting point can be found. 80 % of users feel that software for these purposes need further development urgently, but none of the software vendors see this problem in their answers. One could say that there is obviously lack of discussion between customers and vendors. Another major difference in correlation is in project databases, where the users feel that they can use the software very well, but are not satisfied. The main reason might be the data transfer by telephone lines, which is still too slow for big CAD files.

### Main hinders to use IT effectively and unused features of current technology

In all groups the main obstacle was the lack of know-how and ability to use IT. This hinder was mentioned almost as often as all other items together. The other main obstacles were defective software, incompatibility in data sharing and lack of money, Figure D.

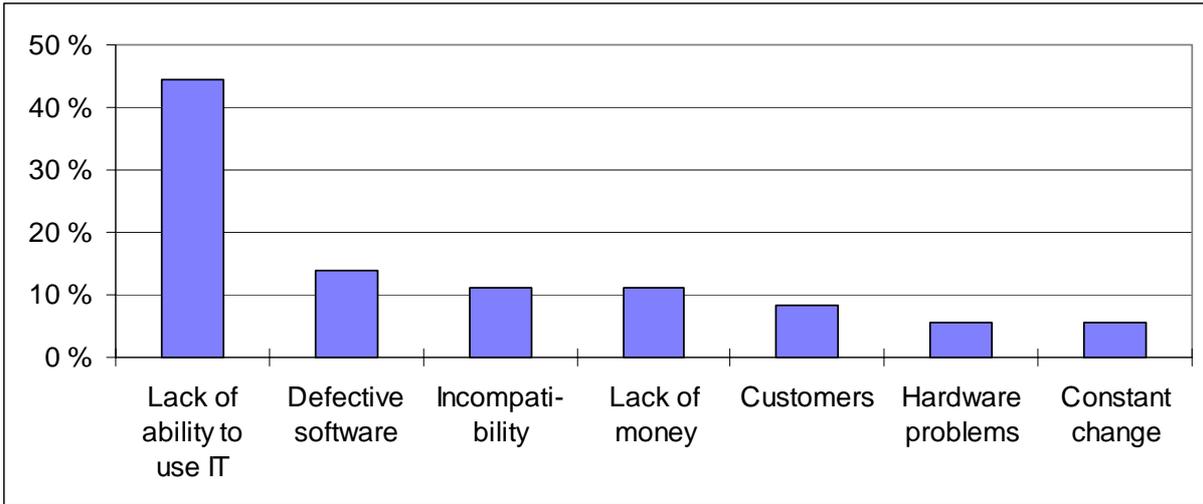


Figure D: Main hinders to use IT effectively

The answers to question “What features in current technology have not been utilised” showed three top items, which together collected more than 50 % of the comments:

- intelligent data sharing
- use of networks
- integration

All these features can clearly be categorised to one group: Information networking, because the integration and use of networks are requirements to information sharing. Other main comments are shown in Figure E.

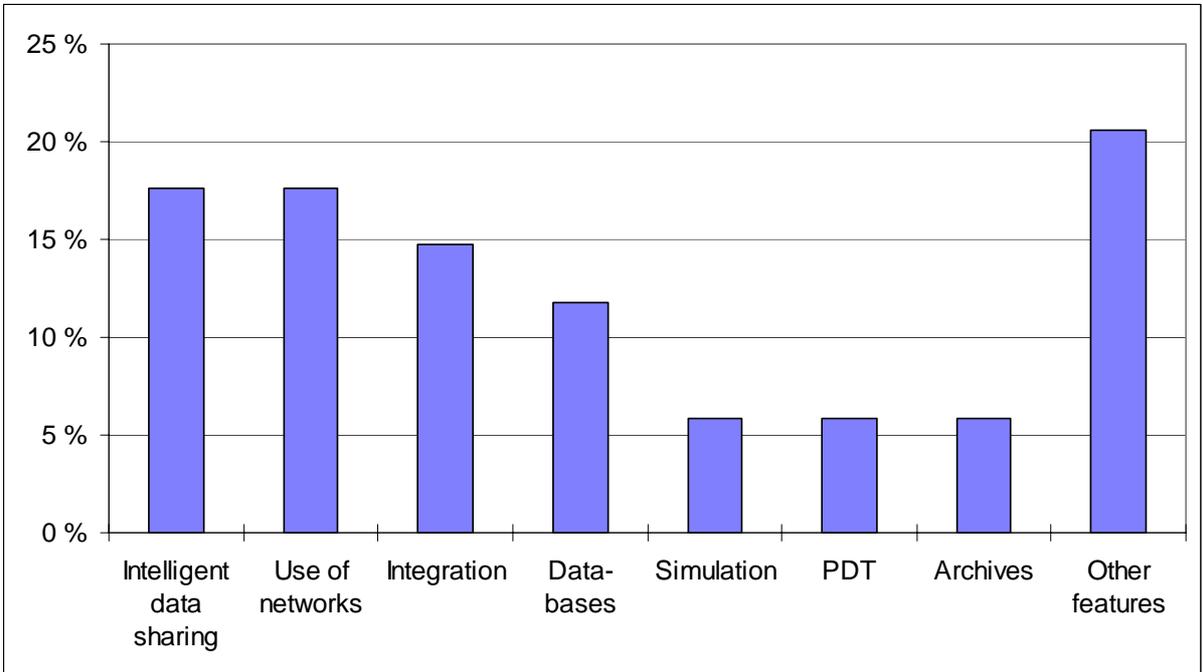


Figure E: Unused features in current technology (PDT = Product Data Technology)

**Development needs within different time spans**

In different groups all development needs were naturally not same. Some of the common needs of all groups are collected in figure f. The common feature was that in all these items the categories “less than 1 year” and “1-3 years” have got together 71...83% of all answers.

This means that the users see the development needs as a very urgent issue and indicates also clearly the need for heavy investments to software development and also this R&D programme.

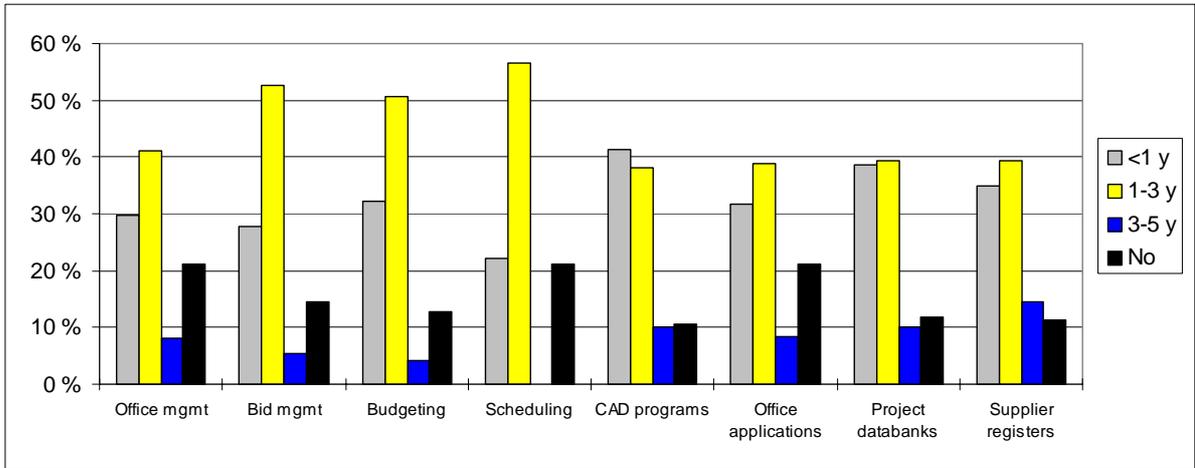


Figure F: User's view of development schedule (No = No need to develop)

### Main reasons to develop the use of IT

In all groups the main reason to develop the use of IT was competitiveness as shown in figure g. Other important reasons were usually quality systems and clients. The least important factor was in all groups laws and regulations.

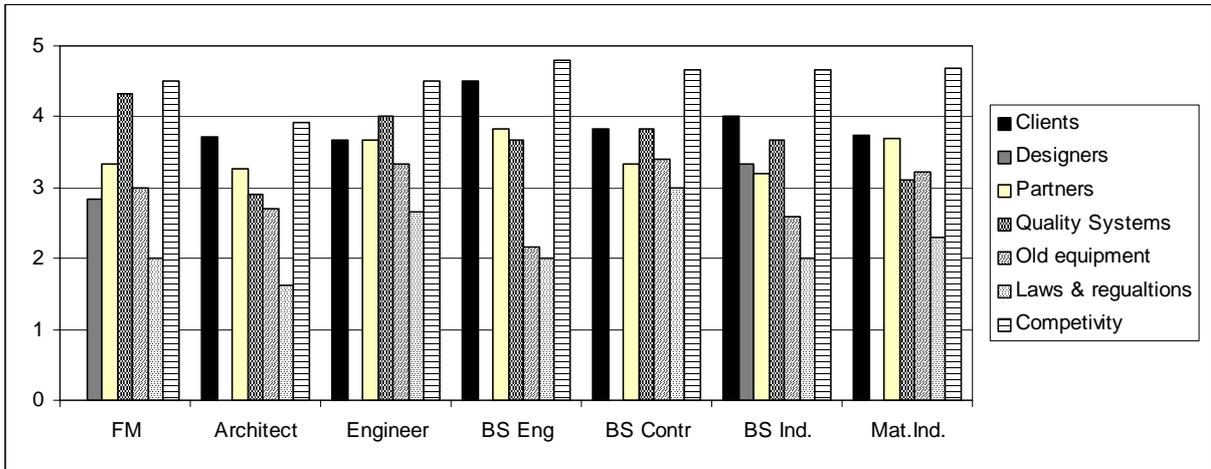


Figure G: Reasons to develop the use of IT

### Importance of IT as a tool

In most groups IT was seen mainly as a strategic tool. Only architects saw it more as a basic tool in their work. None of the companies that answered the questionnaire saw that IT has no importance in their work, figure h.

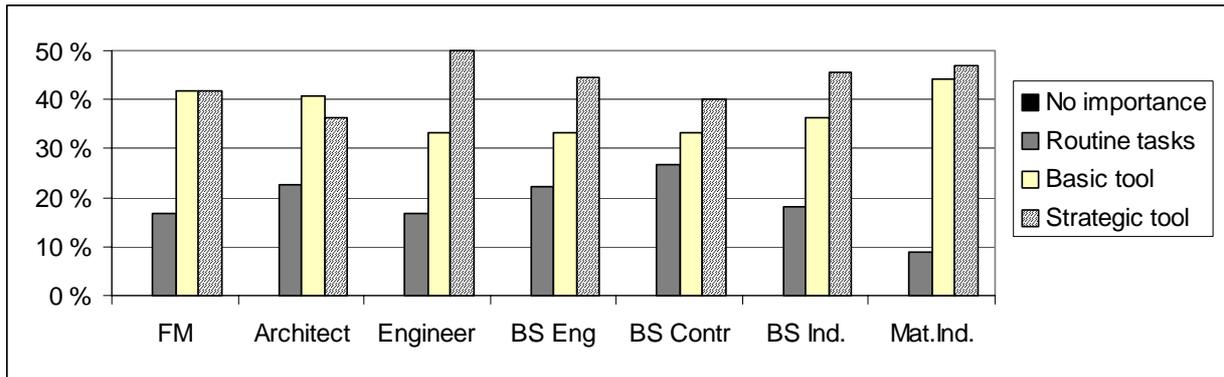


Figure H: Importance of IT as a tool

### Use of networks

In the use of networks was large differences between groups, figure i. All architects and engineers used data transfer, but only 20% of architects used internal email. This of course is natural considering the size of companies, average size was 10 employees. 100% of the building services industry used internal email and 83% had their own Internet server, but only 50% external email and 33% data transfer.

As a total the use of networks was relatively high among the companies that answered the questionnaire.

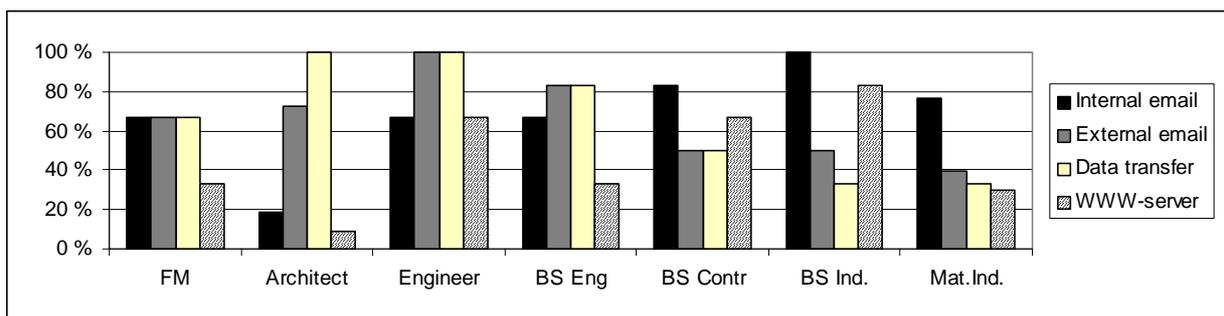


Figure I: Use of networks

### Vision of the IT in AEC industry

A question about expectations in future development on some key areas was also made. figure j illustrates the summary of the future vision in all groups. Some comments:

- Email was seen to be one of the main communication methods in building projects within one year by 60% and within 1-3 years by 36% of respondents-so almost all companies believed that email will have it's breakthrough within 3 years in building industry
- Wide use of CAD documents also by contractors was seen to be common within 3 years by 81 % of respondents.
- Both "Data exchange" and "Use of Internet in the trade of building materials and components" was seen to come true within 3 years by 79 %, but only 13% believed that Internet will be used within one year
- 58% believed that catalogues in digital format will be introduced within 3 years
- Object orientated software and simulation in design phase were both seen in quite similar ways. 33% believed that they will be implemented in 1-3 years, but 35% saw that this will take 3-5 years
- Building life cycle information was clearly seen to be a matter of 3-5 years

- 34% of the companies did not know EDI, all different time spans gathered about 20% of the responses

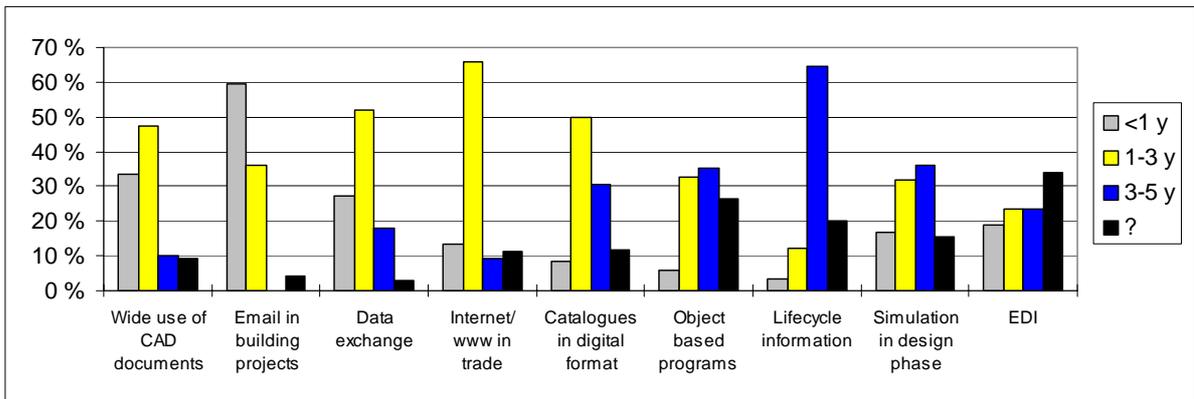


Figure J: Vision of IT development (? = No opinion or item not known)

### VERA programme

The framework for the national IT programme was made on the basis of the preparation work. The programme was approved in the Tekes Board at 26th May 1997. Some main points of these framework and programme goals are presented in this part.

### Technological step

In the early phase of IT the different programs were separate tools for some special task and the information could not be transferred between the software even within the companies. Now the intelligent data transfer between programs within companies is often possible. VERA programme is trying to help in the next step in this progress: to make the data sharing possible between all participants in building industry.

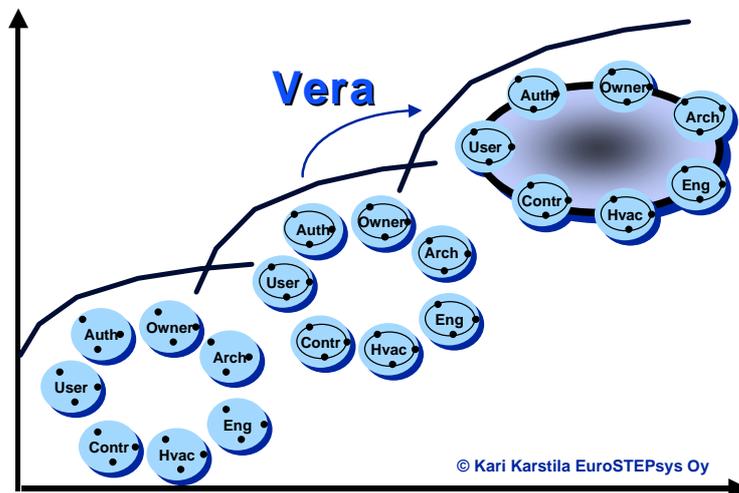


Figure K: Technology steps

### The main development areas in VERA programme

#### 1. To raise the quality of information management between project participants

- The participants must be able to deliver the right information to the right persons at the right time. The main goals are interoperability and data sharing

#### 2. Information management over the building life cycle

- First requirement to fulfil this is, that all information produced in the design and

construction process is interoperable and that as-built information can be delivered after the delivery of the building

### **3. Wide utilisation of IT in building industry**

- The current processes in building industry include much overlapping and repeated work, because the processes and methods are still mainly the same as they were before implementation of IT. Information networking could reduce this overlapping, but it is not possible before all participants use IT widely and the data is interoperable.

### **4. Re-engineering of building process**

- The building process must develop into a user and product orientated, flexible process supporting networking and sustainability
- IT can be used as a tool to change the processes
- The process must be changed before the full benefit of IT can be achieved

### **5. Use of information networks**

- The use of network in data sharing will enable new and faster processes and make revision control easier decreasing problems to find the latest information in the changing situations.

## **International co-operation**

Although VERA is a national development programme the international collaboration will be an important part in the projects. The IT development into practical implementations is very long and costly process. Also the constant change into more global markets will have more and more affect in the building industry. Especially company to company level collaboration will be encouraged.

Within the Nordic countries the discussions of co-operation have already started. The parallel programmes are:

- Denmark IT Udvikling i Byggesektoren
- Norway Samspillet i Byggprosessen
- Sweden IT Bygg 2002

The first project on Nordic level will be benchmarking of the current state of the art in all Nordic countries. The results of this study will also serve as an indicator of the progress in the national programmes when it will be repeated during the process.

## **Conclusions**

Obviously the benefits of IT has been seen by the building industry.

Companies see lack of IT capable employees as the main hinder to use IT efficiently.

Biggest potential in development of IT are:

- Development of IT and processes simultaneously
- Using IT as an enabling technology to re-engineer processes
- Development in networks (client – supplier value chain)
- Interoperability