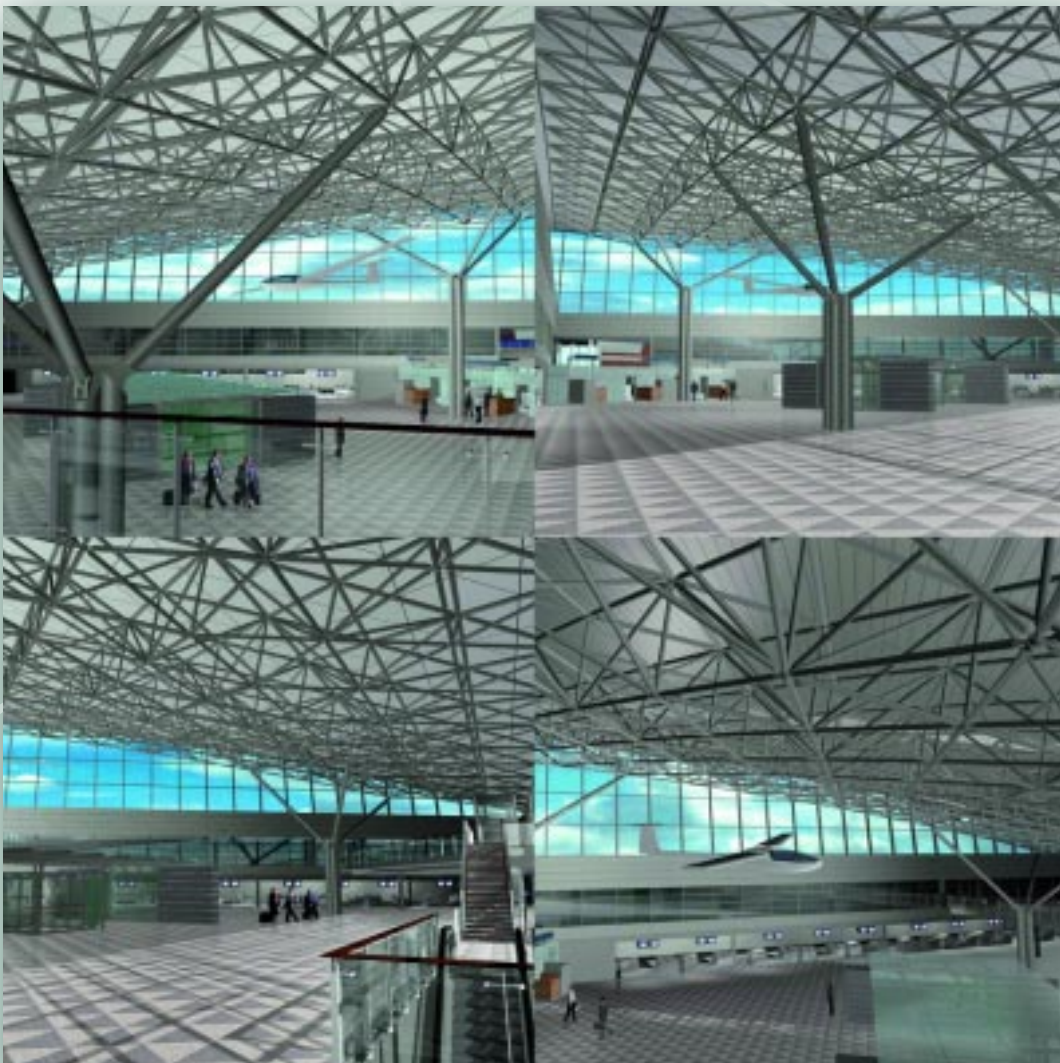


Vera

Information Networking
in the Construction Process



TEKES

Productivity and Quality with Information Management throughout a Building's Life Cycle

READY TO UTILISE INFORMATION TECHNOLOGY

The construction business has traditionally been very fragmented. Therefore, utilisation of information technology has also been very slight. However, great cost savings and better quality can be achieved by using information technology. Employing information technology in project and planning exports may result in a number of competitive advantages.

The various parties in the construction business have applied and developed information technology in their own projects. Internal systems are, therefore, for the most part in place, but information transfer between the parties and joint utilisation of this information are a bottleneck. Internet and object oriented systems have made the use of product model technology and joint use of information in the construction process possible. Development has been given an extra kick lately by the fact that all the leading international software companies have committed themselves to the work of IAI ¹⁾ and to implementation of object oriented IFC ²⁾ software.

As a result of the past research activities (Ratas etc), know-how in Finland is at a high level, which is why the Finnish construction industry is in the advantageous position of being among the first to utilise product model technology more broadly, and thereby gain competitiveness in the international markets.

RE-ENGINEERING THE CONSTRUCTION PROCESS USING INFORMATION TECHNOLOGY

The purpose of Vera, the Information Networking in the Construction Process technolo-

gy programme is to promote the utilisation of product information technology and information networks in construction processes, and to make it possible to manage the construction information flows during the entire life cycle of the building.

To reap the most benefits from Vera, construction processes and information systems are being developed simultaneously. The objective is that the parties in a construction project will be able to form a virtual company, i.e. a project-based, flexible and quick-to-react organisation aiming for a joint goal.

THE FIVE MAIN THEMES OF VERA

The construction process

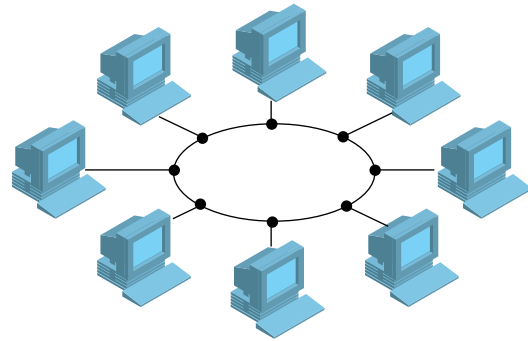
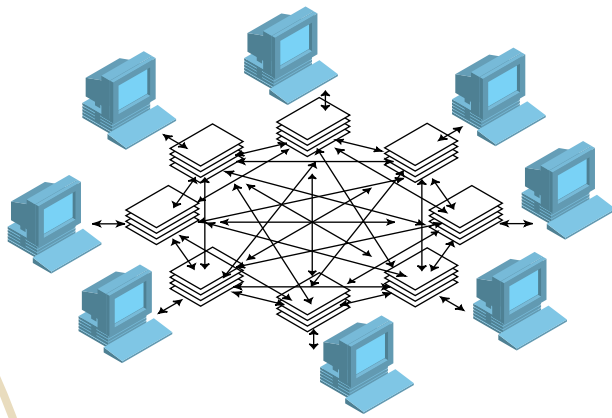
The goal is to make information technology serve the entire construction process. Information technology will also be used as an enabling technology both in newbuilding and in renovations. The scope of the projects could for example concern operational models and guidelines, contracts, task lists and re-engineering.

The information life cycle

In this part of the programme, the goal is to make the information concerning a building available throughout its entire life cycle. Information should be a part of the product, and it should be possible to hand over the as-built data at the end of the construction project to form the base for the use and maintenance of the building. Entering and archiving the data on existing buildings in digital form is also an integral part of this section of the project.

1) IAI (International Alliance for Interoperability) is an international organisation with a membership of about 500 building owners, construction firms, architectural and engineering offices and software companies. The first 11 pilot implementations were presented in the fall of 1996 at the Frankfurt ACS exhibition and the first commercial programmes will probably be published in early 1998.

2) IFC (Industry Foundation Classes) determines a common database structure for all software in the construction industry. Using this database structure, the various parties to a construction project may make use of and complement the jointly used database for the building.



The purpose of the Vera technology programme is to help the parties in a construction project to form networks and share project data instead of paper documents. To solve this problem the Vera programme is actively promoting the definition and use of IFC standards in R&D projects.

Information sharing between the parties

The challenge in information sharing between the parties is to integrate the teams that change from project to project. To manage the information flows it will be necessary to agree on the content, structure, format and presentation of the data, to be able to develop applications for integration of the information systems. Projects in this area include application of product data standards (IFC), revision control, jurisprudence, feedback systems and building maintenance services.

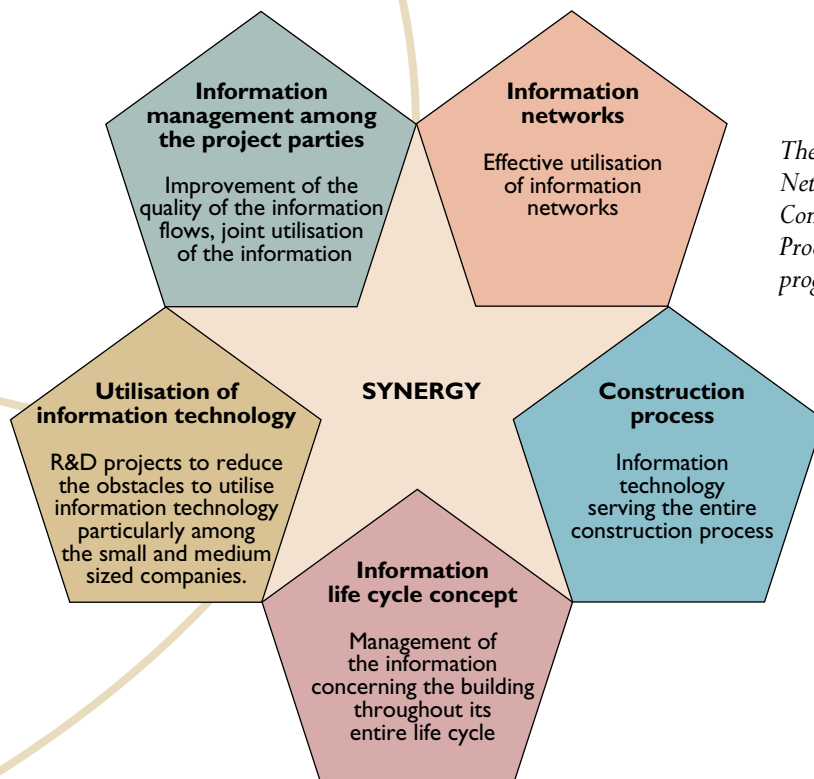
Effective utilisation of information networks

Information transfer through a network makes work more effective. This section of Vera in-

cludes projects to develop utilisation of information networks in construction processes, such as project data banks, general product information and regulations, software to support a virtual company as well as copyright issues in information network utilisation.

Utilisation of information technology

Networking is contingent upon broad utilisation of information technology in the construction business. The goal is that information technology will be able to comprehensively serve the construction business. The goals of this section of the Vera programme are to transfer experiences from the development and pilot projects to a broader group of users, and develop



The Information Networking in the Construction Process technology programme

R&D projects to reduce the obstacles to utilise information technology particularly among the small and medium sized companies. These goals can be promoted for instance through benchmarking and pilot projects as well as technology transfer projects.

NEW COMPETITIVE FACTORS

Through the Vera programme it will be possible to affect operations in the construction process. When the construction information flows are managed, the life cycle concept becomes a competitive factor. The fragmented construction process can be managed and integrated, making it possible to offer the demanding customer the service he needs. Information becomes a part of the product.

Improvement in income from fixed assets

The results of the Vera technology programme will improve the income from fixed assets in two ways. On the one hand, the utilisation and maintenance of the building can be managed better, when information concerning the building and its use are at hand. The maintenance and repairs to the building can also be timed and aimed better, resulting in lower operational costs and longer useful life.

On the other hand, utilisation of information technology can improve the quality of the building itself, and make the building better suited for its purpose. Thus it is possible to affect the costs of the activities taking place in the building. These costs are generally a great deal higher than the costs for construction and maintenance.

Improving quality and overall profitability of construction

As a result of the fragmentation of the construction process, the building sector is experiencing quality problems and the overall profitability of the sector is poor. The Vera programme provides the tools for managing this fragmented process.

Through networking the companies involved in a single project are able to operate as an entity – a virtual company to serve the customer comprehensively and to create products that answer to the demands.

Information management is a significant part of the costs of construction. The biggest estimates are that as much as 30 % of the construction costs could be saved by reducing the friction in information management. This is based not only on the efficient utilisation of information technology but also on process re-engineering. Reduction of friction means elimination of unnecessary work, such as redundant work and fixing of mistakes.



*ICL OFFICE BUILDING
Client: Insurance company
Sampo Pensions Ltd.
Consultant: JP-Terasto Oy
Architectural Design:
Architects Tommila Oy*

Information Technology Made a Tight Schedule Possible

THE DESIGN OF ICL'S OFFICE BUILDING was started in April, 1994. The problem was an unusually tight design schedule: sufficient documents for bidding were needed by August, 1994. In addition to the designing experience, the ability to innovatively make use of information technology was also a critical factor in the choice of the architect and engineers. At the start of the project, detailed project process guidelines concerning the utilisation of CAD was made, and a joint data bank was established in the structural engineering office. Virtually no drawings larger than size A3 were printed prior to the start of construction. Planning and execution proceeded according to schedule and budget.

Information technology – many advantages

- precise, real time management of the information made it possible to follow up the implementation of the original room programme, and thereby follow up costs even at the beginning of the design
- simultaneous and overlapping design and engineering resulted in significant time and cost savings
- without CAD integration the design within the scheduled time frame would not have been possible at all
- in the future, development of CAD utilisation must be controlled in such a way that design data can be used to an even broader extent for the needs of the construction phase and the work site
- the aim should be that information once produced can be applied from the design, planning and implementation stages up to and including the end use of the building.



Increasing construction exports

Information technology makes it possible to promote project and planning exports, but also product exports (such as digital product libraries). Companies are able to quickly create a functioning project management environment, where information streams are managed efficiently and swiftly. This is a significant competitive advantage. The overall increased effectiveness also creates competitive advantages.

Smaller companies can also join forces and prove that they can manage large entities as a "virtual company", and thereby improve their credibility and broaden their market segment.

Other benefits

One central aim of the Vera programme is information management throughout the entire life cycle of the building. This can form a base for a broader application of the principle of sustainable development. Life cycle analyses and product tracking throughout its life cycle without information technology is difficult, due to the large amounts of data to be managed.

The programme also creates new business areas for the building process. These include services primarily in the information technology area, such as "project integrator".

INTERNATIONAL CO-OPERATION

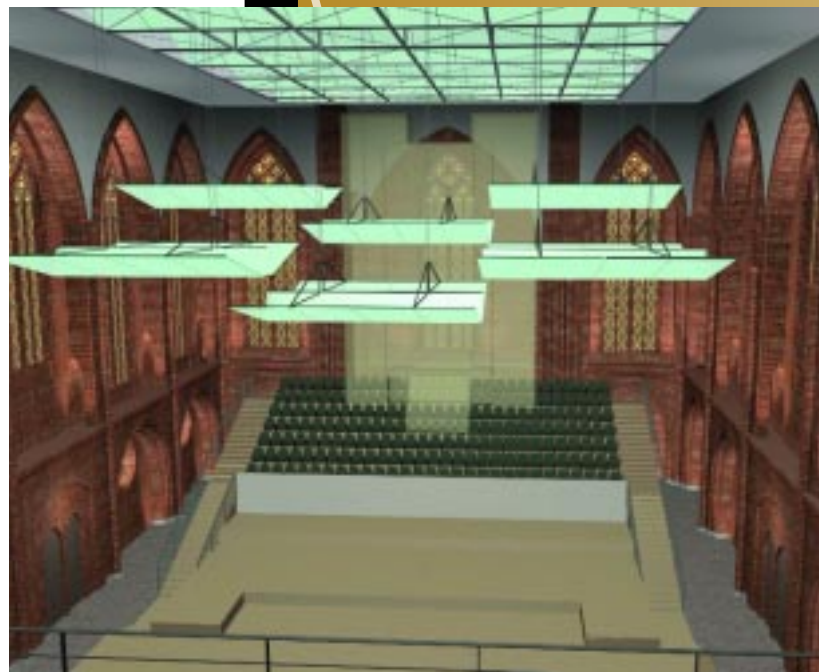
The problems addressed by the programme and the goals we are aiming at are not specific for Finland and the Finnish construction industry. There are beginning and ongoing research programs with similar baselines and goal statements in other countries as well.

It would be beneficial to solve these problems through international collaboration. A good example is the globally ongoing IFC activity. In the Vera program, we want to encourage international R&D activities in other fields as well.

Research on product model technology in construction has long been active in Finland. This has created recognition of know-how world wide both in academia and the industry. We can offer world class know-how in computer integrated construction to international partners.

SCHEDULE AND BUDGET

The overall budget for the Vera programme is FIM 170 million (US\$ 34 million) for the years 1997 to 2002. The goal for the first three years of the programme is to make use of systems based on present information technology. After three years, an interim evaluation will be carried out and new directions will be determined if necessary. During the latter three years, the emphasis will be on implementation of systems based on product model technology.



Complex Project Organisations Demand Networking

THE MARIENKIRCHE CONCERT HALL PROJECT is based on the winning entry in the architectural competition where the decision was made in the fall of 1996. The responsible architect is Architect Bureau Pekka Salminen. All engineers and other experts are his suppliers. The project organisation is unusually complex, since both a Finnish and a German bureau is involved in all areas of engineering. Networking and good information connections are a prerequisite for efficiency.

The solution was the Internet based information transfer and project bank system which was first used for the middle terminal project at the Helsinki-Vantaa airport, also carried out by the Pekka Salminen bureau. The advantage with the system is that it is based on existing software and infrastructure and that it has a simple user interface. In the construction business, where project groups almost always are formed for one project only, another advantage is that the same system can serve several projects at once. The server is connected to the Internet via a fast line and the connection from the office can be through a modem, an ISDN line or a fixed line, depending on the information transfer needs of the user.

The project directories themselves are of extranet type, i.e. user name and password protected. Each party to the project has rights to write only to his own directory, and read-only access to the entire project. Studies carried out during the terminal project proved that an Internet based project bank as such is safer than the traditional copy/mail method. Using separate protection software ensures that outsiders are unable to use the data even if they were able to access it. The greatest threat to data security is in practice the offices of the various parties as well as their careless handling of data.



*THE MARIENKIRCHE PROJECT
and the cover visualisations from
the Helsinki-Vantaa middle
terminal Architect Bureau Pekka
Salminen.*



TEKES – YOUR CONTACT FOR FINNISH TECHNOLOGY

Tekes' primary objective is to promote technological competitiveness in Finnish industry. Activities should lead to increase and diversification of industrial production and exports and improvement of employment and well-being in society.

Annually, Tekes grants about one and half billion Finnish marks for the financing of applied and industrial R&D in Finland. Tekes offers excellent channels for technological co-operation with Finnish companies, universities and research institutes.

Technology Programmes – part of the innovation chain

The technology programmes for developing innovative products and processes are an essential part of the Finnish innovation system. These programmes are characterised by close co-operation between industry, the universities and research institutes. The programmes also form a solid basis for international co-operation. Currently there are over 50 active technology programmes.



Vera

INFORMATION NETWORKING IN THE CONSTRUCTION PROCESS

The latest information on the programme is available from the Internet

<http://www.tekes.fi/english/programm/vera>

<http://cic.vtt.fi/vera/english.htm>

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