Virtual High Tech Clusters – The Modern Silicon Valley?

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Abstract

Silicon Valley – often imitated, but never succeeded. High tech clusters have been for years and still are the attraction for many companies and investors to settle down in one of those lucrative regions in order to get a big share of the profit that is gained there. The economic conditions, that new start-ups find there, are apparently so favourable that economic success is inevitable.

Now, a new generation of success stories is ready to start – virtual high tech clusters. In recent years rapid developments in information technology have dramatically changed the availability of information. It is now almost possible to get any information at any place in the world at any time. Virtual enterprises and communities are the consequence in order to keep up with competitors.

This paper tries to identify the ingredients that are responsible for the success of high tech cluster, and describes an approach of the Technische Universität München to bring European's Space companies and research institutes together into a virtual network and to form a virtual high tech cluster. Suitable platforms and tools are evaluated.

1. Background

Caused by increasing globalisation of the world economy, companies are facing new challenges. Today, a company cannot come up with a new product without thinking in a global way. In particular in high tech industries customers are distributed all over the world. It is mainly the consequence of improved communication and transport infrastructure that barriers of time, distance and borders seem to disappear. As there are competitors all around the world, companies have to cope with, the reaction time for companies are getting shorter and shorter and therefore product life cycles, too. That means, time is getting more critical than costs, and knowledge is getting more critical than low-cost labour and natural resources. Since there is a shift towards a knowledge based world economy, the prosperity of a region is not necessary connected to its geographic context, but to its position in the world economy.

The strategies to keep a company competitive in a global market and to cope with these developments are different: On organizational level favourite approaches are decentralization of control, horizontalisation of production, reduction in costs and delivery times, or increase in quality and product variety. To realize it, several from the systems engineering well-known methods are applied, like flexible automation, total quality management, concurrent engineering, or just-in-time production -there are many more.

But there are also strategies on a political level outside of the company. They focus on the environment and economic boundary conditions that supports the company in the competition. Those political strategies can be subsidies, which cannot be seen as a long-term solution, or export incentives, which helps companies being more competitive in comparison to other countries. But the main task for the national governments is to invest in physical, educational and technological infrastructure. One of those infrastructures can be also a high tech cluster.

2. High Tech Clusters

…are "geographic concentrations of interconnected companies and institutions in a particular field" (Porter, 1998). Silicon Valley is the prototype of a high tech cluster. Other examples are Route #128, Austin, Park City (all USA), Cambridge, Leeds, Livingston (all UK), Shenzen (CHINA), Subiaco Valley (AUS), Toulouse (FRA), Campinas (BRA), Bangalore (IND), Penang (MYS), Midrand (RFA), etc. All these high tech clusters have more or less been planned, and they are all more or less successful, but if you analyze all these locations, you will detect that they all have common:

- Geographic proximity of
  - firms (manufacturers, suppliers, service providers),
  - educational and research institutions,
  - financial institutions, and
  - business services
- Strong linkages among firms and the supporting infrastructure
- Concentration in a particular industrial sector
- Key functions within the community, self-sufficiency

The question arises if high tech clusters emerge by chance or if they can be built.

2.1. 4 Main Success Factors

Looking closer at high tech clusters several ingredients can be identified (Stuchtey, 2001):

Talent. The presence of human resources, of skilled manpower and people with new ideas is evident. Entrepreneurs, scientist, engineers, and technicians are the nucleus for business development.

Idea Flow. Coming up with new ideas is not enough to make a business out of it. The humans resources with new ideas and technology have to be supported, how to run a business, how to write a business plan, how to get financed, etc.

Existing value chain. Another very important factor can be an already existing diversified economic base at the location you want to built a high tech clusters. It is favourable if there are extensive supplier and distribution networks and also specialized business services.

Smart Capital. Last but not at least, no ideas will ever be realized without money that is invested, either in the idea or in the team.

2.2. Additional ingredients

Beside the above-mentioned main success factors there are also more aspects necessary to form a physical cooperation network:

Scientific and technologic infrastructure. The combination of industry and research is very important. To be up to date (To get always the state of the art knowledge), it is necessary, that high tech clusters are close to important universities, research centres, libraries and innovation centres. Stanford University and the Massachusetts Institute of Technology played an very important role in the success of Silicon Valley resp. Route #128. Other locations can be traced back to success stories of single companies.

Physical Infrastructure. The physical infrastructure has always been one of the most important factors to be a competitive region / country. Therefore also high tech clusters have to be well connected to their suppliers resp. customers.

Business climate. Start-up companies usually do not have much capital. Therefore they depend on boundary conditions that enable them to realize their ideas. Those can be low cost of living, low cost of infrastructure, low cost of loans, low tax levels, and low labour cost.

Quality of life. The quality of life should not be underrated. A metropolis with recreational facilities, residential areas, cultural events, and pleasant climate can contribute to the attractiveness of an area - beside the economic situation.

2.3. Initiation

In spite of the existence of these eight success factors, the networking initiative can fail, if there is not an impulse that initiates networking. This impulse can be person or an institute that recognizes the potential of a certain region and promotes the establishment of the high-tech cluster. Some high tech clusters have emerged because of the success story of a single company.

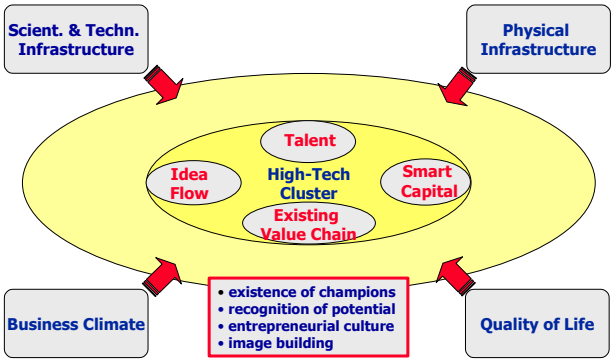


Figure 1: The Ingredients of High Tech Clusters

3. Virtual High Tech Clusters

3.1. European Space Industry

The global revenues from GNSS (Global Navigation Satellite System) product sales is predicted to grow rapidly from around 14 billion € in 2000 to 50 billion € in 2010 and to 155 billion € in 2020 (European Commission, 2002). Looking at those forecasts for the satellite navigation market in the next years, it is understandable that Europe and Germany, in particular, wants to get a big share of it. To do so, the industry in Europe has to be promoted to keep up its competitiveness in that very promising market. Considering the synergy effects form other commercial application fields like telecommunication and geoinformation, the potential of this particular industry is enormous. That was the motivation for the Institute of Astronautics at the Technische Universität München to find a way to initiate networking among European research institutes and companies and to complement their specific know-how.

3.2. Goal

In order to benefit in Germany and also in Europe by recent developments in the field of commercial satellite business a platform is to be developed, which enables networking of all knowledge resources through out the fields of satellite navigation, communication and earth

observation. That is supposed to build the nucleus for new, value adding applications and services.

This platform shall promote the competitiveness of the European industry in the promising areas of satellite navigation, communication, and geo information. Since a lot of enterprises within this area are to be considered small and medium sized enterprises, attention is directed to them in particular without neglecting the large industrial players in the market.

As the small and medium enterprises are limited in terms of business development and marketing activities, the platform shall support them to communicate their specific know-how, products and services to other companies, resp. institutes, in Europe.

3.3. Approach

Following approach has been chosen to initiate networking within European's space industry:

1. Identify enterprises
2. Invite identified enterprises
3. Evaluate competences
4. Classify enterprises
5. Evaluate complementarities
6. Find potential partners
7. Create co-operation (virtual enterprise)

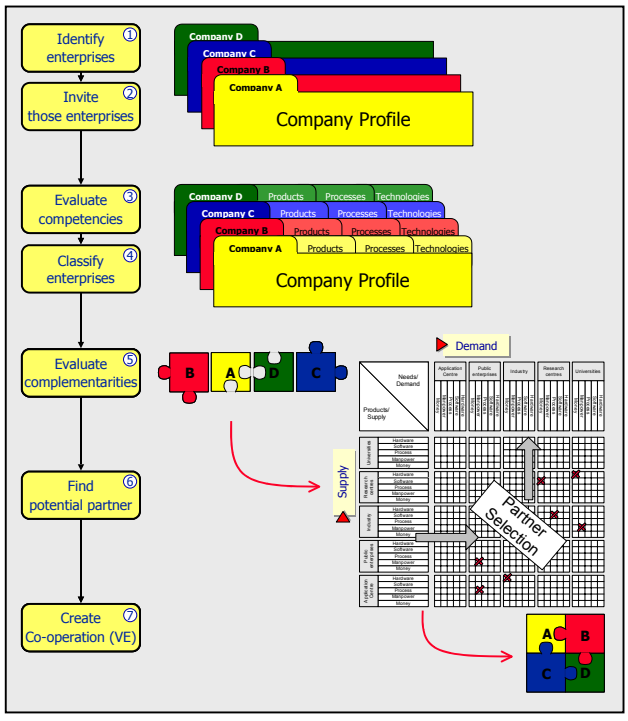


Figure 2: Process of virtual networking

First of all, there are many enterprises that are involved anyhow in the value chain of commercial satellite applications. All those enterprises have to be identified and invited to take part in the European virtual network of commercial space applications. The next step is to identify the specific know-how of each institute or company, for example what products they manufacture, what services they offer, what know-how in processes and technology they have, etc. The enterprises have to be classified by their competences, products, services, processes, technology, and by other important aspects like region, size of the company, position in the value chain, etc. These companies can be grouped regarding to their competences and possible complementarities have to be evaluated. Based on that the right partners can be found, who match each other. An agent of the virtual cluster can suggest a virtual team of matching companies and institutes, or by the initiative of one institute or company itself. Companies can start with their negotiations, if they want to share infrastructure, humans resources, or manufacturing facilities with the purpose of temporary cooperation.

4. www.Best-in-Space.com

The Institute of Astronautics has developed a web-based database with support of the German Aerospace Center (DLR), which aims at providing insights and transparency about all know-how available in different institutions or companies in the area of satellite navigation, communication, and earth observation. This network will be the nucleus for the development of new, value adding applications and services in these fields (Igenbergs et al., 2000).

The starting point for this co-operation network was the establishment of an Internet portal, which is used both by industry (small, medium, large entrepreneurs) and research centres to get information on areas of competence of all enterprises, institutions and organizations. The provision of this information rapidly enables users to get links to potential and appropriate partners (networking) and thus to get new opportunities for business development (market potential).

This virtual community combines all stages of the value chain, both in the vertical dimension (research and development, satellite system, satellite operation, products, and services) and in the horizontal dimension (navigation, communication, and earth observation). The presence of participants of so many different fields increases the chance for new applications dramatically.

The supply of information on potential partners results in the establishment of co-operation and joint projects of different partners. Germany and Europe will benefit along the entire value chain in terms of new products and services. The formation and development of active co-operation networks will strengthen the position of Germany and Europe in increasing international

competition in the strategic field of the satellite industry in particular. (Wieser et al., 2001)

The **benefits** of that virtual platform are:

- Central source of information, available at any time and at any place
- Professional users from research and industry accessing to your company profile
- Transfer of information and know-how within all participating companies and institutes
- Stimulation of international co-operations
- Efficient platform for marketing enabling enhanced public relations for your specific know-how

The **features** of that virtual platform are:

- Access to all company profiles and contacts
- Direct contact to companies via the internal Best-in-Space mailing system
- Extensive search engines functionality (company search by keyword, country, zip code, company size; browse about 300 categories within the Best-in-Space database; full-text search covering the entire web site)
- News from the field of commercial space business
- Event calendar with trade shows, conferences, workshops, etc.
- Mailing lists addressing relevant topics can be set up any time

The functionality of Best-in-Space is only the first step towards a virtual high tech cluster. In order to cooperate within this virtual community, the Best-in-Space performance has to be extended.

5. Cooperation within the virtual cluster

Since new partners have found each other, they want to collaborate anyhow, e.g. they want to submit together a proposal for public funding, or they want to be partners for the development of new products or services. To coordinate the proposal submission process of an international consortium resp. to perform project management for a distributed product development team, they have to exchange data / communication independent of place and/or time.

Many commercial tools and also open source tools are meanwhile available to facilitate the work of groups, therefore called groupware tools.

5.1. General requirements on groupware tools

In order to enable collaborative work in a virtual high tech cluster that is comparable to the real world, we have listed general requirements that have to be met:

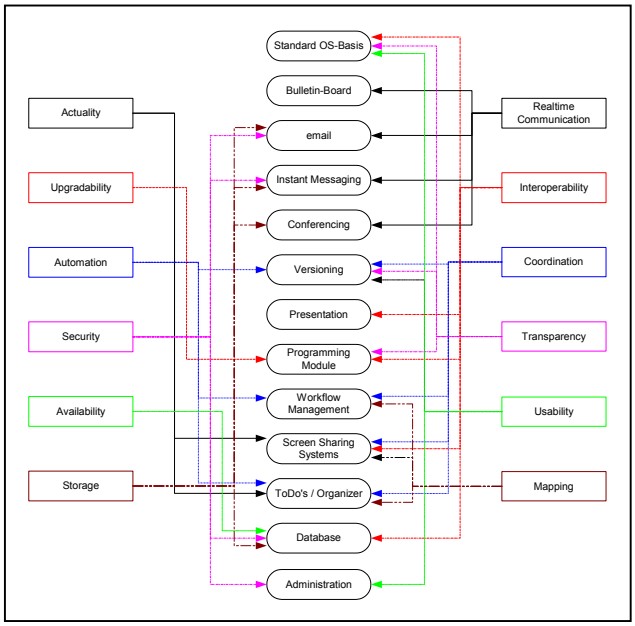


Figure 3: Interaction of functionalities and requirements

Mapping: The groupware system should depict all running processes during a project, in order to optimise the cooperation.

Versioning: Documents have to be editable for different users at different times. It has to be guaranteed that only the latest version can be edited. In case that a user wants to open a file that is being edited by a different user, he has to be informed, that the file is temporarily checked out.

Upgradability: The tool should not be limited to a certain number of users. It should be expandable to a bigger community without any effort.

Automation: Recurrent processes should be able to be automated in order to reduce time.

Security: Only authorized users have access to the stored data. Both data storage and data transfer have to meet highest security standards.

Data availability: All data has to be accessible from any place and anytime via a web interface. Data transfer should be quick.

Interoperability: It has to be assured that data exchange is possible to other standard software like MS-Word, MS-Excel, CAD, …

Real-time Communication: The tool should enable real time audio and video communication of several team members.

Continuity: It has to be assured that the product support will be guaranteed for years and the latest features can be provided in future.

Project Coordination: Project schedules and work packages should be traced and coordinated independent of time and place.

Transparency: The tool should allow getting an insight of the processes
Usability: All main information should be easy visual accessible, like author, last edit, version, …
Storage: Due to security issues the data should not be stored centrally. That way traffic also congestions at a central server can be avoided.

5.2. Common groupware features

Groupware solutions contain different functionalities. The most usual and common functionalities are listed in the following:

5.2.1. Asynchronous Groupware - Tools that enable delayed communication / Interactions

Bulletin Board is used to place comments, ideas, requires, etc. that can be read by the other community partners at a later date.

Email Systems enable asynchronous communication in a written form or/and the exchange of attached documents/files

Instant Messaging Software enables an almost synchronous exchange of written comments and files and is much easier to handle than email systems. Another advantage is the history of previous out and ingoing messages. Security concerns are the only drawback.

Workflow Management Systems support the coordination of project planning and control, usually contains functionalities like work break down structure, timetable, and milestone plan.

Organizer enables user to have a personal address book / calendar and a group address book / calendar. It also provides all users with a project plan and all important dates / deadlines.

5.2.2. Synchronous Groupware - Tools that enable real time communication / Interactions

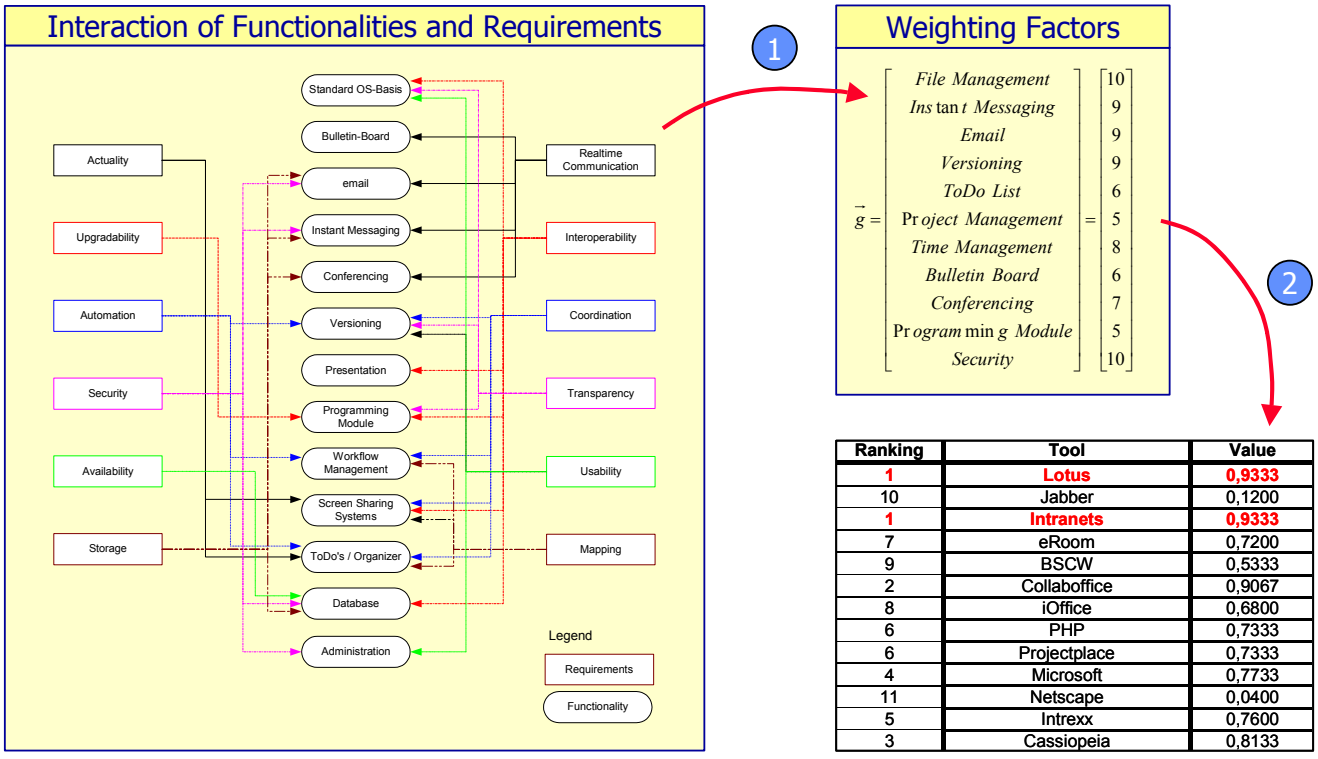
Audio and video conferencing enable real time meetings of several people at different places at the same time.

Chat makes it possible to have a no delayed and real time communication get immediately response to some concerns /question.

Collaborative Writing enables editing documents by several users, even at the same time. All changes are documented and traceability is guaranteed.

Presentation Software enables reviews of work packages.

Screen Sharing Systems make it possible for all users to share the screen of one user. The view and the navigation is by this means for all users the same.



Ranking	Tool	Value
1	Lotus	0,9333
10	Jabber	0,1200
1	Intranets	0,9333
7	eRoom	0,7200
9	BSCW	0,5333
2	Collaboffice	0,9067
8	iOffice	0,6800
6	PHP	0,7333
6	Projectplace	0,7333
4	Microsoft	0,7733
11	Netscape	0,0400
5	Intrexx	0,7600
3	Cassiopeia	0,8133

Figure 4: The evaluation process of groupware tools

5.3. Interrelation requirements / features

The in 5.1 listed requirements are realized in different software solutions. Firstly, it is important to know who are the target users and ion what kind of business they are involved. We may conclude from that different priority for the tool evaluation. Secondly, well know software companies expand their software with groupware functionalities, whereas other tools run independently from other software. Thirdly, some groupware tools contain all functionalities in one software package, some can be installed by single functionalities.

That makes an evaluation of groupware tools quite difficult. The interrelations of requirements and groupware functionalities are illustrated in Figure 3.

5.4. Evaluation criteria

To evaluate different groupware tools for high tech clusters, weighting factors for different functionalities were introduced (see Figure 3). The weighting scale is from 0 for "not necessary" up to 10 for "very essential".

For a distributed group of users it is essential, that documents can be uploaded and are accessible for all other users in the project group. Instant Messaging systems usually provide a status display, showing if other project members are online resp. offline. This functionality is considered as important and very practical, because group members might work in different time zones. There is no discussion about the need for an email system. Another very important functionality the version control, that it is assured, that users have always access to the latest version of specific document. A practical functionality is the display of current "To Do's" and status report on it. The same is valid for project management tools, whereas group calendar and the coordination of meetings and deadlines are considered as very important. The opportunity to have pin general issues, concerns or questions on, and videoconferencing systems for virtual project meetings and reviews, or just to have a more real face-to-face like communication situation were analysed and evaluated, as well. It is also favourable that an existing tool can be adapted or extended concerning individual needs of a certain working group. The main concern, that groupware users usually have, is security. Therefore it had for all evaluated tools the highest priority.

There are two different architectures of groupware tools (the data is stored at the provider's server and the data is stored at the company's server). Since security issues have been identified as crucial, groupware tools that use the provider's server for data storage usually don't find much trust of users and are therefore not recommendable for virtual clusters.

The continuousness of the software company that provides the groupware tool is another criteria, which has not been stated so far. Once a group of several has chosen a certain tool and has put lot of effort in the implementation, does not want the software company to bust, but to provide them with new updates and features.

5.5. Evaluated tools and results

To enhance the Best-in-Space platform towards a cooperation platform, different tools have been evaluated: Lotus, Jabber, Intranets, eRoom, BSCW, Collaboffice, iOffice, PHP Groupware, Projectplace, Microsoft, Netscape, and Intrexx.

According to the functional evaluation criteria the evaluation result is shown in Figure 4.

6. Opportunities

The opportunities of virtual high tech clusters are mainly three:

- Enhancing contact network
- Sharing complementary assets
- Accumulating knowledge across new products and markets

For local universities. Through the virtual network the universities can increase their interaction with the industry, by calling attention to themselves and applying research results in industrial projects.

For the firms. Virtual networks open new markets for the companies. They get access to skilled labor, to universities and resources and to technology networks.

For the governments. Investing into networking activities pays off more often than subsidies of single industry domains.

7. Conclusion/Outlook

Information technology has improved dramatically and offers opportunities like getting in touch with anybody from almost any place in the world and at any time. Virtual platforms are going to replace geographic networks. Being part of virtual networks will be essential in future to keep up competitiveness in global market. Nevertheless the communication technology will never be as advanced as face-to-face communication and will probably never replace it. The importance of those real face-to-face meetings can be seen in the increasing travel activities of managers in spite of all modern communication technologies (p. 161, Reichwald et. al., 2000). There is still a high barrier in the business culture to overcome that.

Another critical issue of virtual high tech clusters is that meetings by chance do not take place. Especially these informal meetings can be very creative and bring up new ideas. But it is for sure, that virtual collaborative work is state of the art and will play an even more important role in the future.

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9. Biography

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