Projet STS

Virtual Organizations—the next Economic Revolution?

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Virtual organizations are temporary network structures for the purpose of being competitive in today's marketplace. We have examined their characteristics and their chances of success. They are potentially very powerful structures but practical realization remains a difficult task.

Contents

1. Introduction

Internet—this is how we got inspired of what a virtual organization could be. And it is what everybody thinks about when we start to talk about our work. But the deeper we got into the subject, less we were talking about what turned out to be just a tool useful for virtual organizations.

Virtual organizations are a different way of organizing the relations between employees, managers and customers. To apply this theory, thinking and organization need to be shifted in new directions. What this theory is about, how an enterprise can get there and whether or not it should attempt the change is treated in this paper.

We proceed by first showing a collection of definitions and phrases which people associate with the virtual organization. This will give a good idea to outline the subject we are talking about. In the main part of our discussion we especially focus on internal and external relations of a virtual organization. Since we consider relations is what the change is all about. The analysis is focused on:

- changes for employees and managers
- custom made products and services
- time to market
- product quality

And is not focused on:

- gain maximization

At the end, the transition phase of an enterprise willing to do the step is discussed. In the conclusion we discuss possible problems and whether an enterprise should attempt the change or not.

2. Definition

Longman's dictionary [lon87] defines 'virtual' as:

> Almost what is stated; in fact though not officially
>
> Synonymous translation of virtual: apparent, seeming

Definition of a *virtual organization* used by most publications that we studied [dav92], [jäg98]:

> Very customer oriented organization, which satisfies customer needs in a personal manner by staying very cost and time efficient.

While studying the subject we came to the conclusion that this perspective is not radical enough. We think that this first definition contains some of the key-point of a virtual organization. But it does not respond to the definitions of the word virtual. Since in this first definition we are still dealing with a real enterprise/organization. Our vision is an enterprise, which is not an enterprise in today's understanding. It is composed of different participants that came together to best satisfy a customer, but once the customer is satisfied, the participants will separate again and regroup with other participants to satisfy the needs of an other customer. The participants are different physical and/or legal persons and the mandator sees his contractors as one unit. This perspective is very close to the perspective proposed in [nor98].

- Virtual organizations... do not need to have all the people, or sometimes any of the people, in order to deliver their service. The organization exists but you can't see it. It is a network not an office. (Charles Handy)
- A temporary network of independent companies linked by information technology to share skills, costs and access to one another's market. (International Business Week)
- Virtual organizations will be reliant on the medium of cyberspace; will be enabled via new computing and communications developments; [and] will initially only exist across conventional organizational structures. (Christopher Barnatt)
- A virtual organization is a temporary network of independent institutions, businesses or specialized individuals, which work together in a spontaneous fashion by way of information and communication technology, in order to gain an extant competitive edge. They integrate vertically, unify their core-competencies and function as one organization (or organizational unit). (Fuehrer, Votalk, 1997)
- Whatever the virtual corporation turns out to be, flexibility will be its defining characteristic. (Society of Management Accountants of Canada)

3. Classification

'Virtual organization' is a relatively new term and there are many different definitions. Common to all of them is some form of networking. While every virtual organization is a network, by far not every network is a virtual organization. One way to distinguish between different forms of network organizations, one of which is the virtual organization, is provided by [jäg98] in figure 1.

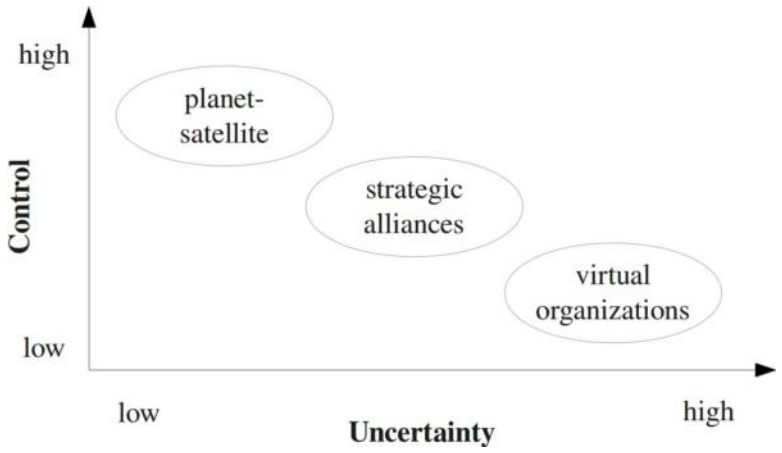

Figure 1: Continuum of network organizations

3.1. Planet-satellite

After world war two many companies began to grow very rapidly. This often resulted in deep hierarchical structures and a very long reaction time to adapt to changes in the environment. Today however, flexibility and speed are needed to satisfy customers and thus, to succeed. As a logical consequence, companies ('planets') will focus on what they are best at and outsource the rest (catering, transportation, advertising, security, accounting, training, ...) to subcontractors ('satellites'). In these relationships, it is clearly the planet who is dominant. It exercices a high level of control and has clear expectations from the satellite. Satellites are also mostly interchangeable, so that they are strongly dependent on the planet.

Example Japanese production companies often work with subcontracotrs. Here, the large production companies determine the specifications, amount, form and so forth for the partial fabricators.

3.2. Strategic alliances (joint ventures)

Strategic alliances are networks of partners with the same goals. Contrary to the planet-satellite relationship, these partners are mutually dependent on each other. However, the collaboration is clearly defined by contracts. Normally, strategic alliances are created for long term stability.

Example The strategic alliance between KLM and Northwest Airlines enhanced the competitive position of both partners by increasing the occupation level of the fleet by

sharing flights and receiving new landing rights on the other continent.

3.3. Virtual organizations

Virtual organizations even go one step further: All partners are equal in that neither one tries to control the other. There is a high interdepedency on each partner's core competencies. However, the collaboration is not regulated by strict rules and contracts but rather through the sharing of information and knowledge and mutual trust. To the customer, this organization looks like a normal company. So, the defining characteristics of virtual organizations can be written as

- Complementary core competencies / pooling of ressources
- Boundary crossing
- Participant equality
- Changing participants
- Geographical dispersion
- Electronic communication

Example Most of these characteristics can be found in the following case study (from [nor98]):

> The Crowley Communications company offers public relations services to a variety of clients with a variety of needs. These services include the writing and editing of press releases on a variety of subjects, the creation of brochures, photography, graphic design, publishing and printing.
>
> Crowley Communications is a virtual organization in a number of key respects:
>
> - It has only one full-time employee.
> - It contracts teams of people to work on projects as and when they are needed.
> - These teams are spread around California and elsewhere in the country and are made up of specialists appropriate to the demand.
> - They are linked by telecommunications: everyone has a computer, modem and fax, and uses email, fax and phone for communication.
>
> To a client, this is a homogenous fully staffed company; the virtual organization does not show its seams. Although the client may know that the team is despersed and brought together only for the project, it feels cohesive, with

each team member sharing the same set of values and commitment to doing things the Crowley Communictaions way. A virtual organization must actually feel like a real organization to the customer—a flesh-and-blood group of people pulling together, with a focal person who takes responsibility. Here is an example of how it works: One of Crowley Communications clients has the need to speak to a variety of 'niche' audiences ranging from seniors to health professionals to human ressource specialists and to residential and commercial builders. Each of these audiences requires messages tailored to their particular sphere of interest. Crowley Communications selects writers appropriately skilled in the particular required subjects, who write press releases and speeches for this client. Other experts are brought into the team as needed: photographers, graphic designers, editors, copy editors, and attorneys.

Everyone on this team works with a remote office, and may never meet other members of the team, even though, through email and phone calls, they may get to know them and their capabilities very well.

For extra large projects, Crowley Communications has formed an alliance with another public relations company, and with their combined teams, they accomplish the larger tasks using telecommunications to coordinate their efforts, in the same way Crowley Communications operates on smaller tasks. There is no need to provide larger office accommodations for the larger team, or to travel to coordination meetings. All of these functions are achieved through electronic communication to and from team members in their remote offices.

Jolene Crowley, the sole full-time member of the company, presides over each project, making sure that everyone understands in some detail their particular responsibilites within the project, overseeing progress, and finally buying off the completed product before transmitting it to the customer.

3.4. Internet companies

This is probably the kind of company that comes into our minds first, when speaking of virtual companies. They are virtual in a way, that to clients they do not appear as a company in the classical sense. Customer-company interaction is done only by means of the internet. The only thing that may be real are products that these companies might be selling. Some internet companies do not even sell real products but provide their clients with information.

However, these companies do not count as virtual organizations as we have defined them: they do not necessarily show a network structure which is a condition for a virtual organization. Furthermore, the company might very well be concentrated at one location. The only things that are geographically dispersed, are customers. Electronic

communication is only used as a marketing instrument.

Example The cost of an electronic transaction is typically one tenth of the corresponding traditional transaction. Companies like Dell now do over $3 million a day via the internet, while Amazon.com sells exclusively this way. Just about every article can be bought from the internet nowadays. In addition to that, companies providing only information or virtual services like Yahoo, E*Trade or Hotmail have gone to the stock market and have become serious multi-million dollar companies.

4. Relations

How will people interact in a virtual organization? As boarders are less defined and fast and appropriate reaction on customer demands are the key to success, relations need to be redefined. It is impossible to react fast when information needs to go a long way up through the hierarchy before a decision can work it's way down to the very place where a reaction is needed.

4.1. Relations inside the organization

Before talking about the relations inside the organization we need to talk about the relations inside one participant of the organization. In [dav92] the comparison of a virtual organization and the human nerve system is made. The body needs a vital nervous system to be able to survive. A lot of basic actions are automatically regulated locally without help of the brain. And in case of danger, when immediate action is needed, reflexes take control of the body to guarantee fast reaction. The same structures can be applied to a participant of a virtual organization. Responsibility is given to the lower hierarchical levels (teams or even employees) and the upper level is only taking a control function. This responsibility contains the autonomous reaching of a given target. In addition, fast decisions can be taken on the lowest level to better satisfy unforeseen events. Only after starting with the spontaneous reaction, the information goes up the hierarchy for verification and long term strategy adjustments. An example structure that underlines the interdependency inside a virtual organization is shown in figure 2.

4.1.1. Virtual Teams

To be able to react rapidly, participants need to be very flexible. One way to gain flexibility is to extend the concept of virtuality to teams. Consequently, a virtual team shows many of the characteristics of a virtual organization:

- Complementary core competencies of team members
- Boundary crossing

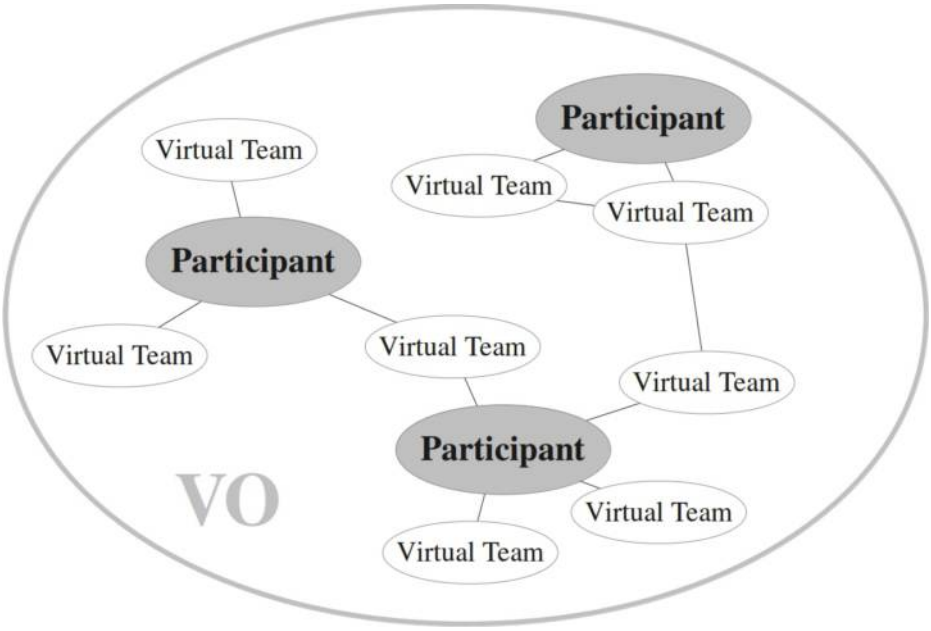

Figure 2: Example structure of a virtual organization

- Participant equality
- Changing participants
- Geographical dispersion
- Electronic communication

Team members do not necessarily need to be in the same location and might not meet physically. A good example are engineering companies who have different sites around the world to do work 24 hours a day, taking advantage of the time zones. When, for example, the shift in Europe finishes, the work is passed on via group software to the team members in the United States.

Team members work together only for a specific project to be accomplished. We will now highlight some implications of virtual teams on traditional structures.

Structure As mentioned before, team members can be geographically dispersed and they might work at different times. Thus, teams no longer have the same structure as in a traditional working environment. Each team member must have a well defined function which allows him to execute his assigned task on his own. One member sets the direction of where the team is going. Even when an employee has greater power

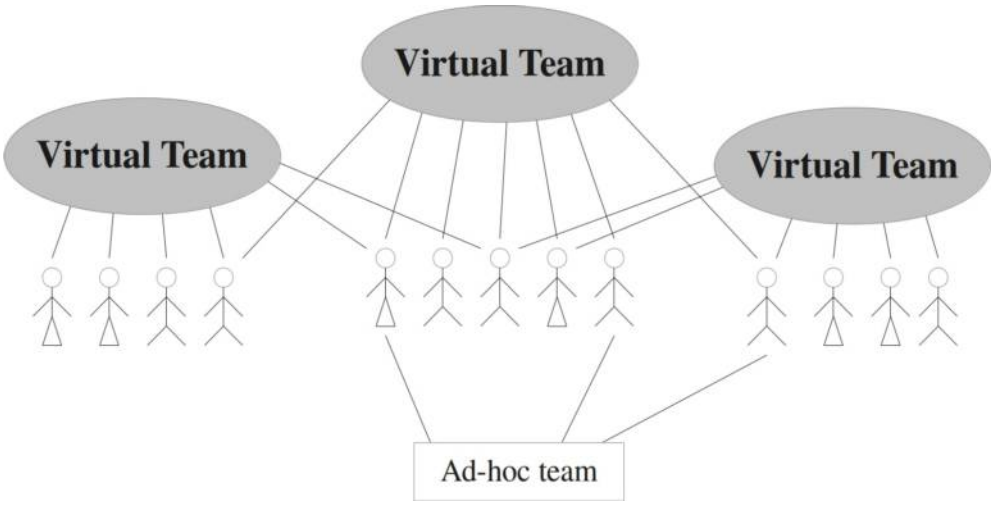

Figure 3: Example structure of a virtual team

and responsibility, the goals and the direction of the team needs still to be defined. Leadership is also to be seen as a function and not as a superior position; there is no hierarchy in a team. At one time, a certain team member will be the leader of the team and at another time, he will be a follower and another team member will be the leader. This is a very nice example for participant equality. The leader's function is as important to the team as is every other specialist's function. A very important aspect of virtual teamworking is that the roles and functions of team members can change with time and can be exchanged (for example during holidays, to manage changing workload or to broaden individual experience). The equality and the empowerment of team members is also for the customer's benefit. Decisions can be taken faster resulting in a very flexible team and reduced time for solving problems. These two factors help to better serve the customer and decrease the time-to-market, for example.

It has been said that one employee normally belongs to different teams or even to different organizations. [sky98] even suggests that "every knowledge worker should belong to at least two seperate teams (see also figure 3). This helps the organization to achieve cross-functional co-operation; it helps the individuals gain a broader perspective." We consider this to be a good idea as it also might increase motivation and the loyalty to the organization. However, when employees belong to different organizations, this might result in several problems. It is certainly difficult, if not impossible for an employee to be loyal to the goals of several organizations. In our opinion, there can not be true commitment to multiple organizations. Also, the leakage of secret information is much more likely.

Ad-hoc teams Ad-hoc teaming means forming a group (usually smaller than teams described above) not for the purpose of a project but for something much smaller. Let's consider an engineer who needs to do a financial calculation. He will contact the financial specialist (who might be working on a different team) to get help for solving his problem. Their collaboration will perhaps last a few days at most. Ad-hoc teams are a very efficient way of collaborating: their goals are clearly defined, people have different competencies and there are no rules whatsoever that could decrease efficiency.

4.1.2. Changes for employees

Function vs. position Team members are chosen into the team because of their special capabilities. Thus, their competencies are much more important than the position they maintain. Ideally, these competencies do not overlap, so that each team member is a specialist in his domain. Paired with the idea of team member equality, even the management of a team is only a function and no longer a hierarchical function.

Flexibility Traditionally, employees have a schedule which is more or less fixed. The reasons for this are easy to find: As members of (real) teams, they have to meet with other team members and managers. As control is an important management instrument, managers want to be able to supervise their employees and check the progress of work.

In the definition of virtual teams it is stated that there's theoretical equality of team members. Work is much more based on trust and self-responsibility than before. Thus, managers no longer need to control their employees directly. Much of the communication is done electronically. This results in a totally new flexibility for the employees. In an ideal world, they could freely decide when they want to do their assigned work. However, for reasons we'll discuss later, [jar98] and [nor98] suggest, that face-to-face meetings are still necessary.

What has been said for working time, can also be applied for the workplace. As people do no longer need to be physically present all of the time, at least a part of the work can be done at home or at remote offices. Some concepts dealing with workplace flexibility are

- telecommuting
- remote offices
- hot-desking
- virtual office

Telecommuting: People are working at some remote place (normally at home). They are connected to the company by information technology: Communication with team

members is done via email or teleconferencing[1] and they have access to the company databases. Telecommuting not only is suitable for communication within the team, even contact with the client is possible. A central phone service routes incoming calls directly to the location of the telecommuter. It is clear that telecommuting can not be applied to all kinds of jobs. We think that for example engineering projects are well suited for telecommuting because they can ofted be split up into single parts. Attention has to be paid that people involved still have a global view of the project. On the other hand, production jobs for example are less suited for telecommuting for obvious reasons.

Telecenters are locations where a workplace is provided for telecommuters. In some sort it is a compromise between a classical workplace and telecommuting. Employees still are connected to the company via telephone, email and fax, but they are gathered in one or several telecenters which provide the necessary infrastructure. Even though numerous people work at a telecenter, they do not necessarily belong to the same team or work on the same project. Still, employees are less isolated than if they were working from home.

Hot-desking describes the concept of allocating offices (and desks) in a dynamic way. It is hardly never the case that every single employee will work at the office one specific day. So the company provides less working places than there are employees. Offices are assigned to employees on a daily basis. They can book desks whenever they need to work at the office.

Example: The trend towards telecommuting has not gone unnoticed in the business world. As shown in [nor98], there are companies that specialize in providing office services to other companies at locations where they have no employees.

> The Virtual Office is a company that provides a service enabling other companies to operate wherever they choose but always able to be contacted on one central telephpone number. This service also makes it possible to have a New York presence without the expense of a permanent office.
>
> Because every client that uses The Virtual Office is given their own phone number, calls are answered in the company name. The receptionist uses a specially designed database so that information about the individual client is displayed on their screen as the call arrives. The call is then transferred to where the business operates—which could be at the other end of the country, on a mobile phone, or even overseas.
>
> Other services offered include a fax mailbox and an on-call personal assistant. A fax mailbox is a computerized disk that stores the informaiton sent by fax. This enables faxes to be transferred to any other fax machine using the tone keys found on most telephones, so that a businessperson can be anywhere in the world and still be able to receive faxes sent to their New York fax number. An on-call personal assistant is a part-time worker who

[1] Conferencing where people communicate by live video.

is available full-time but to whom the client does not pay a full-time salary. This personal assistant will deal with telephone calls, make appointments, write letters, and the like. The Virtual Office is supported by the full range of office facilities: advanced telephone, voice mail, and database systems; secretarial and postal services; photocopiers; and office space. Clients can make use of the company's premises when they visit New York. Touchdown desks are available for short visits, and rooms can be booked for meetings.

Empowerment of the employee Given the equality of team members and the fact that employees are no longer under direct control of managers, each employee has an increased responsibility. Because team members communicate electronically only, they have to take more desicions themselves, because they can not just walk to someone's office to ask questions. A direct consequence of this is better customer satisfaction: Employees can often directly meet the customer's needs without referring him to other persons which are 'qualified to do so'.

A few rules need to be followed to deal with this empowerment of employees. First, as has been mentioned before, information needs to be made available to every person. It is clear that decisions can not be taken by uninformed persons. This implies that the sharing of information is to be made as easy as possible. Knowledge is made available via databases or group software (e.g. Lotus Notes). Second, the goals and the strategy of the company have to be stated very clearly and must be understood by the employees, so that their actions and desicions aim in the right direction. What is needed are not strict rules but rough guidelines.

But it is very important that we do not forget the human aspect: Not every employee is willing to take the manager's responsiblities. It is a lot easier to follow instructions and having a well structured working environment.

Active career management It has been said that one defining characteristic of virtual organizations and virtual teams is changing partners or team members, respectively. In this very dynamic working environment, traditional career structures are no longer existing. This requires employees and companies to rethink their attitudes towards career and promotion

Employees must realize that they must actively manage their career. As projects and teams are changing fast, they can choose in which direction their career is aiming. One engineer might want to keep his engineering function. Over the years his function in the team will not change. However, he gains more and more experience in his domain and will thus play a more important role in the team. Another engineer might want to grow slowly into a managment function and no longer do engineering tasks. Common to the two career paths shown is that the employee himself has to take care of where his career is leading him. It is very important for employees to realize: they have to take

care of their careers themselves. There will not be such a thing as a job guaranteed for life.

Companies must adapt to that fact and provide a new way of 'promotion' that reflects the team-based working environment and flatter structures. One way of doing so is to provide so-called dual career ladders. Specialists like engineers or salespeople can be promoted and advanced without becoming managers. Job rotation is another possibility for the company to offer interesting careers. Employees will be assigned a to work in a new domain every year, for example. Two issues are especially important for the company: One, if it is not able to offer interesting careers, then motivation of employees will be low or even worse, they will wander off to a competitor. Two, training possibilities must be available to the employees. In a virtual organization or virtual team as we have defined it, there is a rather loose relationship between employee and one company. As we have said, one employee can easily be working in different teams for different companies. This bears the danger that none of theses companies is willing to pay for 'their' employee's training. The employee's status quo isn't good for any of the participating companies. So, we suggest that the partners of a virtual organization team up to provide training for the employees. If we take that idea even one step further, there might even be the creation of virtual organizations especially for the purpose of training.

4.1.3. Changes for managers

Transferring a traditional enterprise into a virtual organization is not an easy task. The manager needs to give from his decision power to his employees. He has to admit that they can take the same decisions. Only a self-confident manager will be able to do so, because when his own self-esteem is based on his position and controlling power, he will not be willing to give it away. We will now look at implications on managerial work in more detail.

Fewer Managers We already said that more and more information is shared and employees get more and more responsibility. Thus, the need for control and authority decreases. What results are flatter management structures and consequently, fewer managers are needed. Information technology makes it possible for managers to have access to all data from the desk. In [dav92] an example of an enterprise where one manager controls 700 employees is given. They have to define their ten most important goals and make them visible to the manager via group software.

Failure to adapt It has been said that computers and information technology is a defining factor of virtual organizations. While the future generation of managers will have grown up with computers, the transition to the information age could be a problem for the older managers. Maybe they even had some bad experiences with information

technology a decade ago, when it was not yet ready to be the nerve system of a virtual organization. As we will claim later, the transition from traditional enterprises to virtual organizations is not likely to happen immediately in most cases. It is more likely to be continous process, so in our opinion the transition to computer technology should not be an issue.

The non-technical transition will be more serious. The empowerment of employees is closely related to loss of power on the manager side. Some managers will try to hold on to their power, resulting in overcontrolling employees instead of leading them. If reciprocal trust is not given, then the concept of a virtual team will not succeed.

Traditionally, work management consisted of executing a control function. In the virtual working environment, the work management task becomes more complex involving two dimensions: the management of the processes necessary to perform the work and the management of the execution of work. If a manager does not realize that he has to create and manage these processes, he will not succeed, even if he has adapted to his leading function instead of controlling.

A trust-based management style The remaining managers' duties are different from what they consisted of before: People in different teams working on different projects, in different organizations in different places need to be managed. These people can no longer be controlled. So a new management style is required. It is based on giving guidelines, motivating people and most of all: trusting the employee.

Thus, future managers will have to take a different position within their working group. Before all, they need to be good communicators. It is very important that everybody knows the direction and the target that should be achieved. Under this condition it is much easier to the employees to take decisions. For that reason [dav92] calls the future manager a leader. It is not a question of managing numbers, time tables and stocks but the employees need to be lead to the target by showing the way in words and sometimes in active assistance.

The empowerment of employees certainly leads to more responsibility for the single individual. However, it is also clear that the average employee does not have a global view of what is going on in a virtual organization. That's where the leader comes into play: Based on the organization's strategy, he defines the goals and creates guidelines and deadlines for the teams and thus for the employee. So far, this is not truly different from what a typical manager does presently. But what is finally done in the teams with these guidelines is very difficult to control, given the dispersion in time and space of the teams. This is where trust appears as a new aspect of management. The leader in a virtual organization must be able to rely on his staff without wanting to control it. He knows that his people will do their assigned work. It is needless to say that the information flow between leader and employee is at least as important as between employees.

As trust is so critical, recruitment of the right people becomes extremely important. In a traditional working environment, the performance of not-so-good employees could be increased by close monitoring and tight control. As this is no longer possible, only top staff can be used in virtual teams. Ideally, it should present the following skills

- be self-supervisory
- be able to manage time
- be willing to take extra responsiblity

Should it happen that people who can not be trusted and relied upon are in virtual teams, consequences should be drawn and they should be moved to a different, perhaps more traditional position. Because if they can not be trusted, they must be controlled. And this, per definition, is not possible to do efficiently in virtual organization.

Motivation of employees The best people will not deliver maximum performance if they are not motivated. However, motivation is very difficult to achieve as workers do neither necessarily belong to only one organization nor are the organization's goals very long-living. As a leader, there are several ways to motivate employees.

First, the employee has somehow to identify with the project, the goals of the organization or with the organization itself. He has to see and feel that he is valued member of a team and organization and that his work is important. This can be achieved by maintaining frequent two-way-communication with employees. The employee must be informed and provided with data daily. On the other hand, the employee should be asked to provide feedback and make results of his work available. Motivation can also come from empowerment, increased responsibility and being trusted upon.

Second, personal contact should be maintained. It is an illusion that the workforce can be managed by email only. Even though [jar98] describes how certain forms of trust can be achieved without personal interaction, the feeling of being member of an organization is much easier to create if people are meeting face-to-face. If the geographical dispersion allows, face-to-face meetings should be planned at least in the initial and final phases of a project. These meetings are not only laid out as work meetings, but also as social occasions where people who will work together can get to know each other and where loyalty to the organization's goals can be built.

4.1.4. Relations among participants

Where as relations inside a participant are getting dynamic, trust is the key which allows the functioning of the system. These elements are getting even stronger between the participants inside the virtual organization. Working closely together is very important. But it is not an easy task to let the other participants have insight into the books,

internal structures and even problems. Still, it will be necessary to allow optimization and co-ordination between the participants. Naturally, it really doesn't help that these participants find together dynamically and might be involved in different or even competing virtual organization for the next task. So for geographical and habitual reasons, for the same kind of task the same participants might find back together.

Participants need to accept that the other participants are having a correct earning percentage on their work.

When one participant is much bigger than the others are, the system might be desequilibrated and the strong participant could tend to reduce costs on the weaker participant's shoulders. In mid- and long-terms this is a very bad strategy. The participants, which are need to accomplish the task, wouldn't be able to reinvest and quality would decrease, increasing overall costs.

How will these participants interact? Several possibilities can be imagined:

One central participant One participant is the contractor and the other participants rather serve as suppliers than as equal partners. This 'central' participant is the interface to the client and takes the leader role within the virtual organization. This system has the advantage of being well situated in today's laws. In case of problems the contractor is still existing and the client knows where to ask for assistance or even guarantee. This approach is not equivalent to the planet-satellite approach. The central participant is on the same level as the other participants and can even be smaller than the others.

Fully equal participants Several equal participants are coming together. Coordination is done by one participant who is offering its managing/leading services to the others. It can be imagined that this participant is specialized in management. It's only purpose of existence is managing virtual organizations as they are created and disappear. Decisions will be taken autonomously by the participants whenever possible. Important decisions are taken in a democratic way.

Even more roles and tasks can be defined inside the organization [sch98]:

- broker: acquiring mandates and competence vendor
- task manager: task organization, engineering, project management
- auditor: internal and external reviser, consultant and examiner
- performance manager: performance assembly and customer contact
- network coach: building and maintaining the network, conflict management

Different participants will accomplish these roles. How equally the participants really get is depending on the distribution of this roles. The power needs to be spread carefully to make sure that nobody will get too much influence and create conflicts.

Most participants will need to create the role of an in-/outsourcing manager. His task is coordination and communication between task- and performance-manager.

Risk limitaiton The biggest problem in today's environment is the legal aspect! In case of problems, who is taking responsibilities once the organization is dissolved? It is very important that the financial risk is limited, this concerns investments and liability. Should they create a fund, which covers the liability? As they might be involved in different compositions with other participants for each task, they would have to block more and more money to cover all the risks! A better solution is the creation of an overhead enterprise or association - englobing all participating participants just for getting legal protection. In today's environment this solution is proposed especially for bigger projects [sch98]. For small projects the authors of [sch98] propose to create an association. But not only finanicial risk should be limited; also duty during development should be limited.

Another problem to solve is the information interchange. For taking decisions and for optimizing the interactions of the participants, information must be available instantly and freely. This invokes problems with patent laws, know-how distribution and financial insights. But participants not opening their information network will not be able to compete, too much administrative effort is needed to filter and prepare the information otherwise. Strong software will be needed to share the information interchange and its creation. The data will be virtually separate for each project. Only information of common projects will be shared between different participants.

4.2. Relations with the outside

Clients will not focus on the product when selecting the enterprise, since the product will be custom made by definition. So customers select a company and not a product. Clients will select their supplier on quality, service and delivering time.

Once the supplier is selected, it is very likely that it will not be changed anymore for future products. As long as the client is satisfied, there is no reason for a change. In contrary, it will be easier to get the desired product while working a second time with the same organization. They will have collected information about the client and will be able to satisfy its demands with less effort and more precisely.

To fulfil these tasks, relations to suppliers, vendors and customer need to be redesigned.

4.2.1. Suppliers

What is actually the difference between a participant inside a virtual organization and a supplier? Participants come together to form a virtual organization to work on a task, they have the same target and they work on the same level to achieve the target. A

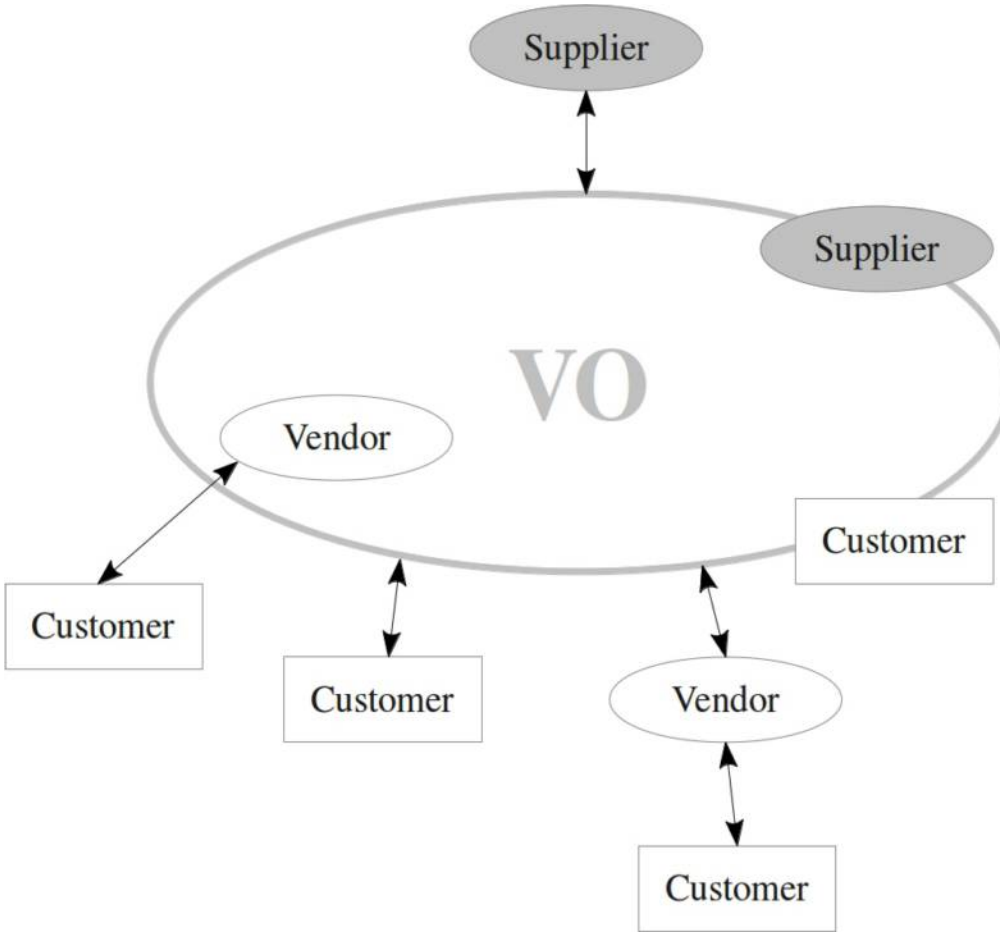

Figure 4: Outside relations of a virtual organization

supplier is not oriented on the task. It will solve a sub problem or just deliver some parts during the project, but it will not be actively involved in the project. This definition will not always be applicable. So in some cases the decision needs to be taken based on the relation between the supplier/participant and the virtual organization.

Suppliers can essentially help in reducing delivery time and in gaining quality. A good information exchange is needed. The virtual organization needs to communicate even their estimates on future development to the supplier. This helps the supplier to adjust its production or even to produce on estimates. Delivery times will considerably shrink. When optimization can be based on good estimates, costs can be reduced. Costs will be reduced when focusing on quality from the beginning. This leads to 'total quality', principle founded in the United States and applied in Japan [dav92]. Less support is needed when customers get quality products. Less dead material is circulating in the enterprise. And less administration is needed to follow and eliminate these bad products.

It will be necessary to work together very closely. The supplier is the one who knows its products best so he will have to act as a service center to his customer. Helping to use the resources at its best, reduce overall cost and leading to intelligent designs. This leads to reduced manufacturing costs, since the supplier can design for manufacturing. This close information exchange can take several shapes. The first step is to share information about fabrication procedures and costs. Parts can be design for optimization of time and costs by the virtual organization. Naturally big efforts will be needed to convince the supplier to show this information. He is not interested in giving his know-how away or in risking a prize reduction because of the insights he is giving. So again it will be important to trust in each another. The supplier will need to understand that it is in his interest as well to work closely with the virtual organization, his customer. This fact is best explained with the word co-destiny. When the virtual organization can reduce its product cost, it will have more chances on the market thus the supplier will be able to sell more products to his client.

Helping efforts of a supplier can even go further. Either an engineer employed by the supplier is helping the virtual organization to develop their product. Or even an engineer coming from the supplier is working for the virtual organization during the product conception.

4.2.2. Vendors

Vendors don't need to exist for selling a virtual organizations product. When there is little customers with big tasks there is no need for an additional interface. Best is to communicate directly within the partners. But when there is large amounts of individuals constituting the customers, an interface is needed so that communication can take place without swamping the design and development participants of the virtual organization.

Computer networks can distribute and collect information. But they can not respond

on precise questions, can not interact with customers as good as a human being. So at least a part of the very important feedback will be lost. Perhaps due to misunderstanding or misinterpretation the custom made product turns out to be different of actually what was wanted. But a customer looking for a custom made product will not work a second time with an enterprise, which didn't respond to its wishes. This customer will be lost forever.

So vendors are something valuable. They promote and explain the products. Solutions are sold and information is collected. This helps to grow with the customer and fulfilling his demands even better.

Feedback is a very important thing to even more increase quality and customer satisfaction. What is liked, what is not? Where are quality problems? What will the customers ask for in the future? Future prediction can be based on knowing its actual customers and extrapolation by considering them getting older, having kids and so on.

Vendors being able to respond to these high expectations will not be easy to find. It will be necessary to educate them and to allow them a good margin to keep their standards high.

4.2.3. Customers

Last but not least we need to talk about the relation with the customers. This relation is the key to the costume made product. So it should stay under surveillance to be constantly improved.

Slowly changing virtual organizations A virtual organization responding to the definition, but at least to the customer it is staying more or less the same company is what we call a slowly changing virtual organization. Improving customer relations will implicate the customer as well; he will need to give more information to the organization when he wants to improve their future performance. Not only feedback is demanded, even though this will be the mayor source for improvement. Also so called personal information is important to the virtual organization. Custom made products are difficult to produce. Listening to the customer is the first step, but the next step to analyze his words, knowing from which environment he is coming from is necessary to reduce discrepancy between wish and reality.

Especially the product design and planing will need customer interaction. Not only when giving the order but during the process, this will improve the result by recursion.

The target will be to keep a customer once it made his first order. Already today it is 5 times more expensive to find a new customer than to keep an old one. As products are getting more personal, relations will be based on trust and experience. Thus best promotion is mouth propaganda. And the worst enemy to fight is bad reputation.

Fast changing virtual organizations When the virtual organization is only formed for one task, customer relations take an other aspect. It is impossible to advertise an identity or brand. The customer is selecting by proximity or by accident its supplier. But when he will order a second product or service, the virtual organization he was working with doesn't exist anymore so he can not chose to work with it again. He will probably come back to one or the other participant based on his experience. It is very likely that this is the performance manager (see relations inside the organization). But it can be any other participant that did a good job. The customer might even built his custom virtual organization after his impression who works best with whom. This could bring additional dynamic into a system which risks to settle when people start to know each another.

Selection of participants will normally be done in a dynamic process while considering availability, quality, costs, working philosophy and other aspects. As the customer not always sees behind the scenes, selection is rather made through participants themselves. They have a high interest in working with good other participants, for minimizing financial risk and loose of their reputation.

In both cases interactive development of the product will be necessary. No product can better satisfy the customer than the one he was implicated as a co-designer. This is standing in complete contrast with Henry Ford's philosophy on his model Ford-T. He sad that customer can have their car in any color they desire, as long as it is black.

5. Social aspects

We have shown what impact virtual organizations will have on the working environment. Work, however is only one particular aspect of life. If the working environment is changed radically, this will also have consequences in private life.

5.1. Private life will change

We have shown that one characteristic of virtual teams is geographical dispersion. People might either be working from remote offices or even at home. In the latter case, the impact on private life is dramatical. There is no longer a well defined border between private and working life. This offers great new possiblities. Life can be planned in a much more flexible and dynamic way. On the other hand, there lies a potential danger in this situation. If the remote worker does not have enough self-discipline, work will most probably suffer. Too little time will be spent for working compared to private life. But the danger is bi-directional: In a traditional working environment, work is physically and mentally left behind at the end of the working day. Not so in a virtual working environment. Some people will not be able to deal with work potentially being present 24 hours a day. This can induce stress symptoms.

Social life is equally affected by virtual work. Communication is normally done by electronic means. Therefore, face-to-face contact with other persons will be an exception. Working life used to be an important part of social life. Now, if this falls away, people who do not socialize a lot in private life might become socially isolated. Of course, the flexibility in private life that is gained through virtual work could be used to compensate for the loss of social relations at work. Still, there is a clear tendency to get isolated that has to be lessend by incorporating social meetings where team members and leaders can meet face-to-face. These do not only strengthen social relationships but also have a positive impact on motivation.

While virtual organizations offer great oppurtunities for skilled workers, people that are not properly trained and that do not possess the necessary character traits will have difficulties succeeding in a virtual environment. We have shown that selecting the right people in virtual teams is absolutely essential for success.

5.2. Consequences for customers

Obviously, more and more shopping will be done at home by computer ('the virtual shopping mall'). The customer will benefit from extra services of virtual organizations such as custom products, increased speed to market and better customer service. Because virtual organizations are geographically dispersed, there will often be global marketing. The resulting competition situation means that the customer can also benefit from lower pricing, for example.

Again, the price to pay for all these benefits to the customer is reduced social contact. The market will become more and more anonymous.

5.3. General culture

According to [nor98], most people will still want to get a long-term, secure job instead of opting for a less secure working environment because the rest of the environment (social, financial, ...) will not change as rapidly. We think it is therefore unlikely that the everyday life of most people will be affected by virtual organizations in the near future. Only when these social or financial factors change with time, virtual organizations will become a part of our culture.

This is not to say, that virtual organizations can not succeed nowadays; it just won't have an impact on the entire society.

5.4. Virtual communities

If the idea of virtual organizations is extended to private life, virtual communities result. Not only the working place is globally dispersed, also other contacts are made by electronic communication only. [sky98] defines a virtual community as "[a community] of shared interests, whatever the location".

Almost all aspects of life, including for example education (virtual universities do already exist) can potentially be affected by virtuality. The danger of social isolation is even bigger than in the case of virtual work only.

6. Advantages for small and big corporations

When a large amount of companies is working after the virtual concept, big corporations producing mass products will have a hard time to survive. Their products are not custom made, so this products need to be cheap to make customers buy them. But when custom made products get almost as cheap as mass products, people will prefer the personalized product.

Especially for small companies down to single individuals virtual organizations are very interesting. A good idea, production skills or just a patent can bring everybody into business. Size doesn't matter to participate in the virtual organization; it is what you bring into the organization what counts.

7. Creativity

Creativity would profit of the virtual concept. A company's products are not developed by the same people and workgroups all the time. Because when working in the same team it results in many cases in a kind of signature staying the same over the projects. Creativity is limited, showing that they are not completely free from the past when having 'new' ideas.

On the other hand, in a dynamically changing environment; when a new setup precedes a project, different pasts and philosophies reunite. Creativity and new combinations are much more likely.

8. Mobility

8.1. Employees

Will everybody start moving after each project? Work in a new composition of participants, in an other town to other conditions? Mobility will have increasing importance but for obvious reasons like the own house, kids at school and others, these migrations will be limited. Computer networks like the Internet are an other reasons why migration will not undergo an explosion. Work can be done in geographical different and distant places. So for the employee mobility will be much more psychical than physical.

8.2. Customers

Mobility in the customers understanding is how often a customer is changing his supplier. Doesn't he have any relational binding to a particular supplier and change from project to project. Or will he prefer to have his supplier and enter a relationship?

We think the customer will stay with his supplier. So once he has chosen his supplier, he will profit of the growing reciprocal knowledge and not move to another without a good reason.

But what will happen when the virtual organization is changing very fast? The next time the customer is looking for the same kind of service the virtual organization did completely change its face. New composition of participants perhaps even different ideologies and problem solving tactics will be found. It is not very hard to guess that this might trouble a customer looking for success guarantee and stability. In this case the customer could change to any virtual organization without loose of performance. He anyway needs to learn about ideologies; the way things are understood and done. And the same goes for the virtual organization, when there isn't a minimum of continuity in participants the customer profiles will either leave with some participants or become unusable. This can be due to changes in information systems, different interpretation of the same information or the need for other information because of different focuses and ideologies.

So as a conclusion of this paragraph we think that customers will tend to stay with the same supplier even more than today because of the personalized character of the products and services. On the other hand virtual organizations have difficulties to become this personal supplier due to their dynamic character.

8.3. Information

Information needs to be very mobile! This in a manner going lots further than today's exchange. First the technology barriers need to be passed. Information technology is on the way to solve the problem. Today we can exchange text and images by using electronic mail. But already to accomplish this easy task we need different converters. When it comes to complicated databases that should be compared, merged or used for data-mining, custom-made solutions are needed. This means that the desired information, which is available after the processing, as for example after comparing, is not available immediately but only after days or weeks. So there is still a long way to go to make information mobile in technical terms.

The even bigger obstacle to surmount will not be the technical one; we consider the information policy as a much bigger problem. Information can not just become public. Not for legal reasons and not for economical reasons. How open information will flow in virtual organizations will strongly depend on the participants ability to trust in each another.

9. Economy & keys to success

The central point in the proposed economic order is the customer. Virtual organizations organize around his ideas and needs. The change to the new form of organization is not evident. We separated several keys to success that should be considered when tempting the change:

- step by step changes
- time to market
- everybody is concerned
- a stable customer interface

9.1. Step by step changes

The number of changes from today's structures to a participant in a virtual organization shouldn't be underestimated. The problem is very complex and a lot of hidden problems will be found. To undertake the less risk, best is to proceed in the Japanese way. They call it kaizen. It means to approach a target by small steps. It is a continual process of improvement of products and production. Kaizen is for example a very good way to improve quality. When every defect is recognized and analyzed, quality can be improved continuously and is approaching 100%. First people should understand and apply the new philosophy before the technical infrastructure follows. Under no condition the technique should be changed for imposing the new organization afterwards. This solution is very certain to fail. The same is true in production; you first need to optimize the process before you try to do it with machines.

Example (from [dav92]) GM gives us an example how you shouldn't proceed. They decided to create a new factory in witch car assembly is completely done by machines and robots. Humans only would supervise the production. Once the factory was finished it didn't work at the beginning. Robots did weld each another and one robot destroyed every window it was supposed to assemble. Many other problems in quality and material flow occurred. This is not astonishing in general, what is astonishing is that even one year later the factory hasn't had produced a single car.

Their mistake was to build a completely new factory with a completely new structure in a revolutionary step. The problem was much to complex to let them succeed.

9.2. Time to market

There are two main reasons why time to market should be reduced: customer satisfaction and cost reduction. Customers are less and less willing to wait for the satisfaction of

their needs. Best is when the custom made product is finished at the very moment the customer makes his decision. By definition this will hardly be possible. But it is possible to reduce time to market, this is reducing the decision uncertainties. A good example is Benetton, the cloth selling chain. Benetton produces its articles out of neutral material. It is only at the end that they are colored. So the decision which colors the articles will have is very close to the market. Reactions on customer behaviors are much more effective.

Costs can be reduced because less stock is needed, and possible, when reducing time to market. A new product line is faster reaching the market, thus gives an advantage over the competitors.

9.3. Everybody is concerned

The best example how everybody is concerned is total quality control. Only while proceeding with kaizen, you can get close to the target of 100% quality. And total quality control only will work effectively when everybody is integrated in the kaizen process. Everybody needs to survey quality and everybody needs to be qualified to recognize defects and create the necessary feedback.

'Co-destiny' of supplier and virtual organization demand that everybody is taking his responsibility within the network. Somebody doing bad work or using the other participants for his purposes is hurting the entire organization, thus this would be unacceptable.

And finally the virtual organization principle is not only limited to the third economic sector, first and second sectors also can work after the virtual principle.

9.4. A stable customer interface

As mentioned earlier, the virtual organization could appear as being without contours and in continuous change. It can be more competitive than today's enterprises because of its better relations with customers and suppliers. But especially customer relations will be more complicated than earlier when having a dynamic organization. Our suggestion is to create a stable interface between the customers and the dynamic organization.

This interface can either be a vendor representing different virtual organizations or a participant bringing his customer base into the virtual organization. Where as the second solution is dangerous, since the participant 'possessing' customer relations gets a lot of power.

10. Conclusion

We think that virtual organizations are potentially very powerful structures. The customer will get the product exactly as he wants it and almost immediately. He will

have the joy to acquire almost perfect quality and good service. This will give a virtual organization the edge over its competitors. There will also be radical changes for employees: work can be done at or close to home, hours of presence are rather flexible and the tasks are very diverse and interesting. In order to succeed a few conditions must be fulfilled. Mutual trust is the heartbeat of the virtual organization. People need to be more autonomous than in today's environment and must accept a transfer of power from management level towards the employee. All units must cooperate closely and share information. Before all however, infrastructures must be created to allow the virtual enterprise to appear.

10.1. Problems

However big the advantages of a virtual organization are, there are numerous problems on the way towards realization. The fact, that virtual organizations are something new which is not well known yet, will keep many people and companies away from virtual work and structures.

The employee's work is based almost entirely on self-motivation and responsibility. While this might work with some people, we seriously doubt that big organization can be built on such an insecure base. Many people will still need an external motivation in form of a leader who exercises control. This is nicely illustrated by the current educational system: There have to be exams as a form of continous control. Otherwise, most students would not study much.

Another problem lies in the need for security that most people have. Families need to be supported, cars and houses to be paid. This requires a steady flow of income which is not given in a true virtual organization. This insecurity might draw away most people from virtual work.

It is difficult to generate a feeling of belonging to a virtual team or organization if there are no permanent structures and human contact is very limited. Naturally, there will not be commitment to the organization. The employee's self-motivation and willingness to take responsibility for the company will be low—hardly the ideal situation in a virtual organization!

Virtual work is closely related to making an extra effort. Many people will not be willing to make this effort simply because they do not get a personal advantage out of it. They already are in a comfortable situation and can not understand why they should take more responsibility without getting paid more, for example. The solution to that would be that virtual workers get a special remuneration.

Customer relations will be a very important good. But it is complicated to keep this good updated and active in a dynamic organization. It is important that the customer is not troubled by the dynamic nature of his mandator. Our suggestion is to create a stable interface between the customers and the virtual organization.

10.2. Judgement

Our studies have shown that virtual organizations are very complex networked structures. Common experience has proved that simplicity is more likely to bring up feasible solutions. Solutions to the problems that we have mentioned before are not obvious. Therefore realization of virtual organizations is problematic. So we conclude that virtual organizations will appear and succeed in a limited number but the big breakthrough will not occur. This represents a chance for companies who can solve the problems we have mentioned.

10.3. Outlook

We are ending our work with an outlook on the future and a last example.

It is important to us, to bring a new word into the discussion of virtual organizations: 'fractal'. The same patterns are repeating in the virtual organization on different levels. For that reason we consider the virtual organization to be a fractal organization.

Big problems need to be overcome to a successful virtual organization. This problems like trust, self-motivation and group dynamic are mostly different from our today's behaviors. We think that some Asiatic people easily could overcome this problems and thus might become the leading economic powers of the future. Since once a virtual organization is successful, nothing will stop it.

This work itself is an example of a product created by a virtual organization. It covers many of the aspects of a virtual team. The two of us found together to create this text and we will go different ways just after it. As we do not follow the same classes, we mostly communicated by email and each of us did accomplish his task autonomously. It is at the end that we did cross-checking and assembly in a cooperative way. Finally we will share the result of our project.

Lausanne, 3.5.1999

M. Seiz T. Cueni

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