

Ph.D. dissertation

CSABA HORVÁTH

Virtual organisations

A fashionable term, or a real trend?

Results of the research, theses

Scientific tutor:

Dr. István Szintay

Doctoral school:

*Theory and practice
of enterprises*

Head of the school:

Dr. Aladár Nagy

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I. GOAL, BACKGROUND AND METHODOLOGY OF THE RESEARCH

I have chosen virtual organisations, as the topic of my dissertation. The actuality of this subject is confirmed by the recent changes in the economic, political and technological environment in the world. The development of international markets, the Euro-Atlantic integration of Hungary, and the conquest of electronic communication make the virtualisation of organisational boundaries more than a theoretic concept. Enterprises cannot operate isolated from each other, the competition is increasingly global, and the intention of giant companies to operate in a flexible and effective manner, parallel with the involvement of small and medium companies in the international supplier networks are all forces that determine the spread of entrepreneurial networks.

Resulting from the complex terminology and the variability of definitions in the literature of virtual organisations, my first goal was to clarify these terms and organize them as well as integrate the different approaches. Besides, in my dissertation I aimed at setting up a framework of methodological analysis to examine virtual organisations. As a result, my work contains all the considerations and parameters, which I deem to be important in the theoretical research, as well as in the practical establishment and management of virtual organisations.

I am involved in the organisational research since 1994, when, as a fifth year student, I studied the correlation of strategy and organisational structure of the Győr-Sopron-Ebenfurt Vasutak Rt. in my final thesis. Although the GySEV Rt. is not a virtual enterprise, with its many branches and related businesses it operates as a kind of enterprise network. Because of this, my final thesis was a precedent of the research on virtual organisations.

As a Ph.D. student, I have taken the research on virtual organisations as a challenge, because there have been very few researches dealing with this relatively new issue. Still today it is difficult to find comprehensive Hungarian literature on this topic, and even the international resources are sometimes contradictory. Resulting from this, the subject of my first research activities was to set the theoretical framework. As a first outcome, I published my typology at a conference in 1997. The widespread interest and the number of questions arising after my presentation convinced me that it is worth to deal with this topic, and at the same time I received encouragement and inspiration for the further investigation.

One of the major – still definitive – research directions was the study of the static and the dynamic-functional approach of virtual organisations. As these two attitudes are sharply differentiated in most publications, I started to examine whether these are radically diverse approaches or complementary methods. My first results in this examination were published on a conference in 1998. As my Ph.D. dissertation and these theses reflect, according to my conclusion the institutional and functional approaches cannot be dealt separately.

Between October 1998 and July 1999 I went on with my doctoral studies at the University of Dortmund, Germany, with a scholarship received from the Deutscher Akademischer Austauschdienst (DAAD), at the Lehrstuhl für Industriebetriebslehre. The books and journals available at the university library provided me with a substantially wider possibility to deepen my knowledge in the topic of virtual organisations than the ones in Hungary, and at the same time the consultation with colleagues were very fertile during the work on my dissertation. Especially a presentation held for students and lecturers of the department has raised many questions, mostly related to the network solutions, and the leadership role applied in the virtual organisations. I have been looking for models that were suitable for the description of special roles, tasks

and processes in the virtual organisations, and which were applicable in the practice during the co-ordination of virtual networks. I found out that the most appropriate description model was the two-level model, each level of which can be, however, broken down to further levels, this way leading to a fractal structure. Such fabric of network relations can be co-ordinated only with decentralised, standardized information systems. The results of these investigations were first published on a conference in November 1999 in Miskolc during the Ph.D. conference.

In my subsequent research I was concentrating on the development of a model, which should have helped to discover the characteristics and problems of a concrete virtual organisation during the process of organisational development. The model I used was based on the scheme of traditional organisational analysis. I adapted it to the features of virtual organisations and identified several points in the process where their special characteristics have to be taken into account. The model developed this way was first presented on the MicroCad conference in February 2000.

Since September 2000 I am working at the Sopron Regional Office of the National Agency for Regional Development, which is a background institution for the Ministry of Agriculture and Regional Development. In my work I am in contact with many spatial development specialists of Western Transdanubia as well as of Austria, and I also take part in the management of the regional development and information project of the West-Pannonian Regional Development Agency and three county labour centres. The experiences of this work have been included in one of the case studies as part of my dissertation.

The goals of my research:

In my research about virtual organisations my goals were the followings:

- Description and systematization
 - explain the international and domestic phenomenon of virtual organisations;
 - systemize the international and domestic practice;
- Develop an original terminology and research methodology, because the comprehensive and integrated research of this field is possible only on the basis of adequate conceptual and methodological framework.
- Identify and conceptualise the theses of my dissertation. These theses are grouped around the following topics:
 - theses related to the conceptual framework (1-3);
 - theses associated with the structural characteristics (4-5);
 - theses connected to the research methodology (6-9);
 - conclusions (10);
- explanation of the theses (justification and verification);
- publishing the knowledge, disseminating the results in scientific and professional-practical circles.

Scientific work

- Sources and their application:
 - Studies, teaching and research activities in higher education institutions
 - international and local publications
 - personal work experience
 - consulting
 - knowledge acquired about scientific research

- Studies and methodology:
 - identifying the research field
 - theoretical research
 - definition making
 - presenting specialised areas in a coherent system
 - systematisation
 - development history, additional information
 - underpinning by practical examples

On the above basis the Ph.D. dissertation can be divided into the following main chapters:

- After a short introduction, a systematised description of definitions from the international literature is presented, including the most important theoretical assumptions, and models. By conclusion, a basic definition is provided, which will be taken as a corner stone of the further analysis.
- The following chapter deals with the virtualisation of organisations in general (with special emphasis on economic-, market- and IT factors), and the process of organisation development related to concrete organisations.
- After this, the Ph.D. dissertation deals with the internal structure of the virtual organisations: in comparison with traditional network structures, studying especially the issues of structure, influencing factors of the operation, internal relations of the virtual organisations. This chapter deals also with the research model for organisational development.
- The fifth chapter contains the critical aspects of virtual organisations (information systems, network security, legal aspects, human factor) and the identification of related tasks.
- In the sixth chapter conclusions are formulated concerning the novelty of virtual organisations, and their possible role in the economy.
- In the seventh, final chapter the evolvement and operation of virtual organisations are presented through two case studies.

II. MAIN FINDINGS OF THE PH.D. DISSERTATION, NEW AND ORIGINAL SCIENTIFIC RESULTS OF THE RESEARCH

1. *Most of the publications related to virtual organisations represent one line of research, nevertheless there is no unified, comprehensive definition integrating the most important attributes of VOs.*

When defining virtual organisations (VOs), my goal was to create a definition that is consistent with the generally accepted view of most international publications, while integrating the different approaches of some non-main-stream publications. The six most common characteristics and the opinions of some researchers examined during my research are presented in Table 1. Based on the detailed study of a large number of international publications I have made the following observations:

		1 network of independent businesses	2 project ori- ented	3 use of IT	4 lack of hier- archy	5 use of core competences	6 one identity
1993	Byrne	X	X	X	X	X	
	Davidow, Malone	X		X	O		
1994	Klein	X	O	X	X	O	
	Olbrich	X	O		X		
	Scholz	O		O	X	O	
1995	Arnold, Faisst, Hürtling Sieber	O		X	X	X	X
	Reiß, Beck					X	
1996	Geuersten	X	X				
	Mertens, Faisst	X	X	X		X	
1997	Erben, Gersten	X	O	X	X	X	X
	Gristock	O	O	X	O	O	O
	Kocian, Corrêa, Scheer	X		X		X	X
	Odendahl, Hirschmann, Scheer	X	O	X	X	O	X
	Nissen	O			X		
Winand	X	O	X	O		X	
1998	Bultje, van Wijk	X	O	X	O	X	X
	Mertens, Griese, Ehrenberg	X	X	X		X	X
	Scholz	X	O	X	X	X	
	Venkatraman, Henderson	O		O		O	

Table 1 Most important elements of defining virtual organisations on the timeline*

- The available literature comes mostly from English, American, and German speaking European sources. The research of virtual organisations was established by the publications of Byrne, Davidow and Malone. They are the most cited researchers in other publications.
- Venkatraman and Henderson – representatives of a different line of research from the USA – consciously marked off themselves with their functional approach from the institutional view of the Byrne, Davidow and Malone. However, their description also allows to draw conclusion about some institutional characteristics.

* Direct references were marked by an X, indirect references by a circle (O)

- The European groups of researchers are mainly German speaking: two groups can be identified in Germany (Saarbrücken: Scholz, Scheer; Nürnberg: Mertens, Faisst, Scheer) and in Switzerland (Bern: Griese, Sieber). In addition to these, mostly publications of Dutch authors (e.g.: Bultje and van Wijk) are available, but there aren't any other significant research groups.
- The fundamental article of Byrne in 1993 listed almost all significant characteristics that have been used for the description of virtual organisations by other researchers during the following years.
- An additional element to these features is that some researchers (mostly from the Swiss school) identify virtual organisations as one single unit vis-à-vis any third parties.
- Researchers grouped around professor Scholz and Mertens see virtual organisations as decentralised short-term networks of small and medium sized enterprises.
- Most publications however, do not present a significant new approach; they are based mainly on highlighting one or another feature of the original definition of Byrne (except for the functional approach of Venkatraman and Henderson).
- Virtual organisations are widely identified as loosely structured networks of enterprises, in order to decentralise large hierarchical structures.
- Similar agreement reigns in considering the IT as a widely and actively used tool to support the information relations between the member organisations of the VO.
- It is stated often only indirectly, but it is still clear enough that most researchers consider core competences of the organisations as the basis of the common work. Similarly, we can agree that VOs are project oriented, or – as some say – have a very limited life span.
- Corresponding the life expectancy of VOs the most commonly used expression is temporality, however often this is stated only indirectly.

Among the definitions listed under Table 1 the description of Erben and Gersten contains most accurately the highlighted characteristics, nevertheless its statements corresponding temporality and the role of the IT needed to be modified. The resulting definition is presented under thesis 2.

2. *A virtual organisation is a network of independent (often geographically distant) companies and private persons – suppliers, manufacturers, developers, service providers and customers – linked by the common interest to share skills, resources, costs and market success in order to utilise the common synergy potential. The VO can be described by the following features:*

- **it is a network of independent enterprises,**
- **which behaves as one single unit vis-à-vis any third parties,**
- **it is project oriented, usually dissolving after the completion of the task,**
- **members of the network offer their core competences to the common performance,**
- **tools of the modern IT infrastructure are intensively utilised,**
- **finally it is not hierarchical, not formalised, instead it is thriving for the optimisation of the process of value creation.**

This definition shall be taken hereafter as the basis for the institutional approach of the virtual organisations. These six critical attributes have been chosen on the basis of a comprehensive literature research.

By drawing up this definition I intended to:

- clarify the conceptual confusion in the international literature by providing a single definition that lists the most widely accepted features of VOs;
- at the same time filling the gap in the Hungarian literature by offering a clear definition of virtual organisations;
- finally by creating this definition I intended to set up a framework for the forthcoming chapters of my Ph.D. dissertation, a hypothesis that can serve as a basis for the further analysis of the virtual organisations.

I want to stress the point, that the virtual organisation is not a single entity, but an enterprise network, behaving vice-versa customers as well as any other persons and organisations outside the network as one single unit. This is important because of the following reasons:

According to this definition IT based companies that have one single legal entity should not be treated as virtual organisations. Furthermore I want to stress that members of a virtual network are not virtual organisations on their own, even if they have some special features as a result of operating in a virtual environment. The virtual organisation and the participating enterprises are related to each other as a whole and a piece.

The question can be raised: what makes a difference between virtual and “other” organisations? What are the sources of virtuality of the former ones? In the formulation of the definition I laid an emphasis on the correspondence to the general criteria of any virtual objects (e.g. virtual memory, virtual reality, virtual organisations, etc.). The definition is interpreted according to four such principles.

1. Constitutional characteristics shown by both the original and by the virtual object.

Single appearance, the common performance of the (networking) partners and the related elements of the value chain can be found in both the real and virtual organisations. To the world the network is represented by one of the partners, an information- or a network broker.

2. Physical attributes, that are usually associated with the original object but which are not available in case of the virtual object.

The virtual organisation does not have a single legal entity, no common administration or a permanently stable organisational structure. Instead of permanence it has a project oriented organisational structure. This is characteristic for both types of virtual organisations: large companies with an established trademark and a related single image, working on a long-term basis (e.g. Nike, Puma, Smart, Dual, etc.), that operate a continuously renewing virtual network structure behind the relatively stable core company, and the short-term alliances that do not have a common appearance in the long run. The temporality of the virtual organisations has two levels: firstly the network is created for the duration of the given project, secondly the composition of the network is not fixed, it can be changed during the lifetime of the project.

3. Special additional features, necessary for the virtual realisation.

One of the special additional features of virtual organisations is that the partners contribute to the common work primarily with their core competencies, those skills, capabilities, resources, in which the given enterprise has substantial competitive advantage. Linking the specialists in the value chain allows improved utilisation of the synergy effect.

The second specific additional feature is the active utilisation of the IT infrastructure (work-flow systems, groupware, Internet, mobile communication, etc.) in the co-ordination of

tasks and maintaining communication. Nevertheless, in virtual organisations the role of IT does not stop at the technical realisation, but it must induce a qualitative change, a substantial methodological transformation in the operation of the network.

4. *Beneficiary effects, as advantages, resulting from the absence of physical attributes.*

The most important advantages of VOs (flexibility, adaptability, time- and cost effectiveness) in comparison with the traditional organisations are consequences of the lack of hierarchy and formalisation as physical attributes – enabled by the IT component. Instead of structure building, members of the virtual organisation concentrate on the optimal configuration of process elements and on the effective operation of the whole organisation.

3. ***For the comprehensive description of virtual organisations the institutional definition must be complemented with the functional approach. According to this, virtuality is understood primarily as a strategic direction, with a focus on the process optimization***

The institutional and functional models are not exclusive, but complementary approaches. The most important difference between them is that while the institutional definition approaches virtual enterprises from the organisation's view – taking the methods and circumstances of operation as results of the structure – the functional perception concentrates on the processes, neglecting the organisational features.

According to the functional approach the main characteristics of the virtual organisations are the followings:

- acquiring and involving the (internal and external) critical competences in the value chain;
- learning, adaptive organisation
- high level IT support
- virtuality is a qualitative feature of the organisation, realised on three functional axes:
 - virtual encounter, or customer interaction,
 - asset configuration, or virtual sourcing,
 - knowledge leverage, or virtual expertise.

Representatives of the functional approach, like Venkatraman and Henderson, reject the virtual organization as a distinct structure (like functional, divisional, or matrix).

The institutional view does emphasise the correlation between the effectiveness/efficiency and the organizational dimensions, whereas the functional perspective makes a clear connection between goals (*superior value in the market place*) and constituent features (*obtain and coordinate critical competencies*). On the other hand, the functional perspective does not tell much about the structural issues of the organization; it deals rather with the strategic dimensions of the three vectors mentioned above. It is interesting to recognize that while the institutional definitions clearly speaks about a network of independent entities, the functional approach can apparently imagine the virtual organization as one single organization under one legal cover. Virtuality is in this case a property of the internal relations, for example in a multinational enterprise with decentralized structure. Of course, this does not exclude the possibility of a virtual company network from the functional perspective; on the contrary, virtuality can be realised by the involvement of internal and/or external skills. Nevertheless, this approach defines the focal firm employing the virtual techniques already as a virtual enterprise.

4. The structure of virtual organisations is characterised by blurred organisational boundaries

The relations of virtual organisation members are characterised by a high level of complexity and blurred organisational boundaries. This is illustrated in Figure 1. The model is based on a similar model of Arnold, Faisst, Härtling and Sieber, which is, however, restricted to one single, isolated virtual organisation. My extended model demonstrates not only the most important features of virtual organisations, but it illustrates the complexity of the structure and organisational relations.

The Figure presents fourteen enterprises, with separate legal entities, each participating in one or more virtual organisations – in this Figure we can find five of them. All enterprises possess different competences (core competences and supplementary ones), which are utilised on the one hand in their own activities and on the other hand in virtual organisations (if their capacity allows, even in more than one). In order to provide a qualitatively higher level of service, which – taking production time, costs, and quality among others into account – would be impossible for the individual enterprise, some value adding processes of the single firms are substituted by the corresponding activities of other firms that have competitive advantage in that activity. Some participating organisations offer their excess capacities, others live on offering specialised products or services to other organisations. The former ones usually keep their existing scope of activities besides taking part in a virtual enterprise (so they are a little bit independent from the network they take part in), while the latter ones must always look for projects in which they can offer their competencies.

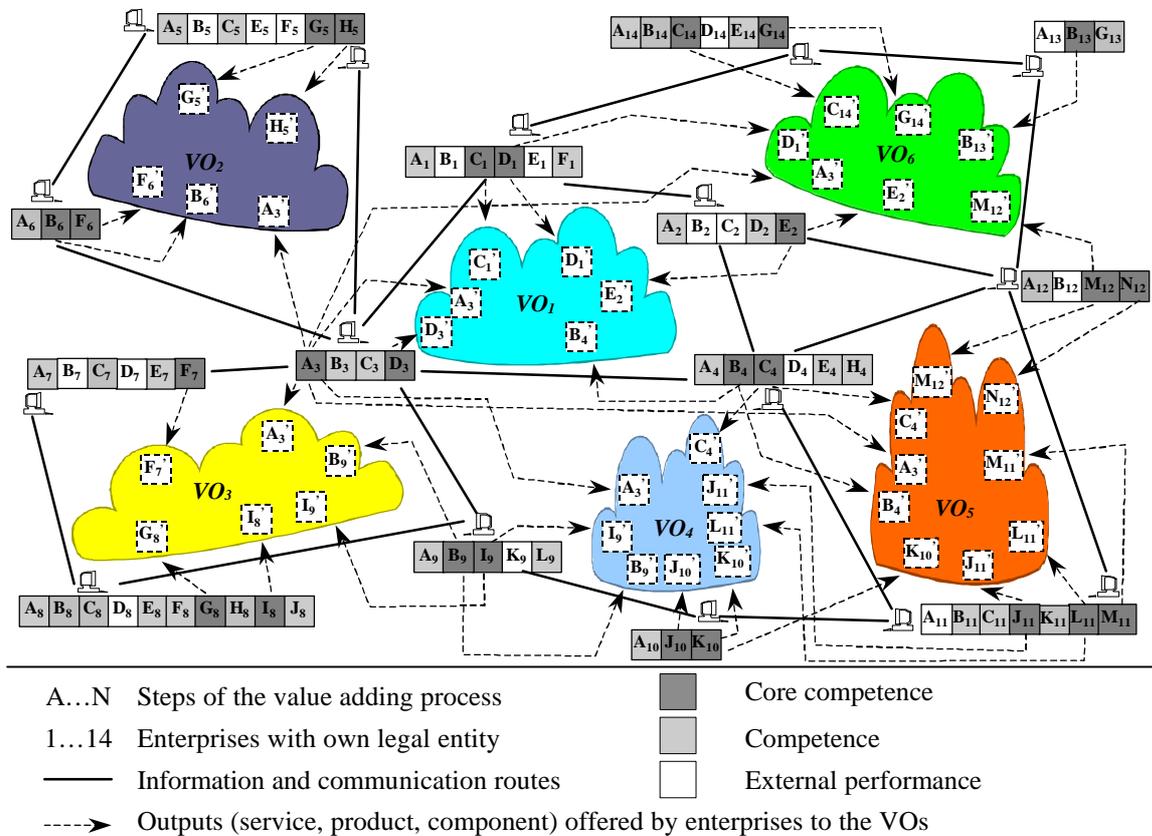


Figure 1. The network of virtual organisations

In the example in Figure 1 the participating enterprises usually have different core competences, although there are some overlaps. Competence “A” is for example present at all companies – either as own performance or as external contribution. We can assume that “A” is an activity that is needed at every enterprise, like for example computing or personnel issues. However, one of the enterprises (in this case number 3) is specialized in this field, and all the VOs in this example take the input of enterprise number 3. This means also that Enterprise Number 3 has the necessary capacity to offer this service. Other inputs are provided by other enterprises. The large demand of virtual organisation number one for input “D” is satisfied by enterprises 1 and 3. Similarly VO No 4 needs more input of “J”, which is taken from enterprises number 10 and 11. Why do they take these services from more than one enterprise, is not explained in Figure 1.

If some input in the virtual organisation is taken from more than one participating enterprise (or private person), this can have capacity-, geographical- or other reasons related to market segmentation. The participants of a virtual enterprise network are subject to a continuous monitoring process, and if they do not comply with the requirements, they can be replaced with other companies. Some of them are contracted only for a smaller part of a long-term project anyway. As a result of this continuous change in the structure, the boundaries of the virtual organisation are blurred and it is almost impossible to tell at which element of the value chain does the VO end, and that the supplier of a given enterprise is not belonging to the VO any more.

5. The virtual organisation is a multi-level network of dynamic, self-organising units

The network structure of virtual organisations is made up of two main logical levels: the “top level” responsible for the co-ordination and external relations (this is not necessarily a separate unit), and the decentralised network of partner companies on the “bottom level”. As the network relations of virtual organisations interlace several subsequent levels of the value chain, these are built upon each other so that the top level of one virtual organisation can be considered as the bottom level of another one. This type of network can be understood as a fractal structure, which is characterised by self-organising and self-resemblance. Members of the network, the fractals are independently acting organization units with clearly defined goals and processes. These fractals are self-resembling, and they organize themselves both on the operative and on the strategic-tactic level. The entire goal-system made up of the goals of the fractals is free of contradictions and serves the goals of the enterprise as a whole. The fractals are connected by a powerful information and communication system, and their performance is subject to continuous monitoring and evaluation.

For the description of the members in a fractal organisation the related model of holonic partnerships is appropriate. Holons are partly autonomous and partly co-operative units, oriented to the common business objectives. Under common objectives we should understand on the one hand the objectives of the legal unit that a holon is part of, and on the other hand the alliance, to which the enterprise – respectively the holon – contributes its service or product. Although the partner relations and the level of independence are regulated within the network, it is still advisable to keep a relatively high level of individual autonomy in the task realization.

The organisations acting on the logical “bottom” level of the virtual organisation are involved mainly in the operative activities. They can be described with the notion of agile enterprises. Agile enterprises are fast reacting organisations that are continuously adapting themselves to the challenges of the dynamic environment, employing a new, extended perception of quality. An agile enterprise behaves as a holon.

6. *There are two directions in the development of virtual organisations: constructive and destructive types of virtualisation*

In the development of virtual organisations two distinct tendencies can be observed; on the one hand the concentration of small and medium sized enterprises into virtual organisations, and on the other hand the creation of virtual structures through breaking down the rigid structures of large companies. The general features of virtual organisations are independent of the two ways of virtualisation – these were described in the thesis 2 –, now their differences will be shown in Table 2 and the connecting explanation.

During the constructive virtualisation the virtual organisation is created by small and medium sized companies that come together to form a network. This is done in order to broaden the scope of resources and activities by involving external skills, finally creating a comprehensive, high-level package of activities. When a large company structure is broken down (destructive virtualisation), the organisational units become independent enterprises, and other companies are also involved through the outsourcing of activities. The goal is to convert the rigid company structure into a flexible network, which can better adapt to the changing challenges. The institutional perspective prefers the constructive model – the “classic” way – of virtualisation. The destructive virtualisation is, however, better explained by the functional approach, which is less concerned about the organisational issues, but more on the effectiveness of processes.

In the constructive virtual development the lifespan of a virtual organisation is restricted to the lifetime of a given task, which is in most of the cases a relatively short period. The co-operation between the partners is limited to the operative issues and the effective sourcing throughout the value chain. Besides these, the broader network of companies that are involved in virtual organizing is maintained for a longer period, with strategic objectives. The destructive virtualisation has a strategic orientation from right at the beginning, and although the members of the network can be changed, the virtual enterprise is built around the core company for the long-term. The short-term alliance of SMEs is usually a result of spontaneous initiatives, while the destructive virtualisation of large companies with strategic orientation is a result of an evolutionary development.

Both lines of development provide a possibility for small and medium sized enterprises to be integrated into the international market flows, but while the SME network is emphasizing the evolvement of individual competencies, if the SMEs join the supplier network of a large company, then the competences of the small ones play (only) a complementary role. In exchange for this, they can count on a longer period of stable co-operation.

Small companies can participate in a virtual network usually if they are members of a formal or informal database, a kind of competence catalogue. In this case the virtual network, (the group of candidate companies for participation in a concrete project), and the actual virtual enterprise (established for the lifetime of the project) can be clearly distinguished. The network is represented by the information broker, whose main task is to collect the competences, maintaining the registry of member companies, contracting, making the choice on the competences and the coupling the competent partners. The broker in the centre does not necessarily have a dominant role.

In case of the destructive virtualisation, the organisational tasks are usually done by the initiating company, and the rest of the activities are performed either by units that gained (relative) independence from this company, and/or by independent companies. After the division of tasks the focal form may retain some of the activities, but alternatively it can limit its actions to consulting and network organisation. The central organisation usually is dominant enough to set the rules of the co-operation, standards and define the applicable technologies.

	Constructive virtualisation	Destructive virtualisation
Related model	institutional	functional
Origin	small and medium sized enterprises	large companies
Goal	to work out a comprehensive, high level package of activities	breakdown of the rigid structure, involvement of external competences in order to achieve efficient operation
Orientation	primarily operative co-operation	primarily strategic co-operation
Life span	limited to the lifetime of the project	stable in a longer term through subsequent projects
Way of network development	spontaneous, if virtualisation of earlier network relations than evolutionary	evolutionary, result of a continuous process of change.
From the SMEs' angle	a possibility to evolve skills, reaching international markets, strengthening the competitive position against multinational companies	joining the supplier network of large companies, relatively secure market access for the longer term
Centre	independent information broker, or the initiating company	the initiating company, or its remaining unit after outsourcing the non core competences.
Source of partner seeking	competence catalogue, information broker, former business relations	independent organisational units, former business relations, competence catalogue, information broker
Dominant organisation	in most cases there is no dominant organisation, or its dominance is negligible	the initiating partner is in a dominant position, the partners are in a relatively dependent situation
Critical points of the structural change	members of the virtual organisation must turn from (relatively) independent operation to working as a part of a larger unit	the virtualised large company turns from a single organisation into a compilation of independent organisations
Specialisation	the involvement of external competences serves higher level of specialisation on the unit level	the division of tasks (and the involvement of external competencies) reflects the existing specialisation in the organisational structure
Core competences	it is built on the core competences of small and medium sized companies	besides the competences of the focal (large) company, it is built on the core competences of small and medium sized companies
Scope and extent of change	participation in the virtual organisation results small scale changes in the internal structure of the members, but larger changes in the external relations and available markets of these units	participation in the virtual organisation results large scale structural changes in the member companies and substantial increase in their adaptability
IT support	less cost consuming standardised IT solutions	besides standardised IT solutions, often tailor made tools
Further development possibilities	after completion of the project the VO dissolves, it can be used as a reference model in new (independent) projects	although the project organisation may dissolve, the core company and the related image, trade mark, etc. live on, their experiences can be utilised in a new project

Table 2 Differences between the two ways of virtual development

In the constructive virtualisation, as a result of joining the network, the small companies are responsible not only to themselves but also to their partners; they must co-ordinate their activities with them. In exchange for this, they get a chance to deepen the specialisation in their own competences. The structural changes inside these firms are negligible; change can be experienced primarily in the external relations. On the contrary, during the virtualisation of a large company where some units of the focal enterprise gain independence and external competences are also involved, the structural change is reflected in the specialisation between the actors. In exchange for increased efficiency and flexibility the core company withdraws from the general

management tasks, it holds only a limited scope of competences as the co-ordination cannot be kept inside the organisational boundaries any more.

Mostly because of budgetary reasons, the SME networks usually prefer the customisable but standard IT solutions (e.g. Internet + plug-ins). In case of the virtual organisations originating from a large company, standardised solutions are often replaced by custom made, tasks driven IT infrastructure allowing for the specialised IT solutions. This is enabled by the greater financial power and the technical heritage of the dissolving company.

The experiences accumulated in a virtual enterprise can be utilised by the partners even after the completion of the project. In case of SME based virtual organisations the experiences are saved in a competence catalogue and utilised in new, independent projects. In the large company based VOs the long-term stability provides a greater chance to utilise the experiences in long-term projects, and in new tasks related to the core company. I think it is important to emphasise that the circumstances and conditions of the knowledge transfer shall be prescribed in the general rules of the virtual organisations, in order to avoid unnecessary legal problems.

7. The comprehensive analysis of the organisational change in virtual organisations requires special methodology

The process of organisational change is made up of the following main steps:

1. perception of the problem and the need for change,
2. causal investigation,
3. identification of problem fields,
4. organisation analysis (identification of the starting parameters, choice of qualification system and methodology, actual analysis),
5. defining the objectives of the organisational change,
6. organisational change (identification of- and making a choice on process variations, introduction of the change process),

In this process two steps need to be highlighted: in this thesis I deal with the identification of problems, than in the thesis 8 with the organisation analysis, with special emphasis on the identification of starting parameters.

The organisational problems (both in traditional and in virtual organisations) originate in three basic reasons: problems can occur in the realisation, in the strategy formulation (planning) and in the environmental factors. Four different problem fields (performance-, process-, structure-, and human relations related problems) are related to these, described in Table 3. In addition, Table 3 provides description about some of the most important determinations of these problem fields according to their impact on constructive and destructive virtualisation, and on the reconstruction of virtual organisations.

The forces determining the virtualisation of a large company structure are usually related to the size of the firm. In contrary to this, the virtual organisation holds several advantages of the small companies (flexibility, adaptability, innovative skills, etc.) while still being able to reach economies of scale, compete on the international markets, and collect the necessary competences. The objective of small and medium sized companies is to reach a similar situation from the opposite direction: they want to keep their existing advantages but get rid of the disadvantages (weak bargaining power, lack of economies of scale, being locked up in narrow market segments, etc.) so that by entering the virtual network they benefit from the advantages of a large company.

Factors determining the virtualisation		Factors determining the reconstruction of a VO	
Fields of analysis	Destructive virtualisation (large companies VO)	Constructive virtualisation (SMEs VO)	
Performance related problems	Performance problems related to some units encourage the outsourcing of the concerned activities	Missing capacities or competences urge for partner seeking.	In the VO the performance of a partner responsible for a given competence is inadequate.
Process related problems	The rigidity of the large company structure (inelasticity, lack of adaptability, slow problem perception) induces its breakdown	<ul style="list-style-type: none"> • Complementary competences are needed in order to market the special core competences, • the whole process cannot be managed alone by an SME. 	Poor management of the network relations (gaps in the co-ordination, information, and decision preparation, etc. systems).
Structural problems	<ul style="list-style-type: none"> • Lack of a comprehensive interest system, • over-centralisation, outdated division of labour, • conflict between strategic planning and realisation, • reluctance to change, • general and specific problems of the organisational structure, • over-segmented structure • inability to reach effectiveness, • high overhead costs, etc. determine the outsourcing of non-core competencies.	The inadequacy of SME structure for the management of global tasks, and missing structural elements urge for the building of network relations.	<ul style="list-style-type: none"> • Problems in the interest system (e.g. lack of regulation), • transparency problems in the decentralised system, • problems related to the level of regulation, • some partners do not fit into the network (because of technical, organisation, cultural, etc. problems), induce the reformulation of the virtual structure.
Human relations related problems	The organisational values and culture have lost their power, therefore the large company structure is broken down into virtually connected descendants.	Need for self determination and independence urge for the building of network relations.	A more sound regulation is required because of the weak personal relations, lack of co-ordination in the interest system, lack of transparency in the subordination system.

Table 3 Conflicts inducing organisational change with respect to virtual organisations

Of course, virtual enterprises themselves are not free from organisational problems, and their recognition induces the reorganisation of the network, or the reformulation of the framework rules. Such problems arise mostly because of the loose structure of the virtual organisations. Examples are: the required competences or the relevant partners were not identified correctly, the management of company or personal relations, interest systems is unsatisfactory, the dissemination of project results is not regulated well, or the human relations are not all right.

8. *In the organisation analysis of virtual organisations the relevant factors are the followings: organisation structure, process structure, decision-making and information structure, human relations and environment*

In the process of organisation change the identification of initial parameters is a prerequisite of the identification of the actions to be taken. For the analysis in the virtual organisations it is useful if we can identify the differences between the traditional and the virtual organisations. Based on the problem fields identified in the previous thesis, the practical parameters to be identified are: structure, process, decision-making and information system, human relations, and environment. The organisational analysis of virtual enterprises is done on two different levels: the virtual network as a whole, and the member organisations as parts of this network.

Structural characteristics

If we want to analyse the structure, as a traditional organisational feature in the case of a virtual organisation, then we have to face the problem that the virtual organisation does not have a permanent organisational structure. What we can do is to study the network, and the relations between the network members.

The division of labour, referring to virtual organisations, means practically the division of tasks among the partners (not among persons or organisational units). This is built on the competences of the individual organisations. The identification of required competences for the given VO and their co-ordination shall be done in the phase of draft planning. The organisational segmentation of a virtual enterprise depends on the required competences in the process. The narrower these competences are identified, the more structured the VO will be. Although this is advantageous for the specialisation, but at the same time a VO made up of too many members may cause problems in the co-ordination. Special issues are the division of tasks, responsibilities and competences. These shall be regulated in the fine planning phase of the VOs' life cycle. The balance between flexibility, fast reactions and lack of regulations in a VO depends to a great extent on the optimisation of the framework rules. This is also the basis of solving critical situations. It is very important to identify the holder of legal responsibilities, and the base of profit (or loss) allocation, etc.

When we examine the type of member organisations in the VO we do it because the integration of different structures (linear, functional, divisional, matrix, etc.) requires special treatment on a case-by-case basis. It is meaningless to investigate the type of organisation for the whole network, as virtual organisations cannot be classified as one of the known types, or as a new, additional form. It is more sensible to analyse the network structure and the relations between the partners. The most important considerations for this analysis are laid down in thesis 9.

Characteristics of the process

The processes of the virtual enterprise run on two distinct organisational levels: between the members and inside these units. In addition to this, the physical value chain is extended by a virtual value chain, which creates wealth by establishing the two-way information flow and knowledge transfer. The dual process network must be set up by taking special care of the:

- optimisation of the value chain (both physical and virtual),
- choice of the appropriate partners,
- definition of the rules of operation,
- establishment of network relations,
- management of network relations,

- appropriate scheduling.

Characteristics of the decision-making and information system

Because of its IT background, the decision-making and information system is one of the most important subsystems. Its task is to provide timely information for the management of processes, provide feedback, and support the conflict and problem management. A basic condition for its good performance is system compatibility among the participant organisations. Compatibility is supported to a great extent by the standardisation tendency of the recent years. Even though, a great attention must be paid to the followings during the fine planning:

- detailed functional analysis of the common project, with identification of the partners' core competences
- definition of the information requirements, and the necessary data
- for the proper technical realisation of the common decision-making and information system is required to define exactly the methods, place, sharing principles, and accessibility rights related to
 - data storage and processing,
 - data transmission,
 - and data collection.

According to this, there are three levels of information technology relations: application communication, database sharing and application sharing.

Characteristics of the human relations

The approach of virtual organisations to the human relations issue is substantially different from the traditional approach, as the latter one is built on scopes of activity, task (role), and person, while the former one concentrates on the skills, know-how and other competences. The primary function of the VO's registry is not to find a given function, the representing organisational unit or a person for a given project, but to find the actor who has the competence to perform the task in question. This requires not only a new registry structure, but also a completely new attitude. The identification of tasks, responsibilities and competences and their harmonisation shall be done by the members of the VO, and they must be also capable of monitoring themselves.

An important aspect is that the work in a virtual structure puts the members into a substantially different cultural environment. According to the typology of Handy these organisations are characterised by the "person" type of culture, in which the values are represented by the individuals and their expertise. However, these values are difficult to put into practice in an environment where personal relations are reduced to the electronic communication. In addition, the multinational networks put the individual in an environment where several different cultures are present, and the application of IT systems requires new behaviour anyway. Geographical distances make personal contacts especially difficult.

Environmental characteristics

Although virtual organisations operate in the same global environment as any other enterprise, we must highlight that the recent changes of this environment – especially of the scientific and technical environment – enabled the birth of virtual organisations. The environment is characterised by globalisation, need for standardised solutions, dynamism and diversity. These have resulted in the growing demand for fast changing network structures and technical solutions that can adapt to the regional and time differences. Virtual organisations are able to answer all these

challenges with the help of reference models, as the efficient project-structures can be rebuilt anywhere with the involvement of local competences.

As these environmental factors are present practically everywhere, we can assume that virtualisation in the development of organisational relations and in the management of enterprise activities is not a speciality of some organisations, but a tendency which is more or less relevant for everybody.

9. The determinant factors of the virtual organisations' structure are the intent and value system of the alliance, the timing and formal procedures of the contacts, the depth of IT integration and the applied technology

The formal realisation of virtual organisations is influenced by several factors, among them the objectives of the network, the direction in which the value adding process is extended, the expected life span and formalisation of the network and the applied IT support (see Figure 2).

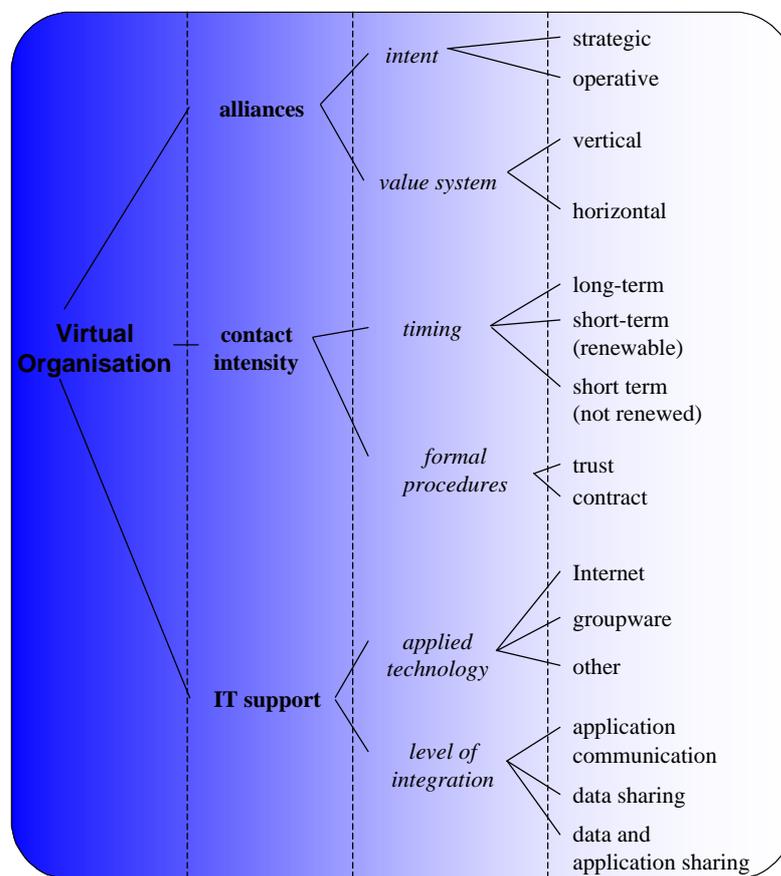


Figure 2. Determinant factors of the virtual organisations' structure

The first aspect is the intent of the alliance. In the classical sense, the co-operation in a virtual organisation is operatively oriented, but there is also a clear strategic orientation if the VO is built around a trademark or image, which exists for a longer period. The competence centre that chooses the members of the virtual network and co-ordinates them also has (must have) a strategic orientation.

The second aspect in the development of the VOs' structure is the direction in which the value system is extended. According to many researchers (e.g. Byrne, Brandt, Port, Erben,

Gersten, Davidow, Malone) the integration of customers and/or suppliers into the value chain, and as a result of this, the blurring of the organisational boundaries is a characteristic feature of virtual organisations. We can talk about horizontal and vertical orientation; the first case refers to the co-operation in similar activities, the second one to the co-operation in the supply chain. An example of the horizontal integration is when a consultant firm involves independent consultants for example because of capacity reasons. In the case of the vertical integration we can differentiate the “forward” and “backward integration, depending on the role of the initiator. Forward integration is the involvement of customers into the development of products or services. Backward integration builds on the involvement of suppliers, when for example the parts providers, assemblers and representatives of other activities are integrated under one common trademark.

Virtual organisations are determined by the intensity of their relations. In this respect two factors must be distinguished: the life span and the formalisation of the alliance. In case of short-term alliances the partners co-operate usually on the operative level. The driving force of this co-operation is the collection of complementary competences (without long-term concepts). As the partnerships are based on trust, the former partners are usually invited to new projects. This creates short-term, but renewed alliances. We can talk about long-term alliances, if it is about a long lasting project, or if a series of projects are connected by a common long-term goal (such co-operations are usually accompanied by a common trademark). Strategic intentions can be harmonised also in the case of renewed short-term alliances.

Especially in the case of some short-term projects virtual alliances are not regulated in a detailed written form, but the alliance is based on the mutual trust of the partners. This trust, however, is usually based on previous business relations and references deriving from common membership (e.g. in the competence centre), or on the framework-contract of the competence centre. Relations can be regulated by written rules, but this reduces the flexibility of the co-operation.

In order to identify the IT tools used in the virtual organisation we must know the goals of the network and the available technological and financial resources. This means that the life span of the alliance has an influence on the depth of the integration, which has an effect on the scope of technical tools that can guarantee the required technical level of the co-operation. According to the depth of the integration we can distinguish application communication, database sharing and application sharing as three levels of the IT communication. The first one means a loose connection between the IT systems of the partner organisations, the second is about the shared use of databases, and the third is the structure of jointly operated and used applications.

The repository of IT tools is broad enough to provide several software and hardware tools to satisfy a given demand. The Internet, for example, is an open system, which can be used for the involvement of a wide range of interested parties (customers and/or suppliers). Groupwares are available for a specific range of users, but they are not available for external persons or organisations. The network communication between the organisations is supported by a wide variety of open and closed systems. Some simple applications, like the ftp (file transfer protocol) or the e-mail serve the basic needs of the electronic data traffic.

10. The novelty of virtual organisations is in the value system and in the new attitude toward competence and knowledge management.

The characteristic elements in the concept of virtual organisations are not revolutionary (not the core competences, not the lack of hierarchy, not the project orientation, not even the IT support), but these together, connected in the way described above, are a revolutionary novelty. Virtualisation is much more than an organisation issue. It is rather a new perspective of the value

system, competence- and knowledge management. The changes in structure, planning and management are reflections of this changing attitude.

The world market is characterized by two apparently inconsistent tendencies: on the one hand there is a need for specialization in small work units, concentration on distinctive competences and transparent structures, on the other hand globalization (the emergence of global brands, global enterprises, global networks) and the need for economies of scale are ruling the markets. The answer of the corporate practice to the first challenge should be the outsourcing of the activities and the demolition of the mammoth structures. However, as a result of the second challenge, the world economy is increasingly dominated by a decreasing number of multinational enterprises.

To resolve this contradiction, more and more companies are building alliances and enterprise networks, which try to answer both challenges by providing a wider market basis for each of the concerned partners, at the same time complementing each others competences and concentrating on their own ones. The ideal virtual organisation can collect the capacities of companies that have a comparative advantage in a time and cost effective way, utilising the synergy potential in the co-operation.

The most important characteristic features of virtual organisations, as special network structures are the followings:

- The VO thinks in *projects*, the contributors are called together for the lifetime of a project – which is nevertheless repeatable and/or extendable.
- The idea of *outsourcing* is constituent in VOs, as they are based to a great extent on the use of external competences.
- The idea of the *lean management* is present everywhere in the network: on the partners' level the concentration on core competences is the most significant sign of the slenderizing organisation. At the same time, the virtual network contains only the most relevant competences that are necessary for the project, and the hierarchical relations loose their meaning.
- The VO – as a special team of enterprises, a collection of best-in-class providers – seeks the *synergy effect* in the cooperation.
- The VO realizes a special variation of *knowledge transfer*; with the involvement of external competences the skills and knowledge become part of the virtual structure, they can be used in order to reach the project goals, but they remain owned by the individual enterprise. However, the traditional knowledge transfer between organisations is also possible.
- The VO is an *adaptive, learning organization*. As a result of its flexible structure, it can react to new challenges with new structural solutions and with the appropriate arrangement of competences.

The wide-ranging and complicated tasks of the management and co-ordination of a network are increasingly supported by the tools of modern IT. Although the virtualization of the organizations is enabled – in fact induced (!) – by the enormously accelerated development of information technology, the organizational virtuality should not be confused with the extensive use of IT in the business processes. Alone the use of e-mail or the World Wide Web does not make a company virtual. The IT is rather the spring, the power of the business, helping to pursue efficiency and effectiveness according to the new challenges on the market.

Combining the institutional and functional definitions of VO we can accept that the virtual enterprise is characterised by some constituent organizational features, but similarly important is that the VO represents a special strategic orientation. From this perspective, the virtualization is

on the one hand a general phenomenon, which – under given circumstances – is applicable to any company, a trend that reaches the most of us. On the other hand, the application of virtual working practices sooner or later leads to the structures described in the definitions of the institutional approach.

III. UTILISATION OF THE RESEARCH RESULTS

The results of the research can utilised in the following ways:

- Resulting from the conceptual confusion in the publications about virtual organisations the general image of this phenomenon has not been very clear. The Ph.D. dissertation supports the clarification of this picture by presenting and integrating the different approaches and by creating a clear conceptual framework.
- The literature of virtual organisations is written mostly in English and in German, Hungarian publications are hard to find. If there are any, they usually cover only a segment of the topic. The Ph.D. dissertation presents a comprehensive review of VOs in Hungarian.
- In addition to the integrating presentation of the international research literature the Ph.D. dissertation draws conclusions that provide a methodological basis for the study on organisational virtuality and for the analysis of virtual enterprises.
- The increased requirements set by the European integration and the IT development, set new challenges to the Hungarian enterprises, new possibilities can be utilised. The Ph.D. dissertation can support Hungarian enterprises to answer these challenges in an efficient way.
- The above-mentioned challenges require that the virtual organisations shall be a topic in the higher education curricula. The Ph.D. dissertation is a good basis for the preparation of a university handbook and a teaching note.

The Ph.D. dissertation raises the following questions for the later research:

- According to the dissertation, there are two levels of virtuality in the organisations. This raises a theoretical and a practical question. On the one hand, it is a subject of subsequent research whether there is a well-defined border between virtual and traditional organisations, and if yes, where? On the other hand, what kind of market, organisational and technological factors influence the virtualisation in the practice?
- As stated in the thesis 3, the functional and institutional approaches shall be used together. The question is on the one hand, to what extent do they influence each other, that is, which level of the virtual practices implies automatically the application of structural attributes, and on the other hand to what extent is the optimal process configuration guaranteed by the virtual network structure?
- The IT has a substantial role in the operation of the virtual organisations, but it raises a series of technical, security, human related, legal and other questions. It is a subject of consequent research, whether the information science can answer these questions, or how the different interests can be attuned? To what extent is the organisational development influenced by the IT? Isn't there an unreasonable dependence on IT?
- Studying the destructive and constructive ways of virtualisation, we can ask the question, which of them becomes dominant in the development of virtual organisations? Can SMEs utilise the potential of virtual alliances, or can the large companies reach the required efficiency and flexibility by the virtualisation of their structures?
- The efficient connections between competences of the member firms are constituent elements of the virtual alliances. What are the dangers of this alternative way of knowledge transfer? Can firms – that are connected to each other only for the short period of a project – protect their know-how? What can help them to do so?

- The virtualisation has a clear impact on the organisational culture. It is a subject of further research, how do the firms from different cultural background influence each other's culture? Doesn't this connection have a negative effect on the national (or) company culture? To what extent do different backgrounds influence the possibility of efficient co-operation?
- To what extent can the experiences of a finished project be built into the subsequent virtual organisations? How can we efficiently use the reference models? Isn't it possible, that efficient groups of firms emerge, which continue to work together? Isn't there a danger of institutionalisation and losing flexibility?

IV. PUBLICATIONS AND CONSULTING ACTIVITY:

Publications:

- *Hitelbíráló a Budapest Bank gyakorlatában*; 1992. – diploma thesis
- *The Strategy and Organisation Structure of the GySEV Rt.*; (A Győr-Sopron-Ebenfurti Vasutak Rt. stratégiája és struktúrája [GySEV Rt.]); 1994. – diploma thesis
- *Virtual Organizations in the Mirror of the Literature*; (Virtuális szervezetek a szakirodalom tükrében) International Conference of Ph.D. Students; University of Miskolc, 13th August 1997
- *Virtuális szervezetek az elméletben és a gyakorlatban*; Day of Hungarian Science; University of Miskolc, 6th November 1997
- *Virtuális szervezetek statikus és dinamikus megközelítésben*; MicroCad International Computer Conference; University of Miskolc, 26th February 1998
- *Knowledge Transfer in Virtual Organizations*; VoNet-Workshop; submitted for publication, Bern, February 1999
- *Virtual Organizations – A buzzword or a real trend*; Universität Dortmund, Lehrstuhl für Industriebetriebslehre, February 1999
- *A virtuális szervezetek kétszintű irányítási modellje*; Ph.D. Forum, Miskolc, November 1999
- *A szervezetek virtualizálódása - Hagyományos vállalkezési struktúrák és a virtuális szervezetek kapcsolata*; MicroCad International Computer Conference; University of Miskolc, 24th February.

Consulting Activity:

- June 1996: Organisation development plan for the Mecseki Bányavagyon Hasznosító Rt. (Pécs)
- June 1997: Team work for the establishment of the strategic development program of the Rákóczi Bank Rt.
- September 1997: Supervision and modernisation of the operations at the Finomhengermű Munkás Kft. (Ózd)
- October 1997: Middle manager training and teamwork in the Sárvár factory of the Ecoplast
- February 1998: Preparation and introduction of the operation development concept at the Borsod Volán Rt.
- May-June 1998: Manager training for the top and middle managers of theÉMÁSZ
- November 1999; January 2000: Distance learning, EU conform manager training pilot programme for the Northeast-Hungarian police headquarters.