

**THE VIRTUAL CORPORATION:
EMPIRICAL EVIDENCES TO A THREE DIMENSIONAL MODEL**

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ABSTRACT

(109)

The development of virtual corporations can be perceived as a complex move along three axes: core differentiation, soft integration, and virtual realization. This theoretically derived conceptualization leads to the *virt.cube*-model, which shows the existence of various types of virtual corporations. This paper explains the model and then focuses on the question of how small and medium sized companies are able to act as successful players in this new economic order. Data from 102 German and Austrian companies are used to describe the actual state of virtualization and to analyze the related factors of success. As a major finding, competitive strategies are shown which differ with respect to company size.

Keywords: *virtual corporation; information technology; organizational networks*

The Virtual Corporation: Empirical Evidences to a Three Dimensional Model

A growing stream of research in organizational theory and management science has begun to address the importance of the virtual corporation to contemporary management (e.g. Davidow & Malone, 1992; Byrne et al., 1993; Scholz, 1994; Birchall & Lyons, 1995; Dess et al., 1995; Hedberg et al., 1997; Mertens et al., 1998; Townsend et al., 1998). Virtual corporations are one possibility to increase the capability of an organization to create superior customer benefits in a fast and efficient way. The underlying principles of virtual organization hold true for all kinds of organization, for virtual shopping malls as well as for virtual supply chains of a car manufacturer (e.g. Rayport & Sviokla, 1995; Mowshowitz, 1997; Venkatraman & Henderson, 1998; Scholz 2000).

The basic ideas of the virtual corporation have been stated in a visionary way seven years ago on the cover of the Business Week: "Big, complex usually can't react fast enough. Small, nimble ones may not have the muscle. What's the answer? A new model that uses technology to link people, assets, and ideas in a temporary organization. After the business is done, it disbands. It's called the virtual corporation." (Business Week, Feb. 8, 1993: front cover page). In the following, this definition has been expanded into various directions, such as the "virtual team" (e.g. Townsend et al., 1998).

The challenge of the original definition lies in the implicit combination of different aspects. As will be explained in this paper, at least three dimensions are involved: (1) The definition implies that certain competencies do exist, which target on a substantial market. (2) These competencies are to be linked in a way that they form a customer-focused unit with a high level of output quality and reliability. (3) Information technology is supposed to function as a catalyst, which enables companies to present themselves on a larger market, creating an effect which might be labeled "virtual size". Moreover, this definition from Business Week suggests that the virtual corporation is especially beneficial to smaller companies.

Starting here, the purpose of this paper is the attempt to examine all three dimensions. In doing so, I will not consider the virtual corporation as a binary concept, in which a company is either virtual or not. Rather, all three dimensions will together conceptualize a multidimensional approach to virtuality in order to explain reality and to propose meaningful alternatives for companies following the virtualization path. Therefore, on one hand I will make a suggestion for a theoretical model ("*virt.cube*"), on the other hand I will use data from an empirical project to test specific hypotheses which suggest specific moves along the three dimensions.

CENTRAL CONSTRUCTS AND HYPOTHESES

The original concept of the virtual organization (e.g. Davidow & Malone, 1992; Byrne et al., 1993; Coyle & Schnarr, 1995) was a rather broad one, claiming to create fluid and interconnected systems in and between organizations. In the following, some authors focus on the intraorganizational challenge (e.g. Townsend et al., 1998; Furst et al., 1999; Rennecker, 1999), others on the interorganizational question of how to define imaginary corporations as borderless systems (e.g. Dess et al., 1995; Hedberg et al., 1997; Fuehrer & Ashkanasy, 1997; Venkatraman & Henderson, 1998). In this paper, I will use the virtual organization as a general concept, enjoying "the increasing technological sophistication and personal flexibility" (Townsend et al., 1998: 17) for virtual teams in the same way as for a virtual enterprise. The reason for this is obvious: In a situation with blurred boundaries even the borders between intraorganizational and interorganizational aspects will diminish.

As a consequence, "virtual" does not imply a specific structure. I rather "treat virtualness as a strategic characteristic applicable to every organization" (Venkatraman & Henderson, 1998: 34). In order to do so, the review of the literature stated in the beginning of this paper, leads to the conclusion that virtual organizations are basically to be perceived as a three-dimensional construct, made out of core differentiation, soft integration and virtual realization. In the following, I will analyze these dimensions with respect to potential research questions.

Core Differentiation as Strategic Dimension

Authors dealing with virtual organizations emphasize that the partners in this type of organization have to focus on their core competencies (Byrne et al., 1993: 39-40; Bleecker, 1994; Christie & Leveray, 1998; Picot et al., 1998). As a result, potential partners for virtual corporations try to provide only those capabilities where they really have unique advantages. As Prahalad and Hamel (1990) point out, in order to compete successfully, a company focuses on activities where it (a) has a natural tendency towards it, (b) is superior to its competitors, and (c) faces a substantial market. The value chain is extremely narrowed to the particular elements where the company has a sustainable competitive advantage.

The discussion of core competencies finds its roots in the idea of modularity as a general systems concept describing the degree to which a system's component can be separated and recombined. Modularity helps to flexibilize the system by increasing the number of possible system configurations achievable from a given set of inputs. As Schilling (2000: 321) points out in her causal model, the heterogeneity of inputs and demands placed upon a system decisively influence the ability to produce multiple configurations. While an increasing heterogeneity of inputs leads to an increasing recombability, an increasing heterogeneity of demands makes the attained combinations more valuable. Thus, in organizations, heterogenous core competencies form differential inputs which – in a complex environment with heterogenous customers – can be seen as important precondition to produce a high system's fitness.

I labeled the first dimension of our model "core differentiation" to point out, that not every attempt to differentiate automatically leads to a core competence. If a company splits up into smaller parts and if these smaller units do not gain markets for their products and services, this kind of differentiation does not serve to move into the direction of becoming a virtual company, because the company stays unattractive for virtual partners. This flexibility connected to the units with core competencies becomes even more important, when the business environment calls for a developing of products and services "on Internet time" (Iansiti & MacCormack, 1997).

To sum it up: Core differentiation is a task for strategy and business policy. Taking the current state of organization theory, this task can be solved by analyzing the business portfolio and concentrating on selected parts (e.g. Ansoff, 1984; Porter, 1998). However, it is still a very

demanding task, since due to the increased necessity for speed (e.g. D'Aveni, 1994), there will be less time for designing implementation concepts than ever before.

Therefore, the following hypothesis is proposed:

Hypothesis 1: Companies that follow the strategy of core differentiation will be more successful than those not following that strategy.

Soft Integration as Organizational Dimension

The second dimension is about executing the task of integration. Integration refers to (1) the degree of the tightness of coupling between system components and (2) the degree to which rules of system architecture enable/prohibit the combination of system elements (e.g. Schilling, 2000: 312). It means the creation of a bundle of matching system elements whose probability to be substituted is low when the reached system's performance is optimized in respect to a given set of inputs. Integration is in an organizational context translated into interdependence, defined as the degree of cooperative interaction and collaboration between partners. This interdependence is based on an exchange of materials, information, and reciprocal inputs (e.g. Campion et al., 1993).

Concerning virtualization, it is not only integration in the mere sense of putting together separated parts, but again a specific type of integration according to a specific set of rules. Here, additionally two conditions have to be met: First, the independent core competencies have to be combined to form a single unit which produces a total optimization across the whole value chain, and second, the realization of "one face to the customer". Soft integration thus serves to become able to deliver as quickly as possible to the customer the lowest-cost, highest-value product that the entire value chain can produce (Flaig, 1992: 153).

In organizational literature, several suggestions for integration can be found (e.g. Aldrich & Whetten, 1981: 388-397; Hatch, 1997: 162-164). However, in order to achieve the virtual corporation, only those mechanisms are to be used which do not create a new dysfunctional bureaucracy. In particular, four concepts seem promising:

Co-Destiny. Partners in a virtual corporation find themselves in a situation in which they succeed together, but also loose together. In contrast to the darwinistic view in which the strong partner always defeats weak partners, the interdependent units in a virtual corporation can only survive when they rely on each other, because there is no slack planned to compensate a loss of one of the unique core competencies. Therefore, the partners must have the mutual understanding of an almost symbiotic coexistence, reaching a feeling of co-destiny (e.g. Davidow & Malone, 1992). However, it has to be kept in mind that the interdependence-performance relationship follows a U-shaped curve, as Stewart and Barrick (2000: 144) showed for work teams.

Shared Vision and shared goals. If no bureaucratic mechanisms for explicit integration exist, an implicit coordination by shared goals and – even better – by a shared vision allows the partners to orientate themselves into the same direction (Coyle & Schnarr, 1995: 41). This does not automatically mean absolute consensus, for some critical dissent (e.g. Dooley & Fryxell, 1999) is still functional to neutralize tendencies towards groupthink (Janis & Mann, 1977).

Fairness and trust. Even though "trust" (e.g. Luhmann, 1986) might sound old fashioned, a virtual corporation must rely on a specific code of conduct, on a specific professional sense of fairness. This can be observed in highly professional teams in the Internet-community as well as in Mafia-type organizations. Fairness in this professional sense is not pure altruism: It is coupled with a transparent system of negative reinforcement in case of one partner breaking the implicit fairness code. By that, integration resembles in some parts the clan culture (Ouchi, 1980). Therefore, it is not surprising, that almost all authors dealing with the soft side of the virtual corporation emphasize the necessity of trust (e.g. Welles, 1993; Handy, 1995; Fuehrer & Ashkanasy, 1999).

Culture of virtuality. Extending the three aspects mentioned above, a specific corporate culture of virtuality is needed. Even though all partners bring along their own cultural profile, in a virtual corporation they have to rely on shared cultural values such as strict customer orientation, focus on technology, and a feeling for polychronity (Hall & Hall, 1990). This "mentality often demands a willingness to work – without a contract – for an indeterminate length of time" (Bottoms, 1994: 62). At the end, "virtuality" becomes a social constructed phenomenon (e.g. Berger & Luckmann, 1966) with very real consequences.

Summing up: None of these mechanisms of integration is structural, they all cover "soft" factors. Dealing with them and bringing them into a managerial form is the real challenge to be addressed by organization theory.

This reasoning suggests the following hypothesis:

Hypothesis 2: Companies that follow the strategy of soft integration will be more successful than those not following that strategy.

This hypothesis is definitely not trivial and obvious, since at least one strong argument could be made in the opposite direction: It could be argued, that only if the hard integration of competencies is optimized across the value chain, the soft integration comes into play. Therefore, one might have all the soft integration factors in place, but still would lack success, if the structural integration is not adequate. Still, hypothesis 2 should be phrased in the way stated above, since for a virtual organization a too intense hard integration would have the same negative effect as the lack of it, since the former results in too much inflexibility, the later in too much inefficiency. Therefore, only the move into the direction of soft integration should increase the success of the company.

Virtual Realization as Technological Dimension

Information Technology is a dominant way to accomplish both the core differentiation and the soft integration and, by this, serves to realize the modular system building. Therefore, virtual corporations are strongly linked with IT and, in particular, with the concepts of virtual reality and cyberspace. Or, as it has been stated already several years ago: "The concept of 'cyberspace' is crucial to an understanding of virtual organizational forms. Put simply, cyberspace refers to the medium in which communications flow and computer software operates." (Barnatt, 1995: 83).

By virtual reality, it is possible to act without physical attributes. Many sites and services can be addressed via computers nowadays, since the Internet has become the most time-flexible and ubiquitous communication medium (e.g. Szyperki & Klein, 1993; Romm & Sudweeks, 1998). The dramatic quantum leaps in data processing capacities enable companies to use virtual reality

to reach customers on a global scale. Moreover, companies no longer address their customers one-way, but customers more and more actively search for information and services in the Internet by themselves. Thus, it is the challenge to create a presence in virtual reality – with all and even the sociological consequences (e.g. Featherstone & Burrows, 1995; Turkle, 1997).

The information technology is currently a hot topic both research and practice (e.g. Townsend et al., 1998; Venkatraman & Henderson, 1998). It ranges from different modes of collaborative software applications and Internet/Intranet-technologies all the way to the creation of "real" virtual reality, which is also supportive for virtual corporations. They can use the technical means to communicate about the foundation of a virtual company and are no longer bound to their local environment while searching for partners. Furthermore, they can create the "one face to the customer" by using the modern communication technologies. Nevertheless, virtual realization does not just mean to simply transport a data model into the computer. It also has to deal with emotions and feelings: Optical and acustical stimuli can be used to establish a customer-corporation relationship. Further developments may emerge, like the use of haptical stimuli.

An additional aspect emerges due to the increase of internationalization and globalization (e.g. Steger, 1998). Because the globalization requires employees and business units to work geographically distant from each other on a broad range of activities, information technology is needed. It must move the cooperation beyond the idea of a simple exchange of data to a strategic formulation of core competencies and to the creation of a unifying identity (e.g. Boudreau et al., 1998).

Summing up: Even though the third dimension seems to call for information science, the behavioral science is also challenged, since the creation of attractive interfaces between customers and virtual corporations becomes more and more important.

These arguments lead to the third hypothesis:

Hypothesis 3: Companies that follow the strategy of virtual realization will be more successful than those not following that strategy.

Multidimensional Model-Building in a Contingency Frame

In order to put these three dimensions together, the model of virtual corporations has to be specified. While the task of following its strategic implications is difficult, it is even more complicated to match strategies to the company's situation because of the many external and internal factors managers have to weigh. The basic contingency frame I use here covers the external factor of environmental dynamics as well as the internal factor of corporate size.

Multidimensionality as Necessity for the *virt.cube*. Dealing with an organizational model on a multidimensional basis is connected with the question of statistical independence of the dimensions. In our particular model of virtual organization (the "*virt.cube*"; figure 1), this question translates into the following: Can companies move effectively to all corners of the model, or are certain logical interdependencies to be observed?

 Insert figure 1 about here

According to Lawrence and Lorsch (1967), differentiation in successful companies is always accompanied by integration. Therefore, focus on core differentiation must be followed by a focus on soft integration. A similar idea can even be derived from Ashby's law of requisite variety (Ashby, 1956). As to the dimension of the virtual realization, it seems obvious that one can use IT for all stages of core differentiation and/or soft integration. This means, no connection between virtual realization and the other two dimensions is to be expected.

We, therefore, can formulate the following two hypotheses:

Hypothesis 4: The strategies of core differentiation and soft integration are interdependent.

Hypothesis 5: The strategy of virtual realization is independent of the strategies of core differentiation and soft integration.

Environmental Dynamics as Driving Force. Starting from the older research on virtual corporations, authors emphasize the fact that the virtual corporation is basically a reaction to the changed environment (Davidow & Malone, 1992; Byrne et al., 1993; Dess et al., 1995; Hedberg et al., 1997). This is again in accordance with Lawrence and Lorsch (1967), who state that both differentiation and integration reflect the degree of environmental dynamics. Therefore, one would expect the degree of virtuality to be higher in those companies which face a rather dynamic environment, since in these cases the specific capability of virtual organization to adjust itself in an extreme flexible way becomes very important. On the other hand, if the environment would be stable, organizations, which optimize organizational routine-work should prove to be more effective. This argument can be developed also from the classic literature on organizational design, in this case particularly from the Aston research group (e.g. Pugh & Hickson, 1976)

Hypothesis 6: In industries with a high degree of environmental dynamics, we observe higher values on all three dimensions of the virt.cube, due to a larger necessity of virtualization.

Size as Contingency Factor. Already the first articles on virtual corporations (Byrne et al., 1993: 39; Bullinger et al., 1995: 358; Scholz, 1994: 56) saw this concept as a chance of survival, in particular, for the small and medium sized company. By not just using the traditional networks but, going further, creating temporary "real" companies, even smaller companies would be able to compete on a global market. This holds true especially for Germany, where many governmental programs try to foster the growth of networks of the virtual corporations type (e.g. Wolter et al., 1998).

The inner logic of this argument depends on the specific dimension: As to the core differentiation, smaller companies do have to focus on core competencies, since it is the only way for them to gain a sustainable competitive advantage. The soft integration becomes important, since the impulse to create and to maintain the virtual corporation has to come from the companies themselves. Finally, as to the dimension of virtual realization, the smaller companies should be the real winners of the new situation. For them, it becomes possible, independent from the size to act on global market, to reach customers all around the world and to do so without being restricted by the usual inflexibility of a larger corporation.

Hypothesis 7: Smaller companies rank higher on core differentiation, soft integration, and virtual realization than larger companies.

In addition to the descriptive hypothesis 7, the hypothesis 8 is normative, since it is not only the current distribution of virtual corporations of interest, but also whether smaller companies act more successfully when they are organized in a virtual way, as compared to larger companies.

Hypothesis 8: Smaller companies benefit more from core differentiation, soft integration, and virtual realization than larger companies.

METHODS AND DATA

Research Team. To analyze the implications of the model, a research group was formed, which involved senior faculty as well as doctoral students. The task of this group was to measure companies along the three axes of the *virt.cube* and to derive suggestions for industry development. In addition to the basic model presented in this paper, the data base will serve as basis for several other research projects, which cover specific details of the *virt.cube* as well as strategies connected to it.

Research Sample. The instrument was used as written questionnaire and as interview guideline, in order to collect additional qualitative data (not discussed in this paper). The 102 data-sets were collected 1998 and 1999 in Germany and Austria. There was no emphasis on industry or size, since we tried to get companies from various environments and sizes: With an average size of 13,418 employees, the companies were 33% small firms up to 400 employees, 31% medium sized firms from 400 to 4,000 employees, and 35% large firms over 4,000 employees. The sales average of the companies in the sample was 4.5 billion German Marks (approximately 2 billion US-\$). However, there is a small bias towards innovative companies, since we expected they would make a stronger use of innovative models of organization such as virtual corporations. The data, therefore, in their descriptive interpretation are not representative for Germany and Austria as a whole.

Measures. For each of the three dimensions a specific scale was defined. Responses for the items were measured on a five-point Likert scale ranging from -2, "very low extent", to +2, "very high extent". Each of them has a sufficient Cronbach's alpha value. Core differentiation ($\alpha = .82$) is measured by 12 items, such as "large amount of outsourcing in the past" and "focus on areas with superior performance". Soft integration also consists of 12 items, such as "culture of trust" and "strictly sticking to our principles of behavior" ($\alpha = .71$). The 10 items for virtual realization range from the usage of groupware system for internal operations to new media on the customer interface ($\alpha = .79$). The complete list of the 34 items used to construct the *virt.cube* is presented in table 1.

 Insert table 1 about here

In order to evaluate whether the three dimensions of the *virt.cube* really make sense in their combination, it seemed appropriate to move one step further than the reliability score of the scales measured by the Cronbach's alpha value. In order to do so, a confirmatory factor analysis was performed, using the Varimax rotation and Kaiser Normalization. It was searched for 5 factors, in order to allow for more than three dimensions but at the same time restrict the number of potential outcomes. As can be seen from table 2, the dimension "core differentiation" was almost perfectly detected, the other two dimensions each split up into two subgroups, which does not contradict the original model. All together, 30 variables out of the total of 34 have been put in the right places (88%). This means, that the three dimensions stated in the *virt.cube*-model are from the statistical point of view meaningful construct.

 Insert table 2 about here

The size of the companies in this paper will be measured by the number of employees. For the environmental dynamics, 5 items have been used ($\alpha = .61$). These items relate to the increase of market volume and customer needs as well as to the change of boundaries and technologies.

Consistent with organization effectiveness research (e.g. Scholz, 1992), I used both strong and soft measures of company performance but concentrated on external efficiency measures (e.g.

Kilmann & Herden, 1976; Hitt, 1988) because of the competitive market characteristics virtual organizations orientate themselves towards. Strong measures such as Return on Investment and Sales per Employee are based on objective data, but had not in all cases been possible to retrieve. The soft measure used is a self-assessed indicator for performance. It is constructed out of 10 items ($\alpha = .84$), and asked for the assessment, whether the company was able to reach its quantitative goals (e.g. market share) as well as its qualitative goals (e.g. customer and employee satisfaction). In contrast to the hard measures, most companies were ready to provide these information. Therefore in the following, I will basically use this measure "Corporate Success", especially since it is correlated with ROI ($r=0.4$) as well as with other measures (such as sales per employee), but has less missing cases.

RESULTS

The main findings for H_1 to H_6 are presented in table 3.

 Insert table 3 about here

Performance. All three dimensions of the *virt.cube* are correlated on a sufficient level of significance with corporate success. Especially the focus on core differentiation ($r=.49$) and soft integration ($r=.46$) are extremely important factors of success. Also the virtual realization proofs to increase the success of the company ($r=.28$). H_1 through H_3 therefore can be considered as supported: All moves of companies along each of the three axes in the *virt.cube* increase the level of performance. Using the more narrow defined ROI-criterion, focus on core differentiation ($r=.30$) and focus on soft integration ($r=.51$) both have a positive influence. No significant relationship however was observed between the virtual realization and the purely financial measure.

Intercorrelation. As to H_4 , the expected result of a strong correlation between focus on core differentiation and soft integration occurs ($r=.33$), calling for a fit between the specific form of differentiation and of integration. Other than expected in H_5 , we also observe a strong correlation

between core differentiation and virtual realization ($r=.42$). Nevertheless, our result can be explained by a triangular relationship between market dynamics, the necessity of core differentiation and the intensity of entering the cyberspace, in combination resulting in an increased completeness of the markets (see also H_6). On the other side, we do not find a correlation between soft integration and virtual realization. This could be due to the fact that virtual realization currently is more used for data integration and less for cultural integration. This observation can easily be supported by looking at current web-pages of companies, which provide information and allow data exchange, but rather lack mechanisms of cultural integration. Obviously, companies currently do not see the potential of using the power of the virtual realization to increase their level of soft integration.

As to the item "Perception of Being a Virtual Corporation", only 13% see themselves this way. These companies seem to consider moves along all three dimensions as being part of the existence of a virtual corporation namely core differentiation ($r=.29$), soft integration (.25), and virtual realization (.20). For these companies therefore the *virt.cube*-model reflects what they consider intuitively as a "virtual organization".

Environmental Dynamics. Concerning the findings related to H_6 , I find a strong correlation between the environmental dynamics on one hand, and core differentiation and virtual realization on the other hand. The more dynamic the market is, the more companies move along these two axes. (Still at this point not necessarily a causal relation can be stated, since the companies to some degree by themselves create the dynamics by moving along these two axes.) There is only a weak connection between environmental dynamics and soft integration.

Size. Moving to the relation to size, it has to be noted from table 3, that there is hardly any relation between the moves along the three axes and the size of the companies. Only the virtual realization seems to be to some degree more used, but contrary to H_7 by larger companies ($r=.26$): This contradicts the common assumption that especially small companies move into cyberspace. H_7 therefore has to be rejected.

While H_7 refers to the purely descriptive evidence, that smaller firms are expected to make more use of the virtual organization, H_8 concentrates on the normative aspects and states, that smaller companies benefit more from virtuality than larger companies. Going into this direction, table 4

reveals that the relation between the three axes of the *virt.cube* and the company's performance is, indeed, dependent upon size: Small and medium sized companies benefit more from it than the larger companies. Interestingly, the small companies basically benefit from core differentiation and especially from the soft integration ($r=.56$). This is an important finding which is not totally in accordance with the common belief: Usually, the smaller companies are said to focus primarily on core differentiation. Putting an additional focus on the soft integration would mean a change in the necessities for organizational development in smaller companies, in order to prepare them for virtual corporations. For the medium sized companies, basically their ability to focus on core differentiation is the explanation for their success ($r=.57$). In addition to this, taking the virtual realization dimension, especially the companies between 401 and 4000 employees are able to benefit from it.

 Insert table 4 about here

To deeper analyze the relation stated in connection with H_7 , a regression model was formulated, in which the success of the company is predicted from the position of the companies within the *virt.cube* (table 5). Here even stronger can be seen that the strategy of soft integration is the main factor of success for small companies, while the large companies basically have to work on their core competencies. The medium sized companies have to follow all three dimension.

 Insert table 5 about here

The dimension "virtual realization" has according to table 3 a positive correlation to success ($r=.28$), but this is the lowest of all three dimensions. Therefore, it does not surprise that in the regression for all companies, this dimension brings the smallest contribution to the explained variance. Here again, I can refer to the prior given explanation that the content of the virtual realization is too much concentrated on core differentiation and too less on the soft integration.

LIMITATIONS

Further research on the dynamics which determine the virtualization of corporations is clearly needed. First, as to the scales, not all of them have sufficient values for the Cronbach's alpha. Second, concerning the *virt.cube*-model, its three dimensions are neither by design nor by empirical evidence statistically independent. This causes various methodological problems for testing causal relations. Third, this study uses data from Germany and Austria. Even though the theory behind the *virt.cube* is derived from literature originated in Europe and the USA, the results might still not be transferable to other countries.

CONCLUSIONS

Related to the Empirical Evidences. The results presented above indicate that all three dimensions which are necessary to form virtual corporations – core differentiation, soft integration, virtual realization – bare the potential to increase corporate success. The dimensions are contingent to external factors like environmental dynamics, and internal factors like company size.

As to the size of the company, one major finding the data suggest is that small and medium sized companies do not move as fast as larger companies along the three axes of the *virt.cube*. But if they do, the concept of virtualization contributes much more to the success of the company as it is the case within larger companies. This finding might result in competitive strategies especially to be used by small and medium sized companies, for they are able to realize their success in virtualization with far less efforts than the large companies. For small and medium sized companies, we find here an important potential to strategically gain success. The large companies, however, do not benefit from their virtualization efforts in the same way. They seem to stick to their size which they have, over years, transformed into physical structures, and they only seem to be successful in forming core competencies. Entering the virtual reality or integrating with partners is perhaps perceived as a threat to their identities.

As to the move towards core differentiation and soft integration, the data suggest that both are meaningful strategies, especially if they are used in combination. Here we really go back to the

roots of the virtual corporation, which call for the flexible combination of core competencies. However, the isolated move towards core differentiation seems also effective if the company becomes part of a virtual corporation.

As to the move towards virtual realization, the data suggest that companies should use this broad range of technological capabilities – in addition to the shaping of core competencies – much more as a tool for soft integration. This calls for a change of the content of these systems from information to emotion as well as from pure data to more culture. Since a virtual organization is built upon attributes such as common culture, trust and the feeling of a co-destiny, the virtual realization should be able to support this.

Related to the *virt.cube*. To visualize the dimensions, the *virt.cube* was chosen. Its axes of core differentiation and soft integration are – as expected – intercorrelated, and corporations especially combine activities on the core differentiation axis with those on the virtual realization axis. The *virt.cube*-model can be used in three different ways:

First, as a tool for classification. It is evident that there is definitely more than just one type of virtual corporation. The different forms of virtual corporations as well as several stages in the process of virtualization can be distinguished by using the *virt.cube*.

Second, as a management tool. Even though empirical evidence is still rare, already some heuristic considerations can be made. Following the idea of the *virt.cube* and coming back to figure 1, three stable situations seem to exist, each of them bearing its particular challenges: Taking a company strongly concentrating on the virtual realization axis and transforming its business into cyberspace, here it is important really to utilize the full range of the multimedia environment in order to acquire and to keep customers. This move can then be combined with concentration on core differentiation (F). Another stable path is to differentiate into specific core competencies and join with other independent partners to a virtual corporation by means of soft integration mechanisms (D): The important point here is to focus on core differentiation and to resist the temptation of creating more and more structural, bureaucratic mechanisms of integration. In addition to this, virtual realization may be used as an enabler for the two dimensions (H). As it looks right now, one alternative is no stable option, namely trying to

integrate similar units which do not represent core competencies and then even trying to make this situation accessible via virtual realization (G).

Third, for empirical research. Building virtual corporations without a solid empirical base seems meaningless. All three axes of the *virt.cube* need further work, for instance on the questions, (a) how can virtual corporations establish sustainable core competencies, (b) how can virtual corporations develop counter-forces against bureaucratic integration, and (c) how can virtual corporations make efficient use of IT.

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FIGURE 1
The *virt.cube*

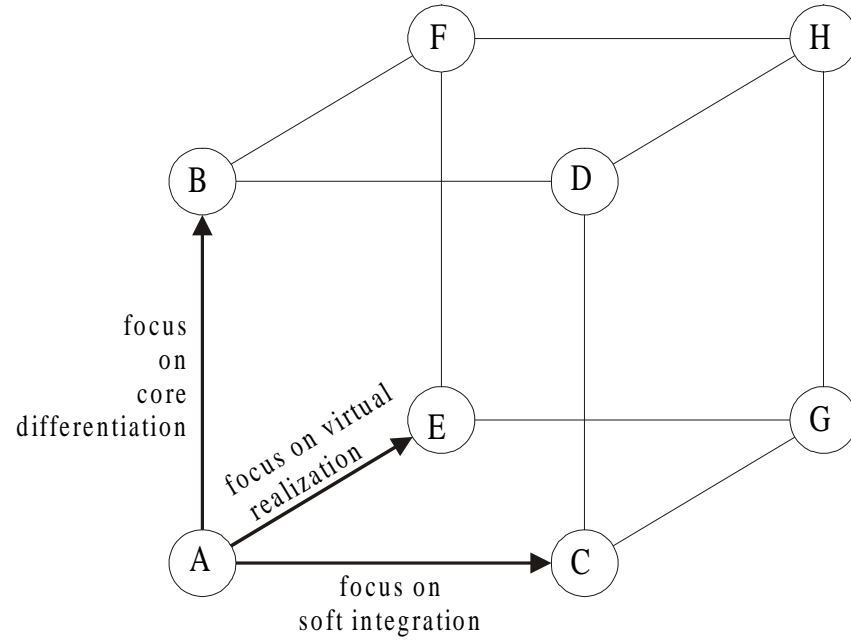


Table 1
Means and Standard Deviations for the 34 Items of the Three Dimensions of the *virt.cube*

Label	Item	Mean	s.d.
cc01	We have a strong readiness for outsourcing. [#]	-0,16	1,18
cc02	In the past we did a lot of outsourcing.	-0,10	1,23
cc03	It is important to concentrate on our own strengths.	1,41	0,65
cc04	We never do anything what we aren't really capable to do.	0,59	0,94
cc05	We have a clear idea of what we are able to do.	0,87	0,83
cc06	Each organizational unit is only active in its field of competence.	0,37	0,83
cc07	When economically feasible, we use external competencies.	0,63	1,01
cc08	"Core competence" is a term often used by the top management.	0,69	1,21
cc09	Our strengths differentiate us from our competitors.	1,09	0,82
cc10	Our strengths can be found in the whole company.	0,60	0,94
cc11	It is hard for our competitors to imitate our strengths.	0,50	0,92
cc12	Our internal units sell their strengths, to a high degree, on the external market.	-0,61	1,24
Scale "Core Differentiation" ($\alpha=.8249$)^{###}		62	15
si01	We keep up to written agreements, even if it brings us economic disadvantages.	1,51	0,63
si02	We keep up to verbal agreements, even if it brings us economic disadvantages.	1,24	0,79
si03	We follow the individual needs of our employees in our organizational activities.	0,68	0,77
si04	We stick to our corporate guidelines, even when it leads to economic disadvantage.	0,43	1,05
si05	We do not change the rules of games in our company, even if it causes us disadvantages.	-0,17	1,14
si06	We have a strong coordination by formal rules. ^{###}	-0,13	0,92
si07	We have a strong coordination by assignments from the top. ^{###}	-0,13	0,92
si08	We have a strong coordination by written documents. ^{###}	0,54	0,94
si09	We have a strong coordination by informal talks.	0,90	0,88
si10	We rely in risky situations on the judgements of our employees to facts & consequences.	0,06	1,06
si11	We believe that trust is good, but control is still better! ^{###}	0,50	0,97
si12	We have an atmosphere of honesty, openness and trust.	0,70	0,83
Scale "Soft Integration" ($\alpha=.7108$)^{###}		63	11
vi01	Strong usage of groupware for process automation. [#]	-0,25	1,49
vi02	Strong usage of workflow systems.	-0,79	1,42
vi03	Strong usage of automatized data exchange (e.g. EDIFACT).	-0,40	1,59
vi04	Strong usage of new media such as Internet, CD-ROM, Info-Terminals ...for shopping systems (e.g. eCommerce).	-0,83	1,36
vi05	...for presentations of the company or its products (e.g. Web-presence).	0,38	1,26
vi06	...for after sales services (e.g. complaint management).	-0,41	1,39
vi07	Our employees have a positive attitude towards modern information technology.	1,01	0,86
vi08	Strong usage of E-mail, Chat, Net-Meeting, Video-conferencing, Virtual Reality for ...internal communication.	-1,19	0,73
vi09	...external communication with customers.	-1,48	0,64
vi10	...communication with external partners.	-1,27	0,90
Scale "Virtual Realization" ($\alpha=.7880$)^{###}		37	18

[#] for the items scale from -2 to +2 .

^{###} for the total scale from 0 to 100 (percent).

^{###} scale reversed

Table 2
Confirmatory Factor Analysis for the Dimensions of the *virt.cube*

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
cc07	0,73384	0,09390	0,02434	0,03975	0,18480
cc05	0,68380	0,05655	0,31955	0,20014	-0,00437
cc04	0,65523	0,03915	0,31327	0,20884	-0,16918
cc06	0,63728	-0,06153	0,12310	0,08708	-0,16733
cc03	0,63373	0,10327	0,17358	-0,03339	0,14518
cc09	0,62918	0,31866	0,31500	0,10854	-0,13715
cc08	0,61412	0,32884	-0,16979	0,04506	0,04074
cc02	0,60070	0,19733	-0,16563	-0,21125	0,27326
cc01	0,55528	0,14428	-0,26453	-0,21120	0,26119
cc10	0,54281	0,19211	0,37316	0,18700	-0,07952
vi07	0,45661	0,28494	-0,00195	0,26896	0,17463
vi06	0,08534	0,76753	0,07121	0,00530	0,09394
vi04	0,09611	0,72638	0,09903	-0,17371	0,03056
vi02	0,19281	0,72360	-0,07377	0,02796	-0,03360
vi01	0,08851	0,62601	-0,10472	-0,05346	0,17192
vi05	0,25553	0,57425	-0,11551	0,05599	0,16036
si10	-0,04823	0,53363	0,15025	0,21715	0,00561
vi03	0,18937	0,47851	0,02945	-0,30217	0,12412
si04	-0,00661	0,13909	0,71621	0,00678	-0,00687
si01	0,19820	-0,17319	0,65935	-0,16678	0,20325
si02	0,12760	-0,27044	0,65853	-0,11149	0,10347
si03	0,34012	-0,10145	0,56820	0,19067	-0,07614
si05	-0,05945	0,10512	0,51795	0,08387	-0,12247
cc11	0,20885	0,25381	0,47299	0,20691	-0,12239
si12	0,37338	0,20975	0,41412	0,31719	-0,04180
cc12	0,29307	0,12316	-0,31219	0,04813	-0,18984
si06	-0,08103	-0,14123	-0,09073	0,81605	0,21007
si08	-0,03153	0,03720	0,06044	0,62253	0,15372
si07	0,22287	-0,10121	-0,04926	0,61796	-0,05439
si09	0,21764	0,08414	0,24770	0,53843	0,04149
si11	0,21528	0,42494	0,06937	0,42986	0,04982
vi09	0,06910	0,13215	0,00796	0,04335	0,79996
vi10	-0,06500	0,06317	0,09912	0,23878	0,78072
vi08	0,17648	0,32075	-0,14343	0,13358	0,64287

Table 3
Means, Standard Deviations, Scale Reliabilities, and Correlations^a

Variable	Mean	s.d.	1	2	3	4	5	6	7
1. Corporate Success ^b (n=99)	0.70	.53	(.8391)						
2. ROI (n=35)	.08	.09	.40*						
3. Strategy of Core Differentiation ^c	62.22	14.73	.49***	.30 [†]	(.8249)				
4. Strategy of Soft Integration ^c	62.66	11.33	.46***	.51**	.33**	(.7108)			
5. Strategy of Virtual Realization ^c	37.14	18.03	.28**	-.00	.42***	.14	(.7880)		
6. Environmental Dynamics ^b	0.70	.62	.28**	.21	.41***	.18 [†]	.45***	(.6088)	
7. Size (number of employees, in thousands)	13.42	35.67	.07	-.06	-.02	.06	.26*	.19 [†]	
8. Perception of being a Virtual Corporation ^d	.13	.34	.21*	-.00	.29**	.25*	.20 [†]	.10	.04

^a Cronbach's alphas appear on the diagonal for multiple-item measures.

[†] p < .10

* p < .05

** p < .01

*** p < .001. All significance tests were two-tailed.

^b scale from 2 to +2.

^c scale from 0 to 100 (percent).

^d scale from 0 (no) to 1 (yes).

TABLE 4
Correlation Coefficients for Different Classes of Size^a

		1. Corporate Success			
		small companies (n=32)	medium sized companies (n=30)	large companies (n=34)	all companies (n=102) ^b
3.	Strategy of Core Differentiation	.45*	.57**	.40*	.49***
4.	Strategy of Soft Integration	.56**	.43*	.28	.46***
5.	Strategy of Virtual Realization	.26	.41*	.06	.28**

^a coded as small n<400, medium 401<n<4000, large n>4000.

^b including 6 companies without exact information regarding size.

* p < .05

** p < .01

*** p < .001. All significance tests were two-tailed.

TABLE 5
Results of the Regression Analysis for Different Classes of Size^a

Predictor Variable	small companies (n=32)		medium sized companies (n=30)		large companies (n=34)		all companies (n=102) ^b	
	Beta	T	Beta	T	Beta	T	Beta	T
Strategy of Core Differentiation	.29	1.80 [†]	.36	1.52	.45	2.48*	.34	3.49***
Strategy of Soft Integration	.47	3.06*	.19	.94	.24	1.50	.33	3.68***
Strategy of Virtual Realization	.08	0.48	.17	.87	-.16	-.92	.09	.97
<i>R</i> ²	.42		.36		.24		.34	
Adjusted <i>R</i> ²	.35		.28		.16		.32	
<i>F</i>	6.46**		4.6*		3.05*		16.32***	

^a coded as small n<400, medium 401<n<4000, large n>4000.

^b including 6 companies without exact information regarding size.

[†] p < .10
* p < .05
** p < .01
*** p < .001