



Virtual teamwork in the context of technological and cultural transformation

Birgit Großer

FernUniversität Hagen
Universitätsstraße 41, Hagen 58097
Germany
www.shortbio.org/birgit.grosser@fernuni-hagen.de

Ulrike Baumöl

FernUniversität Hagen
Universitätsstraße 41, Hagen 58097
Germany
www.shortbio.org/ulrike.baumoel@fernuni-hagen.de

Abstract:

Megatrends affect all individuals and organizations in our society. Mobility and flexibility are examples of megatrends that influence our everyday lives and also intensely alter the ways we work. The deployment of virtual teams meets the new chances emerging with these trends. Employees aspire to work virtually due to benefits, such as flexibility regarding the locations and hours for working. Organizations deploy virtual teams to remain competitive regarding new technological opportunities, employee retention and cost efficiency in an increasingly digital environment. Organizations can guide their change towards virtuality by building on the knowledge of practice as well as scientific insights regarding the deployment of virtual teams. In order to provide a holistic view on the structures and processes affected by such a change and thus provide guidance, a framework for analyzing and planning organizational change is adapted to virtual teamwork and presented in this paper. The framework shows that the deployment of virtual teams affects the whole organization. This comprehensive view on the implementation of virtual teamwork allows an integration of virtual teams and focusses on their performance. The adapted framework furthermore provides links for further in-depth research in this field.

Keywords:

Virtual teams; teamwork; change management; integrated framework; megatrends.

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1. Introduction

Mobility and connectivity are only a few examples of megatrends in the context of digitalization that extensively alter society with its individuals and its organizations¹. Almost all organizations, from start-ups to so-called incumbents such as large industrial enterprises, are affected by these trends that constantly require changes. As a consequence, they need to address these changes by adapting their structures and processes in order to remain competitive and strengthen their value creation. Daimler e.g. evolved from an automobile manufacturer to a “mobility service provider”² and actors in the medical sector embrace big data drawn from connectivity for unprecedented possibilities of disease analysis and prediction³.

These megatrends introduce change into people’s everyday lives and open up ample opportunities but also challenges regarding e.g. mobility, technology use, and flexibility. Mobility directly increases through technological innovations, e.g. high speed rails. But technological solutions paired with cultural adaptations also have an indirect effect on mobility. Communication tools support social bonding and relationships across large distances (e.g. Skype, Instagram) and remote working is enabled through secure communication channels (e.g. VPN clients). These examples also present changes in technology use which rapidly transformed over the last decades. This change process has not yet stopped, but still seems to accelerate. Virtual worlds emerge that are inhabited by millions of players (e.g. World of Warcraft, Final Fantasy online), television is more and more replaced by streaming on demand for home and mobile devices (e.g. Netflix), daily errands are settled online (e.g. banking, purchasing tickets and consumer goods) and people embrace these products and services by tending to be “always-on”.

Considering this current technological evolution and progression, respective changes can be assumed to intensify in the next years and decades. Future generations of employees currently growing up with increasing virtuality in their everyday life may show an easier adoption of virtual work environments [1]. Even though the current employees are socialized with face-to-face communication, as well as the “normality” to see, touch and feel results and products of their work, the changes in products and production, organizational structures and processes already affect this current workforce and will for sure affect future employees. People, as employees of these organizations and also in their everyday lives, adapt to and at the same time influence these changes. As a symptom and also driver of virtualization, the occupational profile of “digital nomads” evolved over the last years [2], being paradigmatic regarding the requirements and wishes of the current and upcoming workforce: the longing for flexibility and freedom, the affiliation to a fluent and dispersed group replacing the former continuity of traditional workplaces.

The deployment of virtual teams (VTs) is recognized by organizations and research to meet many of these facets of societal and technological evolutions. Virtuality as a driver for change in organizations impacts work-environments. But virtuality can also be a result of change. Technological innovations, inducing new ways of communication and mobility as well as triggering cultural trends, result in extensive opportunities to virtualize, e.g., work related processes. Therefore, virtuality in work environments as well as in other areas of people’s lives and existing and emerging information and communication technology (ICT) can be regarded as interdependent. Several factors influence the relevance of virtual teamwork for practice as well as for research. Organizations now have the opportunity to introduce technological solutions into the work environments that match the technology use of the potential employees’ everyday lives. This helps to meet the requirements of the employees concerning the work environment as described above. Due to the high demand for qualified employees also new ways of acquiring and retaining employees emerge. One way for organizations to remain competitive on the labor market is offering a work environment that provides flexibility of time and workplace. The adaptation of virtual teamwork is supported by technological and societal changes and appears to be

¹ <https://www.zukunftsinstitut.de/dossier/megatrends/>

² <https://www.daimler.com/innovation/digitalisierung/digitallife/>

³ https://www.medica.de/cgi-bin/md_medica/lib/pub/tt.cgi/Daten_sammeln_Daten_nutzen_%E2%80%93_Vom_Segen_der_Datenberge.html?oid=84248&lang=1&ticket=g_u_e_s_t

relevant for employee retention [3]. Moreover, well-known cost-related factors, such as saving on travel costs and real estate for office space, can be addressed.

Current research on virtual teamwork focuses on a variety of perspectives. As a consequence, available results provide answers to many very specific topics, such as leadership of VTs [4] and employee motivation for VTs [5], as also shown by literature studies [6]. But an integrated view on VTs, derived from comprehensive analyses of organizations and scientific insights on structures and processes of organizations deploying VTs, are still open for research. Results derived from such comprehensive analyses are fundamental for providing guidance for organizations and for understanding drivers and interrelations in the field of virtual teamwork.

The goal of this paper is thus to present a holistic organizational framework of structures and processes regarding the deployment of VTs as result for change. This framework can serve for analyzing organizations, guide organizational change when introducing or enhancing virtual teamwork and the teams' performance as well as for planning new organizations or organizational units that are supposed to include virtual teamwork.

As first steps, we analyzed existing organizations that are mainly based on virtual teamwork in a case study analysis [3] in order to provide insights on structures and processes. We additionally performed a literature review on current knowledge on VTs in scientific literature [7]. Both works serve as foundation for this paper and their results are thus referred to in the respective sections.

Table 1 shows the components of this paper and the procedure of the associated knowledge creation.

Table 1. Components and procedure

Component of framework adaption process	Implementation and section
1. Research question	How do the processes and structures manifest for organizations deploying virtual teamwork? Section 2, section 3.
2. Conceptualization	The scope includes organizations with various degrees of virtuality in teamwork. A concept for virtual teams, a suitable framework and the state of the art are derived in section 2.
3. Synthesis of insights	The framework is adapted to virtual teamwork along the results of the case study analysis and literature review in section 3.
4. Conclusion and agenda	The main results, limitations and links for further research are given in section 4.

2. Conceptualization

Numerous definitions of VTs exist, serving the diverse research focuses of current studies in the field. In order to define a concept for VTs for this paper and as a proposition for future research, definitions of VTs are synthesized in section 2.1, resulting in a precise yet conveniently simple concept for VTs [8]. A framework that is applied for analyzing the integration of VTs is described in section 2.2, providing a fundamental understanding of organizational structures and processes that are to be taken into account when implementing virtual teamwork. The procedure and results derived throughout a comprehensive literature study [7] are shown in section 2.3, providing scientific insights for the subsequent adaption for the framework (section 3).

2.1 Virtual teams

Teams differ from groups, as team members share a mutual goal and act towards achieving it [9]. Teams can furthermore be distinguished from virtual communities that do strive towards a mutual goal but are usually not bound to a specific organization, such as a company. Teams can be distinguished between virtual and traditional teams. Teams

that work completely virtually only interact via ICT and their members are geographically dispersed, often even worldwide, and they furthermore communicate and perform their tasks asynchronously. The sole occurrence of both criteria, asynchronicity and geographic dispersion, is sufficient to define a team as virtual [8]. The two contrasting types of teams present opposing endpoints of a continuum [8] as shown in Fig. 1. Most teams in organizations and especially those teams performing knowledge related tasks can nowadays be defined as VTs to a certain extent, being located somewhere along this continuum.

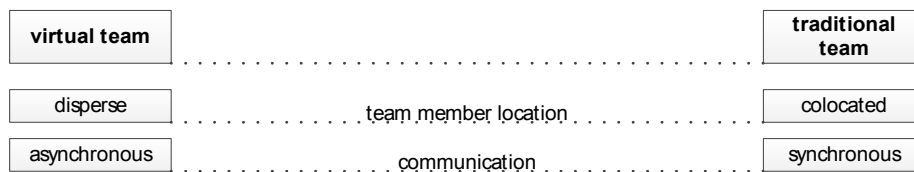


Fig. 1. Degree of virtuality [3]

VTs always rely on ICT to a certain extend. The application of ICT ranges from communication via email and local data storage in rather traditional teams to innovative virtual solutions such as three dimensional virtual environments (3DVEs) and the deployment of avatars.

Other dimensions besides asynchronicity and geographic dispersion that are found to correlate with team virtuality are proposed by literature [6] and shown in Fig. 2 below.

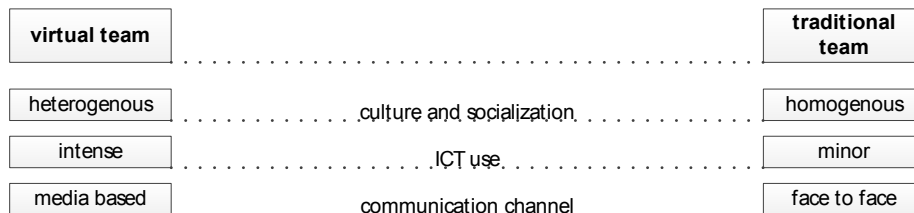


Fig. 2. Dimensions of virtual and traditional teams [3]

We therefore define a VT for this study as a group of geographically dispersed people working together in an organizational work environment using ICT.

2.2 Framework

A framework is used in order to provide an integrated overview of structures and processes for organizations deploying VTs. The application of the framework following described allows providing a holistic view on the relevant structural components and processes of organizations and has been validated by case studies [3], [10]. As this framework can also be used for planning organizational change of an existing organization [11] or even during the planning phase of a yet to be realized enterprise, it was selected over other frameworks, such as the business model canvas. Even though other frameworks allow building a comprehensive image of the analyzed organization, the selected framework provides a focus on change and addresses the strong interrelatedness of the organization’s components [12]. The framework applied for this study provides this holistic view on an organization with respect to the governance and context it is

embedded in [12], [13], [14] from an information systems perspective. The framework consists of various connected layers. As the functional layers are regarded to be co-dependent, the strategy influences the realized processes, the processes influence which technology is used and vice versa. The layers regarding culture, leadership, etc. are also intertwined and provide the environment for the embedded functional layers. Fig. 3 shows the framework with functional layers on the left side and emotional-culturally-oriented layers on the right side, embedded in governance and the context for the organization. The term “governance” used here covers two perspectives: first of all the performance management of the organization and secondly legal and ethical regulations and guidelines [12]. The context includes all factors that are relevant for the design of the embedded layers, e.g. trends and norms, which are not aspects of the following drivers [12]. The arrow entering from the top illustrates the drivers triggering change regarding internal and external factors as well as innovations of ICT.

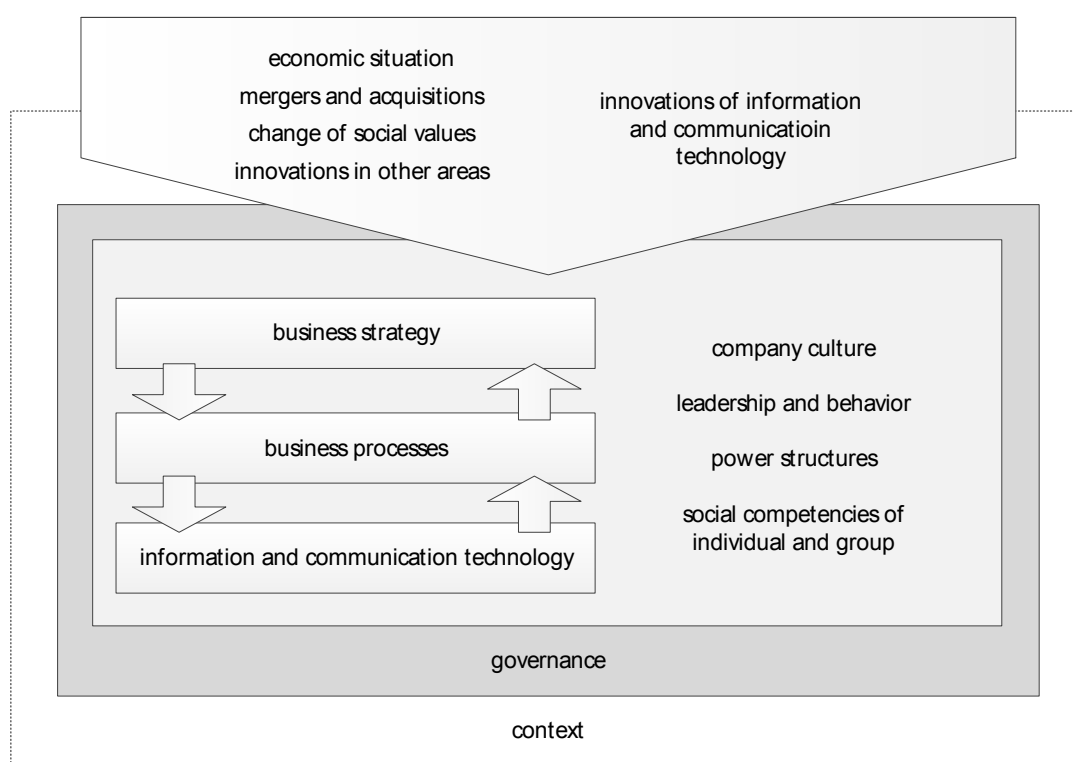


Fig. 3. Framework for analyzing organizational structures and processes [12]

The framework will be adapted for organizations deploying virtual teamwork (section 3) along the properties of VTs (section 2.1) and the results of the literature review regarding factors influencing the performance of VTs (section 2.3).

2.4 State of the art

In order to define the state of the art regarding the factors influencing the performance of VTs, we performed a structured literature review [7]. The results of the literature review show if the insights offered by research are in line or contradictive and present a contribution by synthesizing the insights and providing an overview. The goal is thus to understand what factors influence the performance of VTs and what impact a team's degree of virtuality and the ICT used have on this performance. Even though an interdisciplinary approach from the perspectives of sociology, psychology, informatics and information systems research allows a comprehensive analysis of virtual teamwork, this literature review from an information systems research perspective provides intriguing insights as a first step.

The literature review is positioned as shown in Table 2. In order to provide an overview on existing research, the focus of the study is on research outcomes and the case studies taken into account provide insights on practices and applications of virtual teamwork. The goal of the literature review is the extraction of performance factors as explained above. This goal is addressed by the integration of results and identification of central issues. A neutral representation is aspired by carrying out a structured and transparent study. The coverage can be regarded as exhaustive with representative citation, as a broad search using several databases is performed. The analysis of the results is performed along conceptual categories that are derived from defining the topic, as shown below. Specialized and general scholars and practioners are addressed as audience, as this literature review can serve as link for further research and provides ideas for practical deployment of VTs.

Table 2. Positioning of literature review following the taxonomy by Cooper [15]

<i>Characteristics</i>	<i>Categories</i>				
<i>focus</i>	research outcomes	research methods	theories	practices or applications	
<i>goal</i>	integration		criticism	identification of central issues	
<i>perspective</i>	neutral representation			espousal of position	
<i>coverage</i>	exhaustive	exhaustive with representative citation	central citation	representative	central or pivotal
<i>organization</i>	historical		conceptual	methodological	
<i>audience</i>	specialized scholars	general scholars	practioners	policy makers	general public

The following databases and conference proceedings were searched regarding peer-reviewed articles: EBSCO, Business Source Complete, eBook Collection, AISEL and IEEE. The HICSS proceedings were additionally studied regarding the minitrack specialized on virtual teamwork. Only papers with full text availability were taken into account and news articles, blog articles and other not peer-reviewed results were excluded from the search. Regarding the time span, a peak in quantity was found around 2011 and 2012, followed by fewer articles in 2013. A first analysis revealed that the studies from 2014 to 2016 mainly built upon the findings of this era including and updating its insights. Therefore, only papers from 2014 until 2016 were selected as final sample [7]. Further research could include research from other fields, as for this study from an information systems research perspective, articles from the fields of psychology, sociology, etc., were not taken into account, excluding databases such as PsychINFO and SocINDEX.

The search terms were derived from the goal of the literature review and are shown in Fig. 4. Education was excluded from this study as study groups and other teams in the educational context are assumed to strongly differ regarding their goals and obligation compared to teams in an organizational context.

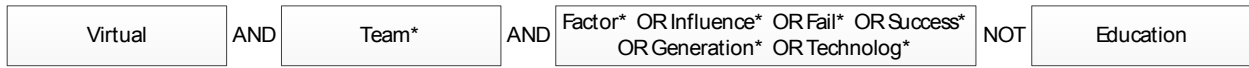


Fig. 4. Search terms and their combinations [7]

The following Table 3 summarizes the process of the paper count. The final set of findings consisted of 30 research papers.

Table 3. Paper count

Literature search	Number of findings
Initial database search	265
After title and abstract check	65
AISel, IEEE and HICSS proceedings	23
Preliminary count	88
Backward search and recommendations	14
Preliminary count	102
Final count for 2014-2016	30

From the definition of VTs (see section 2.1) we derived six categories for structuring and analyzing the papers. These categories present lines of research and each paper was assigned to one category, regarding its main focus. The first category subsuming comprehensive case studies was added after a first review [16]. The categories and numbers of assigned papers are [7]:

1. Examples of implemented VTs presented as *case studies*: 3
2. *Communication* patterns or information processing: 5
3. *Distance* in time, space or culture: 3
4. *Goal* comprehension and shared mental model: 3
5. *Group* properties and individual traits: 5
6. *Management* and roles: 5
7. Use and properties of information and communication *technology*: 6

Fig. 5 shows the main results of the literature review. Factors that influence the performance of VTs were extracted for each of the seven categories. These are described below and in further detail, providing all source information, in [7].

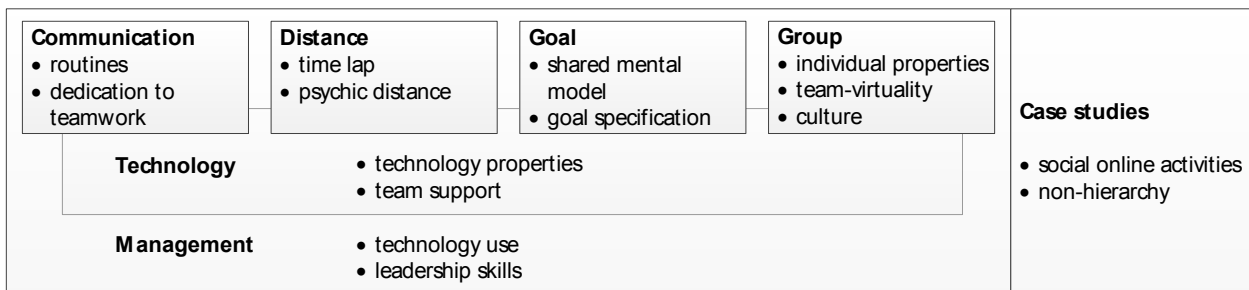


Fig. 5. System of factors influencing the performance of virtual teamwork [7]

The factors that were extracted from the *case studies* address social bonding in VTs as this is regarded to impact the performance and work results of teams. Isolation of team members or groups by means of a traditional hierarchical system should be avoided also for not discriminating employees from certain regions [10]. Non-work-related activities should be introduced. These activities should not require the employees to travel but be realizable online. Examples from organizations are yoga-classes [17] and games [18].

VTs rely on *communication* via ICT even more than rather traditional teams that also use ICT for some knowledge transfer. Some technical solutions exist that support informal and dynamic conversations in VTs [19] but for most VTs routines and standards are regarded as crucial for supporting a successful communication and thus performance. Even though there are no guidelines offered by research yet for these routines and standards that fit all VTs, several aspects can be applied for supporting communication. These aspects concern the when, how and what kind of ICT to use [20], [21], [22]. The second factor that seems to be vital for team communication is a fundamental dedication to teamwork by the team members. This also applies for traditional teams, but communication related behavior appears to need more support in VTs than in traditional teams. Behavioral aspects that are concerned are e.g. dynamics in group discussions and the appreciation of different positions by team members [9], [23], [24].

Research addressing the effects of *distance* in VTs presents the two factors, time lap and psychic distance as main factors influencing the performance of VTs. Time laps are typical for asynchronous work, usually as a result of employees working together geographically dispersed across time zones. This leads to challenges regarding teamwork and communication [25] but also provides chances, as interdependent tasks can be executed consecutively, even exploiting a whole 24-hours work-cycle. Psychic distance as second factor addresses cultural barriers that occur increasingly when team members are socialized differently, by e.g. generation, region and language. The psychic distance can be tackled by social interactions as described above. Also psychic distance can be regarded as chance to increase performance when it is handled with care and approached by creating an open and trustful atmosphere [9], [22], [26].

The factors in the category *goal* are a result of the two aforementioned categories, communication and distance [7]. Extensive and structured communication is needed in VTs to achieve a mutual and precise understanding of the collective goals. Therefore the team members should be guided to obtain a shared mental model regarding the goals as such [9], [27], [28] as well as the processes and structures to achieve these goals [29].

Individual properties, team-virtuality and culture were extracted as factors regarding characteristics of the *group*. The affiliation to a certain generation with its technological and work socialization is a relevant individual property influencing the performance within a team. Having the skills to work in a team again appears to be more important when the team operates virtually [30], [31], [32]. The analysis of generational impacts on the performance of VTs opens links for future research on VTs [1], [6]. Cultural factors have positive and negative influences on the performance [32]. Challenges that occur regarding disparities in culture in VTs are also found to be a chance for increasing performance [22], [33]. The degree of virtuality of teams impacts structures and processes of the teamwork and how it is embedded in the organization. Decision making processes e.g. require to be adapted for VTs [32], [34].

The *management* also needs adaption regarding planning and leading VTs especially concerning the technology use of the management and the management skills as such. Besides focusing on a good technology-task-fit for the employees, the management is also required to adapt to virtual teamwork and the use of virtual management tools [28], [34], [35]. An innovative adaption could even be, to replace managing employees by surrogates [36]. Besides technological skills, it is also essential that management and leadership are trained for working with VTs, regarding cultural and social intelligence [18], [25], [33], control, motivation etc. [28], [34], [35], [37].

Regarding the last category, *technology*, two main factors influencing performance are proposed by research, technology properties and team support. Both factors are strongly intertwined with factors from the aforementioned categories due to the continuous and fundamental support of VTs by ICT. Norms for the technology should be established on the one hand [38], while still being open for individual preferences on the other hand [25]. The design of the deployed ICT is also vital for the performance, therefore feature richness should be provided and for highly virtual

teamwork [39], 3DVEs are found to be promising [40], [41]. Regarding a proper team support, ICT should serve the reduction of conflicts, the integration of team members [38], [39], [42] and the realization of all processes needed, e.g. documentation, innovation, and communication [23], [25], [41].

These insights by research are synthesized with properties from examples of organizations that implemented and strongly rely on virtual teamwork [3], resulting in an adapted framework as follows.

3. Organizational framework for integrating virtual teams

The framework for analyzing and guiding successful change [12] is adapted regarding the integration of virtual teamwork and described in the following. Propositions are derived for pivotal results.

The drivers, illustrated in the arrow shape in Fig. 6, present a holistic view on the various changes that are met by deploying virtual teamwork in an organization. Internal changes that are addressed by deploying VTs are e.g. the lowering of travel and real estate costs. Direct labor costs can be either lowered by including a workforce from regions with lower salaries or can rise, if the employees required are rare and highly skilled. Changes affecting the organization's constitution are e.g. the innovative restructuring of departments for the deployment of VTs and the new foundation of respective start-ups. The drivers concerning changes of social values also address changes in the workforce, not regarding potential customers as in the original framework [12]. The changes leading to virtual teamwork affect several aspects of internal organizational culture as well as societal culture and generational effects that also have impact on expectations towards employment, as shown above (section 2.3). Innovations in external areas that serve as driver to deploy VTs are e.g. the increasing mobility of people, the custom to be "always-on" and the worldwide interconnectedness. Innovative technologies that induce change in organizations are e.g. new opportunities of teamwork via 3DVEs, options for external storage in clouds with remote access, virtual work via VPN (virtual private network) clients and the opportunity to introduce feature rich platforms for teamwork as well as for private interaction.

Proposition 1: The deployment of VTs likewise meets the changes induced by drivers located in- and outside of an organization.

The context for organizations introducing virtual teamwork contains current and changing trends, such as certain hard- and software standards. Organizational governance in such a change project has to regard the context and to adapt to virtual teamwork due to its potential internationality and the work online. The regulations regarding internationality can be adapted from traditional organizations that operate transnationally, e.g. for adaptations along employment law. Requirements that arise with online work include challenges regarding security of communication, data transfer and data storage as well as safety of network stability. These need to be governed and the governance of those changes needs to be integrated in the corporate governance [12]. Adapting ethical regulations in order to allow and support the deployment of VTs follows the same logic. Metrics should be established that allow measuring the value creation and contribution of the deployed VTs. Therefore, the governance faces the vital duty to enable the organization to deploy VTs in the first place and to subsequently provide a setting that allows VTs to work successfully and without hindering constraints.

Proposition 2: The governance is required to allow, support and secure virtual teamwork.

The core of the framework, the functional and the emotional-culturally-oriented layers are embedded in the context and the governance and are equally affected by change when integrating virtual teamwork. The co-dependent functional layers (core, left side) include the business strategy, the business processes and the utilized ICT. The deployment of VTs can affect the business strategy, as VTs provide chances, e.g. regarding international expertise, 24 hour reachability and selected highly skilled employees. Organizations mainly consisting of VTs were found to rather follow a one

product strategy, providing an example of the described changes in strategy [3]. This leads to changes in business processes. E.g. communication and documentation processes are adapted due to asynchronicity and accessibility, and standards and routines are defined for the procedure of these processes in order to support team members to work autonomously. These adaptations for business processes and the findings regarding communication and reporting in VTs lead to the following proposition:

Proposition 3: Business processes regarding communication and task procedure require precisely specified rules and standards in order to enable VTs to work independently.

The adapted business processes might require new ICT for their realization, and new solutions in ICT in turn allow changes in business processes. E.g. secure data storage in the cloud provides members of VTs equal access without restrictions regarding time zone and location. ICT presents the fundament for VTs to be able to work together and cooperate. The choice of ICT should serve the employees' requirements, or otherwise they would draw on individual solutions. The choice of ICT is based on an analysis of the process requirements from an organizational perspective and on an analysis of the employees' requirements, also taking into account their private technology preferences and cultural aspects. The choice should repeatedly be monitored and reflected, as innovations in ICT again introduce change as described above. The use of the selected ICT should then follow agreed upon standards (see Proposition 3). These challenges lead to the following support centered proposition:

Proposition 4: Deployed ICT should be selected regarding the goal to support virtual teamwork in all work-related and social processes.

The change towards virtual teamwork influences the manifestations of the emotional-culturally-oriented layers (core, right side) which also serve as foundation for the functional layers. The organizational culture focuses on employee retention instead of customer acquisition and retention [3]. This is also supported by the changes in leadership and behavior in terms of small teams and a supportive workplace. The importance of trust in VTs is realized by simple hierarchies and the avoidance of micromanagement of the employees. This issue of trust is not only relevant for the management perspective but also for trust among the employees. This can be enhanced by hiring employees and a management based on their social competencies and by deliberately training these skills. These aspects are again intertwined with the technology use by employees and management and group related characteristics (see section 2.3) leading to following proposition:

Proposition 5: Individual teamwork skills by employees, leaders and management and workplace design should serve the mutual goal of employee retention.

The key elements of the framework described above, adapted to change regarding virtual teamwork are shown in Fig. 6.

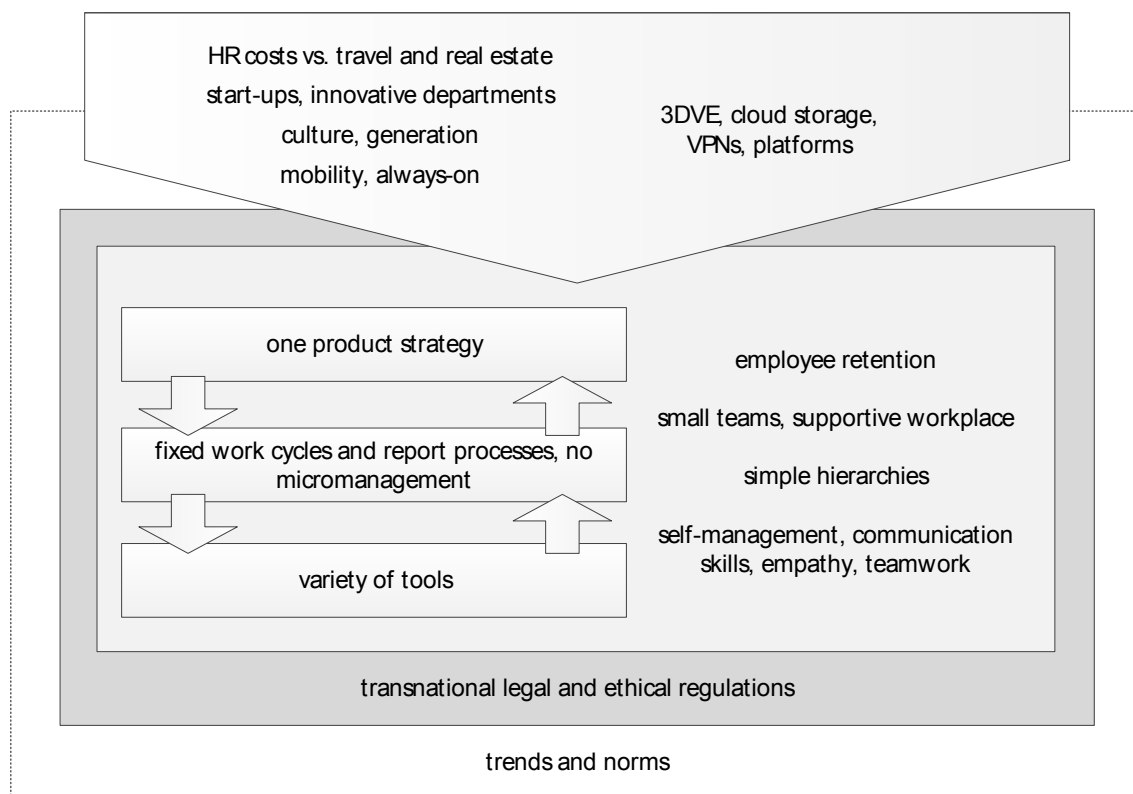


Fig. 6. Framework for deployment of VTs

4. Conclusion

Organizations profit from the deployment of VTs in many ways as shown throughout this study. But in order to successfully integrate virtual teamwork into the organization, structures and processes need to be adapted to this deployment. We therefore answered the research question regarding “how do the processes and structures manifest for organizations deploying virtual teamwork” along the proposed framework. These adaptations of structures and processes to this change at first seem vast and hard to capture. But the detailed inquiry into these various aspects by using the integrated framework as shown above, proved to provide clear and processable insights. These insights allow answering the research question and therefore enlighten the manifestations of the framework’s components for the deployment of virtual teamwork.

Some limitations of the approach could be discussed. First of all, the used framework has been selected due to its apparent fit to the object of analysis. This could be verified by testing other frameworks in the set context. Moreover, the analysis was based on an information systems perspective and could be enhanced by including other scientific perspectives, such as psychological and information technological expertise.

However, when analyzing the presented framework for VTs in further research, an in-depth analysis could furthermore provide insights on the timeline and sequence of adaption steps that organizations have to run through when introducing virtual teamwork. Further research might very well allow precise conclusions on the interrelatedness of the layers and further insights on the potential manifestations of the layers. These analyses could also include further variations

regarding the characteristics of the organizations, such as the degree of virtuality, the industrial sector, and the age of the organization.

These future research works can advance the insights of the paper at hand which provides structured results to build upon. The propositions present essential current knowledge on virtual teamwork that requires a steady updating in an ever-changing environment.

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Biographical notes**Birgit Großer**

Birgit Großer works as Ph.D. student and research assistant at the chair for information management (Prof. Dr. Ulrike Baumöl) at the University of Hagen, Germany. Various perspectives on virtual teamwork are of relevance for her research, and she has published and presented respective insights on international conferences. The focus of her research is currently on the organizational integration of virtual teams as an impact of digitalization.

www.shortbio.org/birgit.grosser@fernuni-hagen.de

**Ulrike Baumöl**

Ulrike Baumöl (Ph.D.) is a professor for information management at the University of Hagen, Germany and an associate lecturer at the University of St. Gallen, Switzerland. Her research interests lie in the areas of technology-driven business innovation, digitalization, and business transformation. Ulrike leads several applied research projects in this area. She has published widely at international conferences and peer reviewed journals. Ulrike works closely with many leading organizations and SMEs helping them to understand the impact of technology-driven innovation and design the organization to cope with the consequences.

www.shortbio.org/ulrike.baumoel@fernuni-hagen.de