

Facilitate Successful Cross-Organisational Business Processes – A Business Case

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Abstract: The objective of our research project is to learn from an identified real life business case in the form of a running inter-organisational collaboration. The aim of the research task is to facilitate cross-organisational business processes (CBPs) under consideration of aspects of ergonomics in order to provide adequate work procedures for employees in SMEs. The chosen approach addresses technical and human aspects, respectively. The latter are to cause severe tensions between entrepreneurs and employees working in inter-organisational settings e.g by intransparency of the whole value chain process and lack of shared vision and knowledge. Therefore, the goal is to design a holistic and interdisciplinary framework for research and to identify some leverage points for collaborative work. Starting point is the analysis of the business scenario at hand. The paper intends to present the chosen approach and wants to discuss hitherto existing lessons learned.

1. Introduction

The increasing concentration of an astonishing high number of enterprises regarding their core competencies causes a constant growth of virtualization and distribution of value chains between companies. This happens by externalisation through outsourcing of specific parts of the value chain which do no longer match with the companies' core competencies or core business. Today, enterprises face a no doubt enormous pressure in the inter-networked economy with increasing internationalization and globalization of markets with more and more difficulty to build up stable and long-term relationships to their customers. For this reason smart or *virtual organisation* (VO) are one example for nowadays business networking [6] which ranks amongst the most important capabilities businesses will need in future to enhance their competitiveness [10], [14], [17]. Numerous research projects have addressed, and will do, these developments by developing a variety and diversity of organisational and technical concepts, methods and tools based on their background and made assumptions. Actually, all activities are aiming at supporting specific requirements of business collaborations and making cross-organisational value chains more effective and efficient. It can be observed, that in most cases the attempts are clearly dominated by requirements related to information and communication technology (ICT) which is perceived as facilitator or key driver for business collaborations. Whereas, today research still has rather a narrow insight of success factors of VO in relation to a human or employee's perspective and how this part goes in alignment with the technical components. This paper presents results from a research project undertaken by an interdisciplinary team of researchers from applied informatics and ergonomics to make a contribution in order to narrow this research gap.

2. Definition

Over the past years the steady rise of market globalisation, the increased pressure of competition and the shortened product life cycles caused conditions, which evolved new organizational forms. These forms differ from traditional organisational structures (coordination mechanisms related to hierarchy). The organisational structures are characterised as “hybrid” or “networked”. They are positioned in a continuum spanned by hierarchy and market related co-ordination mechanisms. The boundaries of enterprises are vanishing and are hardly to be differentiated from its environment. The results are open, flexible and “fluid” complex dynamic networked systems [14],[18]. The evolution and organisation of these systems are defined as virtual organisational structures. We introduce the following working definition:

Working Definition of Virtual Organisational Structures (VO):

Organisational structures become virtual, if legally independent enterprises, institutions and/or individuals, co-operate with other(s) in order to pursue common business interests. The organisation appears to third parties as an independent enterprise. The underlying co-operation relies on an either stable (static) or dynamic network. The organisational structure constitutes on an intensive use of ICT in order to support intra- or inter-company co-ordination and co-operation with the goal to compensate the lacking of central management functions. The business endeavour aims at strengthening its competitive position by combining the network partners' (core) competencies to cross-organisational value creation chains, as well as at sharing knowledge and reducing risk and costs for the individual partners.

A network analysis approach was developed comprising seven dimensions and related criteria. The aim has been to develop a theory driven method for measuring the virtuality degree of organisational structures. The analysis results in a relative position of the research subject in a continuum spanned by three ideal types of increasing virtuality degree. An overview of alternative criteria can be found in literature inter alia in [17], [10], [14], [19].

3. Business Case

The business case at hand describes a real-life business collaboration amongst a number of European SMEs, constituting an international supply chain in the high technology sector. The involved business partners are dedicated to promote *intelligent decentral systems* through application of LONWORKS technology. The business case is perceived to be unique and not representative for small businesses in the dynamic high technology sector. It is likely to be observed that examples of VO in most cases are created rather syntetically. The aim of our research exercise is therefore to analyse the identified case according to our interdisciplinary research framework to make its elements and drivers explicit. First the characteristics of our business case are described. The value chain is spread across different companies. Though, individual back-end applications are in place, no b2b integration technology is available. Hence the most common way to exchange business data is by manually extracting and sending the data through means like fax or e-mail and re-entering them manually. Data and material flows are centrally co-ordinated by the focal partner, the assigned “hub firm”. The business partners can be distinguished from a horizontal and vertical perspective of the supply chain into *solution partners* and mere *suppliers*. Solution partners are development partners with specific competence in the field of LonWorks® technology. These business partners form the nucleus of the VO under the brand ‘*Infranet Partners*’. The VO aims to grow the market for LonWorks® technology in Europe by exploiting new project opportunities, especially in market sectors where this technology is not widely used today. The aim is to offer comprehensive services to its customers by:

- Creating a comprehensive pool of technology and application *resources*.
- Serving customers as a single organisation offering locally adapted *solutions* from this shared pool.
- Combining their product range under a *single brand*.
- Providing a comprehensive *product range and support* backed by frequent cross training. Providing a comprehensive *training program* across Europe.
- Sharing out *technical support and knowledge* of different markets to provide solutions.
- Sharing marketing information by using an advanced *dynamic groupware marketing tool* to enable acting faster to meet customer requirements.

The *solution partners* have externalised most of their office and production processes to service providers and suppliers. The *supply chains* are set up and configured dynamically on demand. The supplier network is individually coordinated by the hub firm, which is one of the solution partners. The primarily local *suppliers networks* of the individual solution partners are not totally transparent to the other business partners. And the co-ordination of the value creation is foremost based on ad-hoc communication. In the following focus is taken on one of the local supply chains in Germany. The supply chain is lacking an adequate *Business Process Management* (BPM) for the private and the cross-organisational business processes (CBPs), respectively. Albeit, the business partners run solely internally back-end application systems, standard (e.g. SAP) or proprietary, in order to store and manage their business data. Up to now, no integration concept was neither envisaged nor planned to be implemented by the business partners. *Business relations* are established by the solution partners and are activated on demand in case of an incoming inquiry or new purchase order. They are constituted by personal contact and are backed up by regular bilateral meetings to facilitate trust and commitment between the business partners.

However, the respective solution partner in the supply chain use bilateral agreements to regulate their business relationships. Today, bidding and responding to customer inquiries is a resource intensive and time consuming task. The gathering and assembling of respective data is difficult and often solely estimated. The configuration of the value chain and the coordination of the various inputs and outputs are consequently offer a huge potential for improvement. Our investigations primarily addressed the production and assembly of the product “Free Topology Area Controller (FTAC)” and analysed the related interactions of the engaged business partners along the supply chain.

4. Methodology

One may observe, that most research approaches address solely one or two of the shown layers in Figure 1 but in most cases do not follow a needed holistic approach. The first layer is the *organisational layer*. On this level the business context is described, analysed and modelled, respectively. Subject of investigation are the general operational business situation comprising strategic aspects, business rules and contracts, individual predominant collaboration behaviour and related goals, objectives, expectations, and problems; as well as trust and network culture. The business process layer interacts with the organisational layer. On this level the whole aspects of BPM are to be covered from design to execution level. Whereas the underlying infrastructure layer is supporting the other layers.

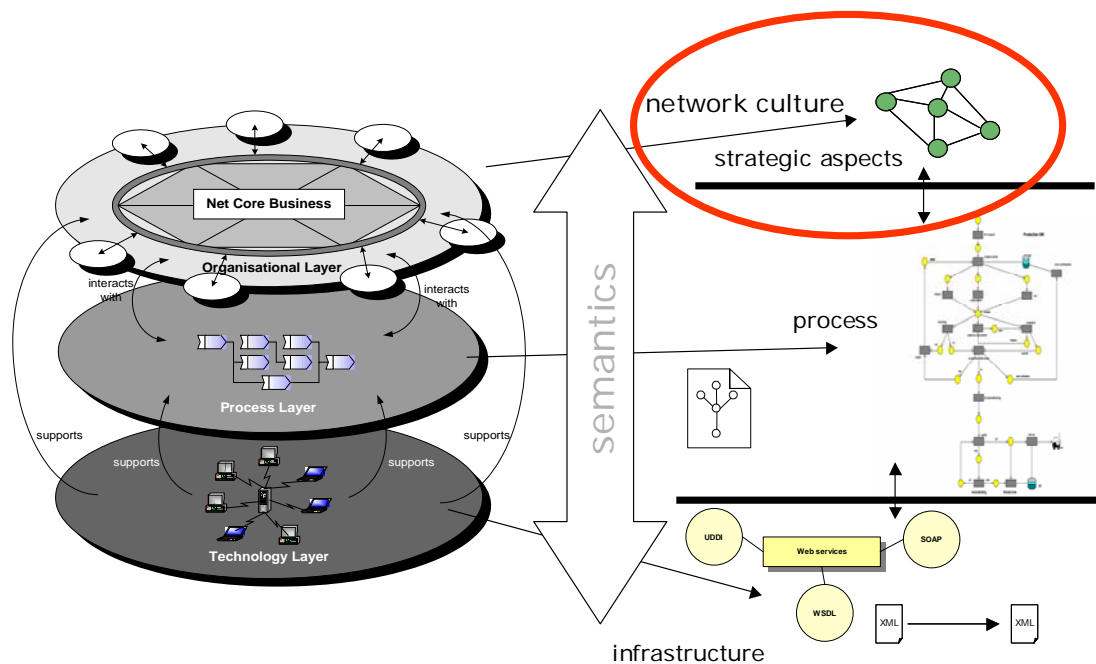


Figure 1 – Layered Approach for Implementing VO Infrastructures [19].

Enterprises themselves are heterogeneous, autonomous and distributed systems. Within business collaborations one may have to cope with different cultures, related behaviours and mentalities. The often isolated systems use different conceptual models for expressing the respective business semantics. Thus, *semantics* are discussed to overcome the existing barrier and to map the different representation and meaning of systems [3], [12]. In the following research findings and lessons learned of run investigations are presented.

4.1 Organisational Layer

According to [9] two dimensions are to be considered concerning the analysis of production of products and services in organizations: (1) the technical infrastructure and the technically organizational processes and (2) human infrastructure like culture, mental models, strategies and visions which are transformed into human processes such as communication, co-ordination and co-operation. The organizational development (OD) puts the emphasis on the analysis of the human infrastructure and processes (see Figure 2).

A reference framework for the organizational development in virtual enterprises was developed. It consists of five dimensions as vision/strategy, culture, knowledge/coworker, environment and structure/processes [2],[15].

- Dimension vision and strategy aims at questions which permits to investigate the range and spreading degree of a vision and/or a strategy in an organization.
- Dimension structures and processes light up operational work sequences and structures and point out, how the members of an organization deal with them in their daily work, and find out which standards are necessary/ desirable for the success of the organization and the (co-)worker.
- Dimension culture describes the rules of handling with one another and the consequences for the achievement and satisfaction of the (co-)workers.
- Dimension knowledge and (co-)worker aims off how extensive knowledge and experiences are exchanged among themselves and in which way learning processes are initiated and documented.
- Dimension environment treats relevant questions from trends and social developments, which can affect the work in the organization.

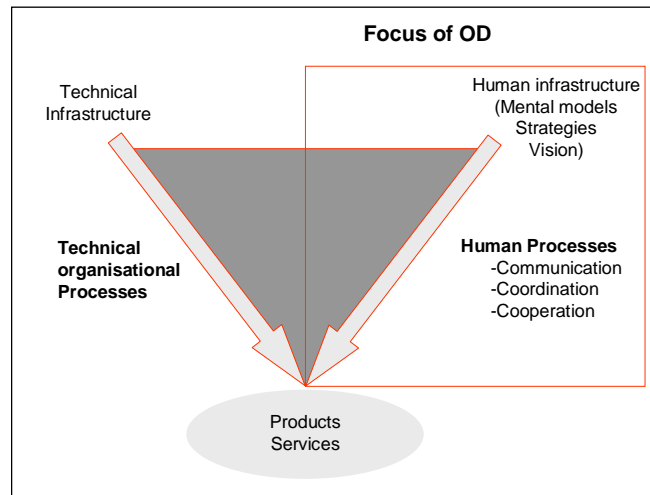


Figure 2 – Focus of OD.

4.1.1 Some Findings of the OD research process

The topics along the five dimensions point out a general conflict between primary organization and secondary organization (mainly the network of engaged business partners along the supply chains in Germany). Members of a particular enterprise (primary organization) tend strongly to think, feel and act out of their own perspective. In order to organise themselves along the total value chain towards customer orientation strong promoters are required. They act on the relationship management level, the power promoter level, in order to thrive business and to overcome barriers as well as on the process promoter level, in order to achieve interorganisational fastidious goals [7],[8]. In SME's usually the head/founder of the company and in more or less codified form some (co-) workers show up as promoters. This could lead to work overload and intransparency.

- It seems also for the authors that at the initial state of a project or cooperation it makes little sense to formalise structures and processes. According to life phases of a virtual enterprise the question of standardization is varying a lot.
- On network level simple communication supporting infrastructure (E-Mail and telephone) is felt as sufficient, on the co-operation level a common IT-platform is desirable.
- A family like culture (with a “patriarchalistic” element) is seen as success factor to make most out of the fast changing market opportunities.
- A partnership philosophy is strongly applied among the members of the virtual enterprise (customers and suppliers). One works with fair sharings and often without contracts (culture of mutual trust).
- The secondary organisation is noticed only by (co-)workers, who are involved in the initialising phase of a new project resp. customer demand.
- Generating of knowledge and innovations take place predominantly on network level. The knowledge management is identified as an improvement field.

4.2 Business Process Layer

When developing a solution for enhancing interoperability of existing systems, one has to choose between (a) instantiating one of the existing XML/B2B standards or (b) developing a tailor-made solution adhering to the standards, but also designed to provide the required flexibility while minimizing the system complexity – a set of characteristics very important to SME's [4]. For VO the management and control of its CBP are today still a great

challenge [3]. BPM is about modelling, managing, and executing processes. Design and analysis of CBPs should consider that processes are modelled with different perspectives. For example from a business point of view business processes are negotiated between business partners. At the *execution level* the business partners have to deal with the actual enactment of a CBP. Existing business process modelling languages are typically limited to one perspective. For instance, executable languages are often not comprehensible for managers. They lack facilities for a high-level analysis of CBPs. CBP modelling therefore imposes special requirements on methodologies, languages, tools and standards. Those requirements can only be derived as a result of an extensive analysis of possible cross-organisational business interaction [12]. CBP indirectly connects *private business processes* in inter-organisational business scenario [12]. A suitable concept requires to selectively hide details of private or local processes, whilst providing a process-oriented interface (views) to facilitate the state-oriented communication between trading partners (Figure 3).

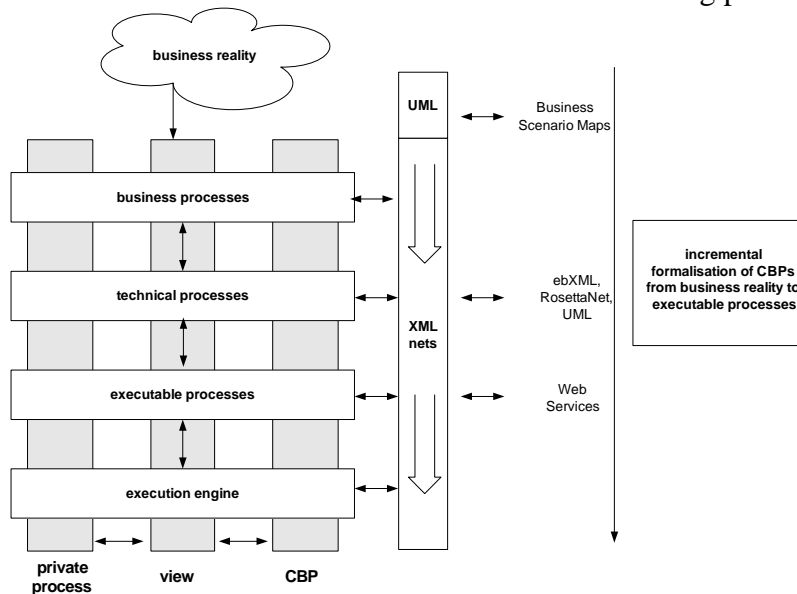


Figure 3 – Chosen approach for CBP modelling (modified from [12])

The set of requirements which should be supported to facilitate CBPs are according to [12]: support of process abstraction concept, a CBP modelling framework should be offered, modelling of the CBP business context, support for modelling at the CBP design level, support for modelling at CBP execution level, support of efficient CBP assembly, and support of global business information schema.

In Figure 3 the chosen approach is illustrated to meet the requirements of the business case at hand. The approach distinguishes three levels (business, technical, executable) on which CBP models are created [12]. State-of-the-art approaches offers hitherto no support for the modelling of CBPs on all respective levels. In addition, if the business partners are already familiar with different tools and which are already in use, one may consider to continue using respective tools. Therefore, the decision was made to use UML to realise a initial modelling with the business partners they are familiar with.

In order to meet the requirements imposed by our business case *XML nets* are applied [11], [13]. XML nets already fulfill a large number of the imposed requirements. Business processes are modeled as manipulations of XML documents representing the respective business objects. XML nets can be directly interpreted and executed by a simulator and a workflow engine. Furthermore XML nets can serve as a basis for the implementation of a monitoring module. As a major advantage of the proposed methodology compared to existing methods, all phases of process-oriented BPM are supported [11]. The comparison of state-of-the-art CBP concepts can be found in [3], [4], [12]. An adequate solution

supporting CBPs should follow a *top-down approach*, then follow the aforementioned drafted bottom-up approach by assembling CBPs by means of local processes. Therefore, the CBP were designed top-down and the business objects and interfaces between the trading partners were described in XML representation. The status of the CBPs can be monitored by a „cockpit“ which provides process data in XML format independently from the applied collaboration tool. The aim is to facilitate the continuous monitoring of CBPs by business performance indicators as e.g. time, costs, resources. The solution as well supports the maintenance and after sales services by collecting and documenting necessary project and product data in XML format.

4.3 Technology Layer

Enterprises exchange data such as purchase orders between each other. Because back-end application systems are designed and built to operate in isolation, the need of b2b integration technology arises [3]. In SMEs the most common way to exchange business data is still by manually extracting and sending the data through means like fax or e-mail and re-entering them manually. Today's b2b integration concepts are strongly intertwining with the aforementioned business process layer if the enterprise follows the emerging business service approach in order building service oriented architectures (SOA). SOA converge BPM, SOA, XML and Web Services to build the *service-oriented enterprise* [4]. Important industry standards are offered by initiatives as inter alia ebXML and Web Services (e.g. WS-BPEL). A good overview of existing b2b integration concepts is provided by [3].

5. Results

The interdisciplinary research undertaken showed the strong interrelation of human infrastructure and processes and the corresponding technical processes within a company. The new emerging requirements of service-oriented enterprises result in higher flexibility and better integration of the back-end application systems of companies. However, important to mention that employees, especially in SMEs, today clearly lack behind these developments. Therefore it is important to reduce the increasing pressure on employees through their changing work and related change in needed skills through stronger involvement in inter-organisational teams. The paper depicted results taken from a business case at hand. The aim was to facilitate CBPs by an incremental formalisation from the business scenario to executable business processes. The approach is a document-centred and represents a new type of high-level Petri nets extended by XML to offer a integrated representation of business objects and business process related data in response to existing and emerging requirements of CBPs for example imposed by technology developments as service-oriented enterprises. The work is realised using the XML nets tool suite and infrastructure which is not yet mature technology. The development of the toolsuite follows a modular approach. The different modules are either in stage of prototype or demonstrator. However, the goal is to develop a technically mature CBP tool suite in the near future [11].

6. Business Benefits

The project delivers a software prototype for an integral Petri net-based BPM, which is currently being developed. The software prototype provides fully integrated modules for Petri net-based modeling (ObjectSchemaEditor, NetModeler), analysis (PerformanceSimulator) and monitoring (PerformanceMonitor) [11]. The research work performed in Arbeit@VU provides important requirements for the further development of the prototype. The simulation and testing of the CBPs will help to make the software more mature. In addition, the results of this study are used to develop *outsourcing services* for

small businesses in combination with the commercial, web-based collaboration software tool *teamworks*. These services will be offered in the near future by members of the consortium. SMEs may learn from lessons learned to enhance their daily business. Decision makers within SMEs should take up the requirements for the organisational development and should consider the required three layer approach to support and implement their cross-organisational business. The research findings made on the respective layers will be combined in a handy handbook in clear business language to support SMEs interested in facilitating efficient collaboration structures.

7. Conclusions

The presented research findings and practical solutions made clear, that the leverage for virtual companies lies in an interdisciplinary research approach. A clear and shared understanding of what it means to work along a whole cross enterprise value chain in a networked business setting with no strong identifiable hierarchical positions and explicit command and control structures is absolutely key for success. Specifications of the “how to work together” rules (knowledge sharing across company borders, modules of shared and simple project management structures and procedures) is a further topic of exploration.

References

- [1] Aderhold, J.; Wetzel, R. (2004): Kopierfehler beim Beobachten. Die "Organifizierung" des Netzwerks als Problem. In: Zeitschrift für Organisationsentwicklung H. 3, S. 22-29
- [2] Becker, H. und Langosch, I. (2002): Produktivität und Menschlichkeit. Lucius & Lucius Verlag, Stuttgart
- Brütsch, D. (1999): Virtuelle Unternehmen. Vdf Hochschulverlag AG an der ETH Zürich
- [3] Bussler, C., B2B Integration, Springer, 2003
- [4] Charalabidis, Y.; Karakoidas, V.; Androutsellis-Theotokis, S.; Spinellis, D.: Enabling Internet-based B2B Transactions through Application Interconnection. In Proceedings eChallenges e2004. Vienna. October 2004.
- [6] Fleisch, E.; Österle, H.: Process-oriented Approach to Business Networking. Institute for Information Management at the University St. Gallen, CH-9000 St. Gallen, Switzerland. in eJOV 2 (2000) 2, Electronic journal of organizational virtualness. <http://www.virtual-organization.net>.
- [7] Gemünden, H. G.; Walter, A.: "Der Beziehungspromotor. Schlüsselperson für interorganisationale Innovationsprozesse", Zeitschrift für Betriebswirtschaft (1995), 65(9), 971-986.
- [8] Gerlach, A.: Innovität und Sustainability Intrapreneurship, (2003), URL: archives.smia.info/2003/SMIA03Gerlach.pdf, last visited 20 April 2005
- [9] Kofman, F. (2002): Seminar „Personal Transformation and Organisational Culture“, unpublished memoscript, Halifax, Canada
- [10] Krystek, U.; Redel, W.; Reppegather, S.: Grundzüge virtueller Organisationen, Gabler Verlag, 1997.
- [11] Lenz, K.; Mevius, M.; Oberweis, A.: Process-oriented Business Performance Management with Petri Nets. In Cheung, W.; Hsu, J., Proc. 2nd IEEE Conference on e-Technology, e-Commerce and e-Services, pp. pp. 89-92. IEEE Computer Society, Hong Kong, China, April 2005.
- [12] Lippe, S.; Greiner, U.; Barros, A.: A Survey on the State of the Art to Facilitate Modelling of Cross-Organisational Business Processes, 11th -Symposium of the German Informatics Society (GI) on Data Base Systems in Business, Technology and Web. Karlsruhe. 2005. <http://www.btw2005.de>, last visit 27.04.2005.
- [13] Mevius, M.; Pibernik, R.: Process Management in Supply Chains - A New Petri-Net Based Approach In 37th Hawaii International Conference on System Sciences (HICSS-37 2004). IEEE Computer Society, January 2004.
- [14] Picot, A.; Reichwald, R.: Die grenzenlose Unternehmung, Gabler Verlag, 2001.
- [15] Senge, P. M.: Die fünfte Disziplin. (2001). Klett-Cotta Verlag, Stuttgart
- [16] Sydow, J.: Dynamik von Netzwerkorganisationen - Entwicklung, Evaluation, Strukturierung, URL: http://www.wiwiss.fu-berlin.de/w3/w3sydow/neuerscheinungen/PubOnDem/Dynamik_von_Netzwerkorganisationen_sydow.pdf, last visited 24 February 2005
- [17] Sydow, J.: Strategische Netzwerke, Gabler Verlag, 1992.
- [18] Weiß, P.; Kölmel, B.: Customer relationship management and smart organization, CARs&FOF'2002, 4. July 2002, Porto, Portugal;
- [19] Weiß, P.; Stucky W.: ODAMY Extending b2b Integration Technology Architecture. In Luis M. Camarinha-Matos, Virtual Enterprises and Collaborative Networks, no. 18th, Chapter: Modeling Enterprise Networks, pp. 43-50. August 2004.