Dynamic Virtual Enterprises – The Challenges of the Utility Industry for Enterprise Architecture Management

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Abstract. Driven by the rapidly changing markets conditions, organizations from the utility and energy industry sector have to cope with increasing demand for change. This demand for change does not only arise from external forces as legal regulations and emerging innovations but also originates from strategic objectives within the company. Thereto, organizations from the industry sector strive for a flexible enterprise architecture (EA) that provides a holistic overview on the overall make up of the organization and fosters adaptation to changing situations.
In this paper, we present characteristics of the energy industry sector and the resulting challenges with respect to enterprise transformation, discuss how prevalent approaches could contribute to a solution, and propose future research areas and topics.

1 Motivation

Today's organizations in general and the ones from the energy and utility sector in special are confronted with rapidly changing market situations and conditions resulting in an increasing demand for change. A holistic overview on the overall make up of the organization, its constituents and interdependencies is typically regarded a prerequisite to cope with this demand for change. The strategic management of the enterprise architecture (EA) is a commonly accepted instrument to support the transformation of the organization [1, 4]. The EA according to [6] is the fundamental conception of the organization in its environment, embodied in its elements, their relationships to each other and to its environment, and the principles guiding its design and evolution.

The following excerpt form the strategy description of E.ON emphasizes the challenges organizations in the energy and utility sector are confronted with:

> In today's world of global competition, rapid business change, legal regulation impacts and narrowing margins, E.ON is under increasing pressure to simultaneously grow revenue and market share while reducing costs, simplifying infrastructure and speeding up processes.

The driving forces for adaptation of organizations thereby does not only originate externally as changing legal regulations or technology innovations but also arises within the organization. Typical internal demands for adaptation are increasing responsiveness via reduced project duration [9], risk management [11], enhanced standardization [2], or mergers and acquisitions [3]. This demanding environment requires a new quality of partnership between distinct parts of the organization to which we refer in this paper as *dynamic virtual enterprises*. A dynamic virtual enterprise emphasizes on the situation in which an organization has to cope with challenges of dynamically re-organizing its overall make-up with respect to legally independent parts.

The idea of a dynamic virtual enterprise can be exemplified along the typical value chain from the utility and energy industry sector as illustrated in Figure 1. Instead of optimizing the overall value chain due to a change demand, the transformation focuses on a dedicated part of the value chain. This results in different virtual enterprises as different parts of the value chain within one organization can even be managed with different business models. Thereto, the utility and energy industry sector can be described by the following set of characteristics:

- legal regulations demand a flexible adaptation of the structure of the overall organization or parts thereof resulting in different business models used in distinct units,
- information needs to be managed throughout the lifecycle and classified with respect to confidential information and information that needs to be shared among distinct units of the virtual enterprise,
- a need for secure information exchange to fulfill audit and compliance regulations,
- information about already existing ICT infrastructures and related business processes need to be available, as well as
- a clear understanding of the organizational interconnections and dependencies.

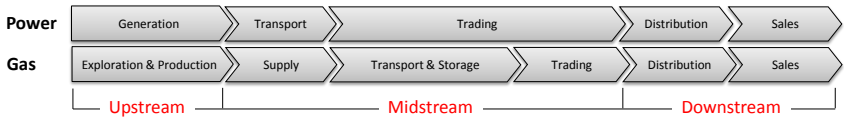

Fig. 1. Typical value chain from the energy industry sector

In this paper, we sketch how a strategic management of the EA can support an organization in (re-)building dynamic virtual enterprises. We reflect prevalent approaches to EA management against the above discussed characteristics of the utility and energy sector and discuss the provided support in Section 2. Based on the findings, we delineate future areas of research in the area of EA management accounting for the characteristics of the utility and energy industry in Section 3.

2 Contributing work

Smart networks are (virtual) organizational structures of high flexibility. This means that for all three levels of collaboration, namely *organizational*, *knowledge*, and *ICT* [5], new partners can be easily integrated or dismissed. In [7] Lau et al. analyze how EA management can be applied to manage smart networks, more precisely to establish such networks. Critical to the EA-based approach to smart network establishment is the distinction between three categories of knowledge that is exchanged between the different participating organizations [10]:

public knowledge which is available to everyone,
community knowledge available to the participants of the smart network, and
internal knowledge which is kept privately by the owning organization.

Once an organizational network is set up, i.e. the collaborating organizations have decided to jointly pursue a business opportunity, the knowledge network has to be established. For this particular network, the different participating organizations decide which internal knowledge is promoted to community knowledge. Such knowledge can be strategic and tactic planning knowledge as well as operational knowledge. In a final step, the knowledge exchange is supported by an appropriate ICT network. For the development of such network, the EA management patterns of Lau et al. [7] provide a valuable basis. They outline a method to decide, whether decentralized and non-automated or ICT-supported communication means should be employed. The method is further supported by an EA modeling language spanning both knowledge and ICT level of the smart network.

The often cited analogy of EA management with city planning or urban development (cf. Pulkkinen in [8]) can further contribute to solving the challenges of the utility and energy sector discussed in Section 1. Thereby, an organization is logically divided into

- a *managed core* i.e. the city center for which detailed rules regarding the construction of new and reshaping of existing buildings exist and
- an *unmanaged periphery* i.e. suburb where less rules exists and buildings can be (re-)constructed with more liberties.

The challenge in the context of EA management nevertheless is the establishment and adaptation of dynamic integration points between these independent areas within an organization, i.e. the dynamic virtual enterprises. Thereby, it must be ensured that a) reliable interfaces between the different areas exists, which remain stable during the future evolution; b) the "right" information is exchanged between these areas to ensure that the dynamic virtual enterprises can effectively collaborate with each other; c) the integration points must be completely deconstructable to allow dynamic allocation and reorganization of new virtual enterprises; and a d) capability-oriented dynamic EA management federation which provides a stable structure along with the long term evolution and vision of the organization can be organized.

3 Future research topics

In the past years, many of today's utility companies have re-structured themselves in respect to their organization. On the one hand, mergers and acquisitions have consolidated the market and have made the remaining companies more competitive. New regulations have forced on the other hand the companies to "unbundle" their different business roles, i.e. to separate the energy provider from the energy distributor. Mergers and acquisitions have led to heterogeneous enterprise architectures, in which similar business capabilities are implemented by different business applications. Vertical consolidation projects leverage potential synergies from homogenization. The organizational unbundling contrariwise demands the companies to rethink and re-structure integrated business applications that support business capabilities owned by different business roles. Horizontal modularization projects seek to establish a clear separation of the business support pertaining to different business roles of the company. Future research in this respect has to answer the following research question:

> How can EA management support vertical consolidation and horizontal modularization of the business support?

The new regulations in respect to the separation of business roles have opened the utility sector for new competitors. Energy resellers, for example, that do not operate power plants or distribution facilities can supply electric power to households and businesses, offering additional services as "smart metering". Such services have implications to both the enterprise architecture of the reseller, but also of the distributor. While the former company requires additional facilities, as the smart meters, to offer such services, latter company has to support the routing of corresponding end-user specific information. This raises twofold implications. On the one hand, the distributor and the reseller have to negotiate and establish a linkage between their enterprise architectures. The reseller on the other hand has to ensure privacy of the obtained information, while it is routed through the distributors infrastructure. We expect the market of energy resellers to be volatile, such that both above implications demand a dynamic federation of enterprise architectures between changing distributors and resellers, while preserving privacy of end-user information as well as of business-critical information about the single architectures. EA research can in this area target the following research question:

> What management methods and models are necessary to support dynamic federation of EAs, while keeping sensitive or business-critical EA and operation information private?

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