Future of ERP: Challenges and Opportunities in the SaaS-era

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Abstract. This paper is concerned with ERP systems, which are defined as company-wide transaction processing systems based on packaged standard software. ERP systems provide the benefit of sharing data between functional areas in a firm. The paper argues that there is room for expansion of these benefits by sharing data with supply chain partners. The paper investigates the role of vendors and concludes that there are interesting new possibilities. These are related to the SaaS delivery model of enterprise software. This model calls for attention of the (enterprise) software supply chain in academic research.

Keywords: ERP, SaaS (Software-as-a-Service).

1 Introduction

ERP systems are standard software packages for transaction processing, which integrate various functional areas of organizations, such as finance, logistics and HRM. The term "integration" means in this context that data on objects are stored and maintained only once, and are made available to each functional area concerned. This creates a common communication language and a "single version of the truth". The value proposition of ERP systems is that organizational processes and transactions can be executed efficiently, even if these processes cross the functional boundaries in organizations. Accordingly, ERP systems have grown mature with the claim that the entire organization needs integrated transaction processing which can be covered by a single investment – in ERP. This paper investigates the value proposition of ERP in the nearby future.

The classical value proposition of ERP can be reviewed in the light of recent and ongoing developments in the ERP and business environment. Four relevant developments are observed. Firstly, the focus of organizational improvement has changed towards *supply chain* issues [1]. In the past, organizations were focused internally: streamlining all internal processes was a major goal. Nowadays, streamlined internal processes (enabled by e.g. ERP) are mostly in place, and room for improvement should be sought outside the boundaries of the own organization. Consequently it would be logical to explore if the benefits of ERP can be realized in the supply chain. Many of the supply chain opportunities that can be identified for ERP vendors are

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mentioned in academic literature on collaborative enterprise systems (see e.g., [2]). However, these opportunities still constitute considerable challenges in practice, because the technologies needed are perhaps described in research, but not available on the market (see [3] [p.817] for a list of business opportunities not yet fulfilled in collaborative commerce, which could be addressed by ERP vendors).

Secondly, much standard software for transaction processing is nowadays offered in the form of *Software as a Service* (SaaS). This offering creates cost reductions for most customers. However, SaaS creates also new opportunities for various standard software vendors. Vendors could move upstream or downstream in their own supply chain. This second development relates to the (standard) software supply chain.

Thirdly, modern information systems cover much more than merely transaction processing systems. There is ICT support for professionals executing their work (Decision Support and Work Flow Management), there are real-time systems governing the execution of processes, there are office applications and social media to support human communication and interaction, and so on. All these other forms of ICT usage in organizations do not exhibit the typical transaction processing nature and require different technologies than classical ERP.

Last but not least, implementing and maintaining ERP systems may (still) require considerable effort. This is not only due to the number of parameters, which have to be set in order to configure ERP systems, but it is also due to the organization-wide nature of ERP projects.

This paper explores the future of ERP against the background of the above four developments. The first development (“organizational improvement has changed towards *supply chain* issues”) is explored in section 2. Section 2 analyzes the supply chain of a company using ERP and identifies opportunities for improvement in data sharing, using arguments that have been explained at length in academic papers. This leads to the conclusion that ERP customers would benefit from more sharing of data and processes with supply chain partners. Accordingly, section 3 analyses the vendor’s position, again using well-known academic frameworks. In this section, we will also return to the second (“SaaS creates new opportunities for various standard software vendors”) and third developments (“modern information systems cover much more than merely transaction processing systems”). This leads to the conclusion, that vendors can exploit opportunities to expand their offering into the (enterprise) software supply chain. Section 4 gives a view on ongoing and future academic research. Section 5 provides conclusions.

2 Towards a Supply Network of Content

As mentioned in the introduction, one of the main benefits of company-wide transaction processing systems, such as ERP systems, is that data on relevant objects are maintained at a single place and are made available to any authorized party in need of these data. This is sometimes called: the *single version of the truth.* Organizations that rigorously follow this principle have considerable benefits, as compared to organizations who still struggle with multiple versions of the truth. Additional advantages of

focusing on the single version of the truth are the agreements that are obtained on the semantics and ontologies related to the objects involved, and the streamlining of business processes. The classical value proposition of ERP systems is largely related to these points [4].

However, *l'histoire se répète:* what used to be true for data content in single organizations is now true for the ecosystems in which these organizations operate. For example, a vendor catalogue's content is copied into the systems of all wholesalers who sell products of this particular vendor. This creates multiple update problems when the catalogue is maintained. It seems better to have these catalogues not copied, but retrieved as a service when necessary. This argument is not only true for so-called master data, but also for transactional content data on contracts, orders, shipments, receipts, invoices and payments, which can be stored in multiple systems. If we want to avoid multiple data storage efforts and the corresponding organizational burdens, the principle of a single version of the truth should be maintained. This principle leads to the idea of *objects servitization*: for each object there is a single data source and when data on this object ("content") is needed by authorized parties, these will be retrieved from the source via a service provided by the object.

Unfortunately, a caveat is needed with respect to this idea. While it allows organizations to retrieve data from business partners, it does not guarantee that data updates are consistent with the requirements of all these partners. For example, if a vendor eliminates an item from the vendor's catalogue, this data update may not be consistent with the requirements of a wholesaler who still has to deliver orders for this item. Such issues are covered by ERP but not by interfaces based on services.

Accordingly, ERP has been adopted as preferred solution by many organizations and even for business units across the globe, consisting of many local organizations residing under a joint owner. For such business units, the above considerations have resulted in so-called *multi-site ERP*: a multi-site ERP implementation covers several organizational units who share part of their data. For example, a company with both production facilities and distribution centers (DC) would *share* the orders from the DCs to the factories, rather than having all orders entered and maintained twice. In this way, a single version of the truth is created. However, remember the fourth issue given above: implementing and maintaining ERP systems is extremely cumbersome. For this reason, viz. to avoid complexity, multiple single-site implementations are sometimes preferred above a multi-site implementation in business units. If so, data are shared in the way mentioned above: there is one party responsible for a set of objects, e.g. a catalogue, and the other party retrieves the catalogue data when needed. The drawback, that data consistency is jeopardized, is taken for granted in order to avoid cumbersome implementation and upgrade issues.

Altogether, there is a need in supply networks to avoid multiple storage of the same data. In the energy branch, special metering companies manage delivery data. In freight transportation, the main carrier takes this role. Many projects are currently ongoing to enable electronic invoices, which may be regarded as a move to avoid duplicate data storage. In fact, e-commerce is often a way to ensure that duplicate data are avoided or that automatic synchronization of the same data objects is enforced.

Accordingly, the notion of a *content supply network* emerges: organizations create information on objects (“content”), and this content is delivered to business partners. Such delivery may be accompanied by payments, as in the case of energy metering services. Note, that the content supply network may consist of the same partners as encountered in the physical supply chain, but the direction of the value stream may be different (see figure 1). Also, independent players can take a position in this network, if they provide content related services to other network participants.

Finally, there may be also other players who add value in content networks. Examples are providers of consumer market sales (Nielsen), on stock exchange transactions (Bloomberg), on the organization’s financial situation (accountants), etc.

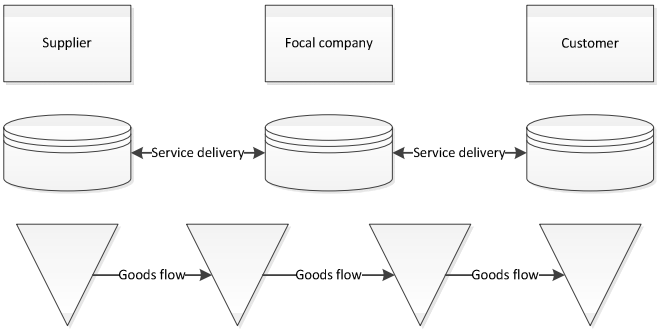

Fig. 1. Content supply network

3 Software-as-a-Service

3.1 Introduction

In recent years, ICT vendors have offered cloud-based solutions to their customers. The essence of this offering is that ICT infrastructures and platforms are not sold to customers and deployed by customers, but these are owned and run by vendors and offered “as-a-service”. ICT can become much cheaper and more scalable when infrastructure and platform are shared between customers. Ultimately, the cost reduction of hardware infrastructure is based on Moore’s law, which states that the costs of key hardware are reduced by 50% every 18 months, combined with the gains obtained from sharing risks. The cost reduction of platforms such as operating systems is based on virtualization techniques, allowing multiple software platforms to share hardware.

By itself, this cost reduction due to Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS) has nothing to do with applications such as ERP. However, there is also a good reason to have standard software such as ERP delivered as “as-a-Service”: the costs of application management can be reduced considerably if the same standard software is shared between user organizations. Sharing of software reduces the number of different software variants which are maintained, and consequently bypasses many tasks, such as adopting platform changes, installing patches, testing upgrades, database backup and recovery, helpdesk work, contracting 2nd tier

ICT suppliers, and so on. Therefore an interesting value proposition for ERP vendors emerges, namely to offer their solution as SaaS to customers. Many major vendors have already begun exploiting this opportunity. However, the move towards SaaS brings vendors also into a different competitive arena. This issue will be analyzed in the next subsection.

3.2 Analysis of ERP Vendor Position When Adopting SaaS

SaaS can be regarded as a new technology emerging in the business context, and comes with new challenges and new opportunities for ERP vendors. However, ERP vendors who embrace the SaaS offering will normally not refrain from their classical "on premise" offering. In order to analyze this change, we will use the well-known organizational adaptation framework of Miles and Snow [5], who distinguish three types of adaptation problems in organizations: the entrepreneurial problem, the engineering problem, and the administrative problem.

In case of ERP vendors, the entrepreneurial problem is mainly concerned with selection (new) product-market strategies, the engineering problem is mainly concerned with the software design and infrastructure, and the administrative problem is mainly concerned with the vendor's internal organization structure and processes.

The adoption of SaaS concerns the transition from a product to a service offering, and may also include changing markets. SaaS also involves creating new ways of delivering value to customers. These are strategic decisions, and therefore concern the entrepreneurial problem. From there, the engineering problem is involved: an ERP product that really allows multiple customers to use the same software (and presumably the same database) requires additional software development in ERP. The software has to be made fit for SaaS and for multiple customers (also called "tenants"). Additionally, appropriate systems and infrastructure have to be implemented for providing the service(s) to tenants. There are many ways to design and implement multi-tenancy and SaaS architectures [6]. Finally, SaaS requires support from the organization and management processes. For instance, the monitoring and reward system should be adjusted in order to stimulate salesmen to sell the new value proposition based on SaaS.

When moving with an ERP product from the classical on premise delivery model to a SaaS model, ERP vendors should not only address the engineering problem, but also address the entrepreneurial and administrative problems. The value proposition of the ERP vendor shifts from a focus on product features to a focus on costs. In terms of the value disciplines of Tracey and Wiersema [7], ERP vendors are traditionally oriented towards product leadership and they start to compete on operational excellence. In terms of Porter [8], the vendors who used to have a differentiation strategy are seduced to compete on cost leadership. However, there is only one party in the market who can dominate based on cost leadership, according to Porter. For most ERP vendors, even for the vendors with a large market share, it is unlikely that they will survive in a market competing on costs. This brings the discussion to the following question: what options do ERP vendors have after adopting SaaS? The next section tries to answer this question.

3.3 Different Positions in the Software Supply Chain: Options for ERP SaaS

Like many other companies, software product companies are part of a supply chain. Actually, there are two supply chains involved, which should be properly distinguished, viz. the design-time supply chain and the run-time supply chain. The design-time supply chain describes partnerships during design and supply of (design) components for the product or service offered by the focal company. The run-time supply chain described partnerships during actual delivery of products and services to the final customer.

This distinction is well known and clear for physical goods, such as apparel, electronics or buildings. During new product development, the focal company searches for design partners who may either supply off-the-shelf knowledge products or perform design tasks for the focal company. However, this knowledge supply chain may be entirely different from the physical goods flow necessary to serve the market.

The same distinction is well known in the software industry. For designing a classical ERP product, the design team may use off-the-shelf components such as security components, user-management and authentication components, database management systems, a UI-framework, a java framework, 4GL tools, configuration management tools and so on. Also, an ERP package may be combined with other application software such as MS Project. After development, these components are delivered to customers jointly with the ERP offering. This is similar to physical products where e.g. an add-on is included in the delivery.

When designing a SaaS product, the situation changes. Five options are highlighted. First, in case of ERP SaaS, license contracts for additional ERP components, such as the DBMS, will be made with the SaaS supplier, i.e. with the ERP supplier, instead of with the DBMS supplier. This means that *the ERP vendor integrates upstream in the software supply chain.*

Secondly, the ERP vendor may also choose to refrain from added value upstream in the software supply chain. For example, the ERP SaaS provider could choose to leave all authentications to a third party authentication service in SaaS mode. If so, someone should pay for the authentication service, probably the ERP customer. Accordingly, the ERP SaaS vendor leaves the added value to suppliers and thus *refrains from integrating upstream.*

Thirdly, if the ERP package is designed to work with a third party applications e.g., CRM, warehousing or even finance, these third party applications could be delivered as part of SaaS ERP or it could run in SaaS mode. This option for service delivery may be called: *specialization in the software supply chain.*

Fourthly, ERP vendors have the option to *integrate downstream in the supply chain* by e.g. investments in mobile apps for specific sessions in ERP. (This option is not restricted to SaaS but fits well with a SaaS offering). Such investments would enhance the customer experience. Obviously, the vendors can also refrain from such investments and leave these e.g. to their resellers or implementation partners. An interesting example in moving downstream in the supply chain is the mobile app “MyOrder”. MyOrder enables customers in any shop (or restaurant) to download a catalogue, place an order, pay, and receive the paid order from the shop's personnel.

Last but not least, ERP vendors or their competitors could *take a position in the content delivery network*. Section 2 describes there will be new players in the content delivery network, either to provide information services for several parties or to add value to information (such as in the case of financial analysis by accountants).

4 Discussion

This paper investigated the value proposition of ERP in the nearby future. In the above section we have argued, that there are many options for ERP vendors and others in implementing SaaS. In the current practice, it is unclear to what extent ERP vendors and other parties are implementing or have implemented the various options. Our pending research focuses on both the organizational context (organizational adaptation) as well as the institutional context of ERP vendors in adapting to software supply chain changes and SaaS developments.

First, SaaS adoption does not only require ERP vendors to address the engineering problem, such as new software and architecture design for SaaS, but also to address entrepreneurial and administrative problems, such as implementing new business models and update the financial and reward structures in the organization. Secondly, the three adaptation problems will be affected by how ERP vendors strategically employ SaaS. ERP vendors are originally product leadership and differentiation oriented with regard to their competitive strategies, yet SaaS may tempt ERP vendors to move towards cost leadership and operational excellence competition instead. Such a move makes it difficult to sustain a competitive advantage for most ERP vendors, because only one or a few players will survive in a cost competition arena.

It is therefore of interest to investigate 1) whether and how ERP vendors make the transition from their classical on premise solution to SaaS, and 2) whether and how they resist the temptation to move into cost leadership competition with SaaS.

Institutional theory, and institutional preconditions in particular, offer an explanation on whether and how ERP vendors make the transition from their classical on premise solution business to SaaS [9–11]. Institutional preconditions are related to three domains, i.e., the regulative, the normative and the cognitive domains, and concern e.g., perception of importance of SaaS adoption (cognitive), importance of relationships in the supply chain (normative) and the role of professional standards and rules (regulative). If the institutional preconditions are for example preventing a move towards a new value proposition, then it is unlikely that such a move will occur.

The five identified options for ERP vendors can be used to understand to what extent ERP vendors are shedding components and services to others in the software supply chain, and thus decrease their added-value and to what extent ERP vendors are integrating upstream and/or downstream, or specializing in their supply chains to increase their added-value. There may be also good opportunities to take a position in the content supply network, but this may contradict their institutional preconditions.

Accordingly, the case of ERP and SaaS is not only an opportunity to position these subjects in a theory of a supply chain of services as outlined above in

sections 2 and 3. It is also an opportunity to add new insights to supply chain design choices from the perspectives of institutional theory and the framework of Miles and Snow as outlined in section 3.2. This line of research may lead to interesting cross-fertilizing towards physical supply chains.

5 Conclusion

In this paper, several challenges and opportunities for ERP in the SaaS era have been identified. Section 2 analyzed the role of ERP in supply networks. The conclusion was the following. ERP is not likely to be extended beyond the boundaries of organizations. However, the increasing awareness of content supply networks will give rise to new services around data, and may invoke new players to take roles in these networks. ERP vendors have many opportunities to move upstream and downstream in their own software supply chains. Although they could enter into the content supply networks, it remains subject of further investigation if they will do so, and how.

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