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Software Characteristics of B2B Electronic Intermediaries: A Novel Design Science Approach

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ABSTRACT

Long being seen as commercially unsuccessful after the dot-com era, web-based B2B electronic intermediaries are currently undergoing a renaissance driven by globalization and an ever increasing cost-pressure on procurement departments of enterprises. These systems are getting more sophisticated almost by the day, which is also reflected by numerous related scientific articles. This development raises the question of the latest characteristics of such systems scientifically described. In order to answer this question, the work at hand depicts the results of a novel design science approach based on a structured literature review. The outcomes of this research are i) a state-of-the-art overview of scientifically described software characteristics of B2B electronic intermediaries, and ii) a taxonomy for structuring software characteristics of this type of systems. The results may help practitioners to further develop B2B electronic intermediaries and e-procurement systems, and will serve as a basis for future research endeavors in the field.

Keywords

B2B electronic intermediary, B2B electronic trading system, e-procurement systems, requirements analysis, design science, structured literature review

INTRODUCTION

In 2001, more than 1500 B2B electronic intermediaries were in operation (Ravichandran, Pant and Chatterjee, 2007). However, many of them have since gone out of business or were sold to competitors. Day and Fein (2003) report that only 43% of the B2B electronic intermediaries in operation in 2000 survived and functioned in 2002. These survivors, however, are currently undergoing a renaissance driven by globalization and an ever increasing cost pressure on procurement departments of enterprises. For example, a recent report on the SCM software market of the *Gartner Group* states that market leader *SAP* had to accept a decline of 8,8% in revenues generated from SCM software in 2009, whereas *Ariba*, an operator of an industry-independent B2B electronic intermediary, managed to increase its respective revenue by 8,8% (Gartner, 2010), and is now operating profitable. Furthermore, vendors such as *Ariba* are getting more experienced, and, as a result, their systems are getting more sophisticated almost by the day. These developments, reflected by numerous related scientific articles, raise the question of the latest characteristics of such systems scientifically described. In order to answer this question, I pursued a novel design science approach resulting in a requirements analysis based on a structured literature review. The outcomes of this methodology are a transitive closure of functional and non-functional requirements on B2B electronic intermediaries, as well as a corresponding taxonomy.

After this motivation of my work, section “Research Methodology” details my research methodology. Section “Results” reveals the results of my work; section “Recommendations for Developing B2B Electronic Intermediaries” gives general recommendations for developing B2B electronic intermediaries. Conclusions, limitations of my work and future research are briefly described in the last section.

RESEARCH METHODOLOGY

In my work, I followed the design science research methodology process model proposed by Peffers, Tuunanen, Rothenberger and Chatterjee (2007). It allows for starting with activity two, the definition of objectives of a solution. According to Peffers et al. (2007), activity two may be triggered by an industry or research need that can be addressed by developing the artifact. Considering i) that it is a common approach to delineate the objectives of a development process of a software artifact by conducting a respective requirements analysis and ii) that communication of experience with preceding design artifacts happens through scholarly publications, my approach is to conduct a requirements analysis based on a

structured literature review in order to answer my research question. To ensure a methodologically sound literature search process, I followed the guidelines of vom Brocke, Simons, Niehaves, Riemer, Plattfaut and Cleven (2009).

Peffers and Ya (2003) identified 326 journals that publish IS research articles, the Index of Information Systems Journals¹ lists 649 IS journals today. Thus, a comprehensive literature analysis is illusive. To identify a set of high-quality journals, rankings are frequently used. To achieve a reasonable degree of internationality, I employ both the German Academic Association for Business Research's JOURQUAL2² and the official AIS ranking³. In the first step, I selected the 15 highest ranking journals of the JOURQUAL2 *IS and Information Management* and *Electronic Commerce* rankings. Then I intersected this set of journals with all AIS-listed journals that have 20 average rank points or less. The resulting set of journals includes *ISR*, *MISQ*, *SIAM Journal on Computing*, *JMIS*, *ISJ*, *JAIS*, *INFORMS Journal on Computing*, *IEEE Transactions on Engineering Management*, *ACMTDS*, *IJEC* and *DATABASE*. I also evaluated an intersection with AIS-listed journals that have 15 average rank points or less, however, the resulting set of journals was considered too small. As the AIS does not include conferences into its ranking, I directly included the three highest ranking conferences of the JOURQUAL2 *IS and Information Management* and *Electronic Commerce* rankings, which are the *ICIS*, *ECIS* and the *ER conference*.

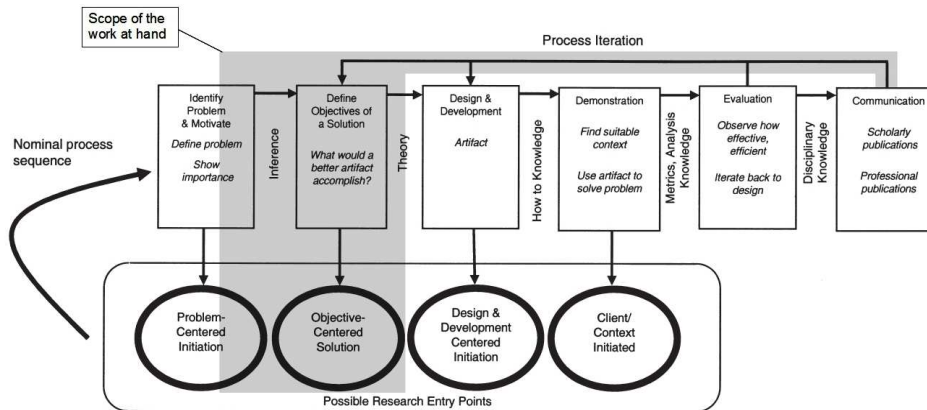


Figure 1: The design science research methodology process model followed by the work at hand (Pfeffers et al., 2007)

The actual literature search covering the period from 2005 to 2009 was conducted by searching the archives of each selected journal and conference manually, issue by issue, year by year. During this initial search, I decided upon relevance by title and abstract. As title and abstract do not always allow for an inference on the actual content of an article (Palvia and Pinjani, 2007), I included every article potentially covering my topic, resulting in a very broad literature index covering most aspects of electronic commerce, e-business and inter-organizational systems. I reduced that rather broad index for the first time by eliminating all articles with explicit B2C or C2C focus that was detectable by considering the abstract only. After this initial reduction step, I tried to get a full-text version of each remaining article by using various Internet sources or soliciting the respective authors for a copy. After having received full-text versions of most of the articles (articles not available full-text were not considered any longer in the analysis), I removed the remaining ones that focus B2C or C2C exchanges. An article was considered B2C or C2C related, if respective datasets were analyzed (e.g., EBay or Amazon datasets), or if the articles frequently referred to consumers. All remaining papers were included into the final literature index, if they explicitly referred to B2B electronic intermediaries or respective synonyms (e.g., B2B electronic marketplace, e-market, B2B exchange, B2B electronic trading system). The procedure resulted in a final set of 77 papers.

This final selection of articles was analyzed in search of requirements on B2B electronic intermediaries. If requirements were found, respective notes were taken. In a second iteration, for each note taken, the respective text passage was revisited, and the identified requirement was registered. Subsequently, the resulting set of requirements was consolidated. Thereby, multiple occurrences of a certain requirement as well as very similar requirements were aggregated. In a final step, the consolidated set of requirements was structured, resulting in the taxonomy for requirements on B2B electronic intermediaries presented in the subsequent section.

¹ <http://lamp.infosys.deakin.edu.au/journals/>

² <http://vhbonline.org/en/service/vhb-jourqual/jq2/>

³ http://ais.affiniscap.com/displaycommon.cfm?an=1&subarticle_nbr=432

RESULTS

Requirement engineers typically differentiate functional and non-functional requirements (e.g., Young (2004)). In line with this approach, I first of all differentiate functional and non-functional requirements on B2B electronic intermediaries. My requirements analysis identified a total amount of 87 requirements comprised of 81 functional and 6 non-functional ones, which are presented in sections “Functional Requirements” and “Non-Functional Requirements”.

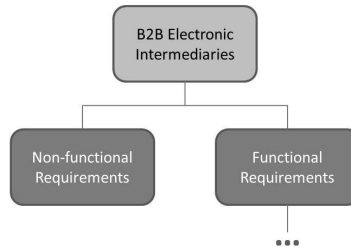


Figure 2: Decomposition into functional and non-functional requirements

Functional Requirements

The effect of B2B electronic intermediaries in supply networks was subdivided by Malone, Yates and Benjamin (1987) into the communication effect, the electronic integration effect and the electronic mediation effect. This classification was complemented with the strategic electronic network effect by Wigand (1997). The work at hand adapts this joint classification scheme for a first structuration of the functional requirements which were identified throughout my literature review. The resulting classification scheme is depicted in figure 3.

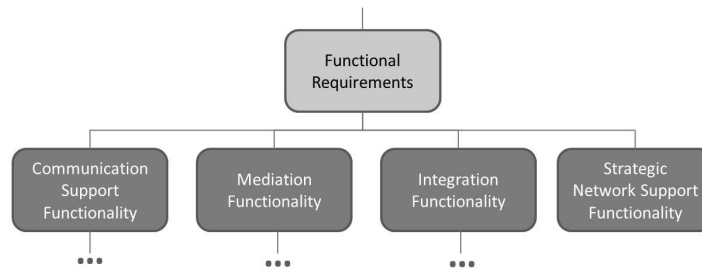


Figure 3: Decomposition of functional requirements

For the classes *Communication Support Functionality*, *Mediation Functionality*, *Integration Functionality* and *Strategic Network Support Functionality*, the requirements analysis revealed 12, 50, 15 and four requirements, respectively. The requirements belonging to each category are enlisted and described in more detail in the following subsections.

Communication Support Functionality

This class can be further decomposed into general communication functionality and negotiation support functionality, which is considered a special form of communication. The class of *General Communication Functionality* encompasses five functional requirements, whereas *Negotiation Support Functionality* is comprised of seven ones.

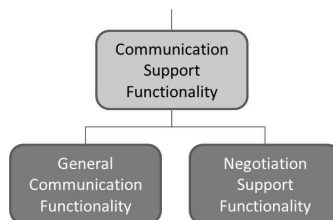


Figure 4: Decomposition of communication support functionality

Not all communication tasks in inter-organizational relationships can be conducted in a formalized or semi-formalized way. Thus, communication channels of general nature but also for customer preferences and knowledge dissemination are required. Respective requirements identified throughout the structured literature review are listed in table 1.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Provide synchronous media with high social presence (e.g., phone, videophone)	Industry practice	Montazemi, Siam and Esfahanipour (2008), Overby and Forman (2009), Rossignoli, Cordella and Mola (2006), Nagle, Finnegan and Hayes (2006)
Provide media such as private chat, forum or squawk box	Industry practice	Montazemi et al. (2008), Rossignoli et al. (2006), Martinsons (2008)
Support alternative ontologies one of which traders must agree on	Helps streamlining the communication between traders	Chiu, Poon, Lam, Tse, Sui and Poon (2005)
Have a graphical environment for simple product customization tasks (e.g., graphical design of ceramics)	Industry practice	Rossignoli et al. (2006), Standing, Love, Stockdale and Gengatharen (2006), Kim and Ahn (2007), Grover and Saeed (2007)
Include an e-learning system offering, e.g., sales or management courses or supporting users in identifying appropriate procurement mechanism (e.g., auction or tendering) for a given demand	Industry practice	Rossignoli et al. (2006), Hsiao, Ou and Chen (2009)

Table 1: General Communication Functionality

Electronic negotiation is considered as an optional activity within a transaction conducted via B2B electronic intermediaries. According to Jennings et al. (2001), respective functionality could further be sub-divided into negotiation protocols, analytical negotiation support tools and negotiation software agents. See table 2 for an overview of respective requirements on B2B electronic intermediaries.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Have a negotiation support system that supports knowledge discovery using parametric as well as non-parametric learning models (e.g., heuristics, case-based reasoning, genetic algorithms, Bayesian learning)	Efficient mining of trading partners' preferences helps improving negotiation effectiveness and efficiency	Lau, Wong, Li and Ma (2008), Chari and Agrawal (2007)
Provide a negotiation support system that allows both for sequential-single offer and simultaneous-equivalent offers	Simultaneous-equivalent offers have the potential to increase the overall efficiency of a settlement	Yang, Singhal and Xu (2009)
Provide a negotiation support system that allows both for immediate acceptance and delayed acceptance of an offer	Delayed acceptance has the potential to avoid a pre-mature closure, thus facilitating an increased joint efficiency	Yang et al. (2009)
Provide a negotiation support system that considers primary negotiation terms (PNTs) as well as secondary negotiation terms (SNTs)	PNTs frequently used; SNTs also contribute to good negotiation decisions	Lee and Kwon (2006)
Include negotiation agents that are capable of agent-to-agent as well as agent-to-human interactions	Both types have the potential to decrease transaction costs while maintaining the possibility to do business with organizations with low IT-capabilities	Yang et al. (2009), Huang, Lin and Yuan (2006)
Include sales agents that support Product Attribute Relevant (PAR) as well as Product Attribute Irrelevant (PAI) negotiation strategies	Customers with different degrees of prior knowledge require different negotiation strategies	Huang et al. (2006)
Include sales agents that try to raise a prospective buyer's perceived value of a product before negotiating price	May increase the perceived utility of a product and hence allow for negotiating a higher price	Huang et al. (2006)

Table 2: Negotiation Support Functionality

Mediation Functionality

As expected, the vast majority of requirements on B2B electronic intermediaries was identified for the class of the *Mediation Functionality*. As depicted in figure 5, this class was further decomposed into the classes *Procurement Mechanisms*, *Reputation Mechanisms*, *Analytical Tools*, *Procurement Software Agents*, and *Mediation Processes*, composed of 21, six, eleven, five and seven requirements, respectively.

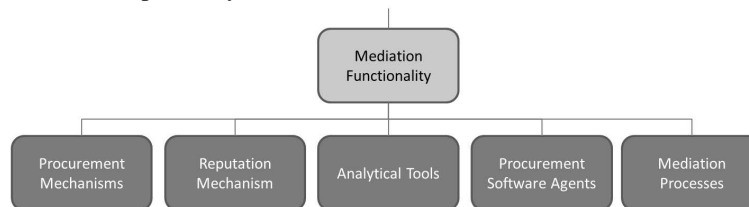


Figure 5: Decomposition of mediation functionality

A major value proposition of many B2B electronic intermediaries is price reduction for buying organizations through increased geographic reach und resulting supplier competition. In that regard, both procurement mechanisms such as RFx (e.g., Request for Proposal, Request for Quotation) that support the procurement of non-commodities, as well as more

complex ones such as different types of procurement auctions that support the pricing of commodities are frequently supported. Table 3 gives an overview of corresponding requirements.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Support all major procurement innovations (e.g., RFx, eAuction, eCatalog)	Functionalities were identified as productivity enhancing in procurement	Rai, Brown and Tang (2009), Dominguez (2009), Bandyopadhyay, Barron and Chaturvedi (2005)
Allow for the establishment of a financial market for commodity trading (e.g., futures market)	Industry practice	O'Reilly and Finnegan (2008), Fairchild, Finnegan, O'Reilly and Ribbers (2005)
Allow for aggregation of supply or demand of several traders	Useful to realize price-discounts or to avoid that buyers play smaller sellers off against each other	Ravichandran et al. (2007)
Allow for splitting contracts into several lots	Technique to energize market participants; allows traders for experimenting with multiple auction formats in order to find the revenue maximizing one	Hsiao et al. (2009), Bapna, Chang, Goes and Gupta (2009), Fairchild, Finnegan, O'Reilly and Ribbers (2005), Adomavicius, Gupta and Sanyal (2008)
Support multi-currency deals (e.g., multi-currency bidding)	Industry practice	Lau et al. (2008), Fairchild et al. (2005)
Have an auction processor that allows for the configuration / execution of a broad variety of auction types (e.g., rule-based combinatorial auctions) and respective winner-determination mechanisms (e.g., heuristics)	Different types of business settings require different types of auctions; type of applied auction influences the auctioneer's as well as the bidders' economic outcome	Jones and Koehler (2005), Pardoe, Stone, Saar-Tsechansky, Keskin and Tomak (2009), Bichler, Shabalin and Pikovsky (2009)
Allow for auctions with configurable information feedback	Level of information feedback has a significant impact on auctioneer's and bidders' surplus	Adomavicius et al. (2008), Adomavicius, Curley, Gupta and Sanyal (2007), Adomavicius, Gupta and Zhdanov (2009)
Allow for dynamic and/or configurable bid in-/decrements	Helps to achieve higher revenues / lower costs for the auctioneer	Bapna, Goes, Gupta and Karuga (2008), Pardoe et al. (2009), Fairchild et al. (2005)
Support the application of learning techniques to derive auction parameters from historical auction data (self-adaptive auction mechanism)	Helps to achieve higher revenues / lower costs for the auctioneer	Pardoe et al., (2009)
Allow for a final sourcing decision after an auction considering items other than price	Allows to draw sourcing decisions based on total costs, not just the price of a contract	Hsiao et al. (2009)
Allow for linkable auction running times	Industry practice	Fairchild et al. (2005)
Allow for either showing or hiding the opening price and lead bid	Especially useful when current market prices are relatively unknown	Fairchild et al. (2005)
Allow for a limitation of auction extension times	Industry practice	Fairchild et al. (2005)
Support auction preparation processes (e.g., questionnaire with weighted answer)	Industry practice	Fairchild et al. (2005)
Support auction event monitoring for auctioneers	Industry practice	Fairchild et al. (2005)
Allow for altering an auctioneer's preferences throughout an auction	Allows for a reaction to bids already received	Adomavicius et al. (2008)
Provide bidder decision support tools	Bidder support is required for bid-formulation in complex auction types (e.g., Continuous Combinatorial Auctions)	Adomavicius et al. (2007), Adomavicius and Gupta (2005), Bichler et al. (2009)
Support auctions with optional bid withdrawal	Leads to higher efficiency and revenue but lower surpluses for bidders	Adomavicius et al. (2007)
Support configurable stopping rules for auctions	Helps to eliminate "sniping", i.e., placing bids in the last seconds of an auction	Adomavicius et al. (2007)
Allow for a detailed analysis of unsuccessful bids of an auction	Gives suppliers the impression that the buyer is concerned about the consequences of an auction	Hsiao et al. (2009)
Provide a feedback system for auctions in order to enable bidders to rate the extent to which they were satisfied by the auction process	Helps to improve trust of bidders and allows for detection of problems/inefficiencies	Charki and Josserand (2008)

Table 3: Procurement Mechanisms

Problems arising from the Principal-Agent Theory such as moral hazard and adverse selection constitute a major component of market mechanism inefficiency. B2B electronic intermediaries address this issue by so-called reputation mechanisms which allow buyers to rate the extent to which they were satisfied by a seller (and occasionally vice versa). See table 4 for an overview of respective requirements.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Provide a configurable reputation mechanism for traders (e.g., type of reputation mechanism, frequency of profile updates)	Different reputation mechanisms have different impact on social welfare	Montano, Porter, Malaga and Ord (2005), Dellarocas (2005), Dellarocas (2006)
Provide a reputation mechanism in which older ratings have less weight than newer ratings or are not considered	Allows for emphasizing the current situation (e.g., current ability to deliver on time), broadens the range of settings where a reputation mechanism induces cooperation	Montano et al. (2005), Dellarocas (2005)
Provide a reputation mechanism that treats missing feedback as positive feedback	Identified as the optimal policy for dealing with missing feedback	Dellarocas (2005)
Provide a reputation mechanism that allows for side	Provides buyers with a strict incentive to	Dellarocas (2005)

payments to promote feedback provision	participate in the reputation mechanism	
Allow for linking subscription/transaction fee to a trader's reputation	Allows for rewarding sellers for their important role in building trust of buyers in the intermediary	Kim and Ahn (2007)
Allow for rating sellers in the categories credibility, reliability and product/service quality	Attributes relevant for buyers	Kim and Ahn (2007)

Table 4: Reputation Mechanisms

B2B electronic intermediaries accumulate vast amounts of data; thus analytical tools are frequently offered to traders as well as to the operator in order to leverage this data for business purposes. These tools reach from sophisticated search functionalities to applications that support horizontal information sharing and mining. Table 5 gives an overview of analytical tools described or mentioned in the reviewed literature.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Provide advanced search functionality / market intelligence tools	Necessary to locate suppliers and rationalize price discrepancies in volatile markets	Grover and Saeed (2007)
Provide trader search functionality that allows for sorting by reputation factors as well as price	Reputation factors are major (the only) factors for finding trustworthy trading partners; Sellers with high reputation receive substantially higher prices	Bolton, Loebbecke and Ockenfels (2008)
Provide product search by specification	Allows for efficient identification of potential sources of supply	Soh, Markus and Goh (2006)
Allow for listing sellers by product quality	Product quality is a major concern for buyers considering to join an electronic intermediary; Better on average product quality increases adoption of an electronic intermediary (as well as quality dispersion)	Xia and Xia (2008)
Allow for a detailed expenditure analysis	Typical activity in strategic supply management	Hsiao et al. (2009), Soares-Aguiar and Palma-dos-Reis (2008)
Allow for screening, selection and ranking of suppliers of a specific organization	Industry practice	Mola, Rossignoli and Carugati (2008), Fairchild et al. (2005)
Support vendor performance measurement of approved vendors	Component of supply chain risk management	Hsiao et al. (2009), Dominguez (2009), Soares-Aguiar and Palma-dos-Reis (2008), Ash (2005)
Provide traceability services allowing traders to monitor product transformation at each stage of the value chain	Industry practice	Mola et al. (2008)
Support horizontal information sharing and mining (e.g., mining transaction data of competitors)	Industry practice	Zhu and Zhou (2007)
Provide tools to support sellers in pricing products appropriately	May serve as value-adding service for inexperienced traders (e.g., SMEs trying to increase their market-reach)	Soh et al. (2006)
Include an ontology-based product recommender for product recommendation to traders as well as for sorting new products into product catalogues	Increases satisfaction of traders with low product knowledge	Xu, Benbasat, Cenfetelli and Vancouver (2009), Rossignoli et al. (2006), Lee, Chun, Shim and Lee (2006)
Provide facilities to support intermediary operators to monitor and control the successful performance of transactions	Industry practice	Kim and Ahn (2007)

Table 5: Analytical Tools

In order to realize cost savings through automation of supply chain management processes, the usage of procurement software agents is frequently recommended. Nissen and Sengupta (2006) further differentiate procurement software agents that support product search (information retrieval agents), product selection (advisory agents) and the purchase decision (performative agents). See table 6 an overview of requirements on procurement software agents.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Include software agents covering the phases product search (information retrieval agents), product selection (advisory agents), as well as purchase decision (performative agents)	These types of agents offer tremendous potential for automation of supply chain management processes	Nissen and Sengupta (2006)
Include software agents that were able to both act autonomously as well as to incorporate human decisions in case of ambiguity	Possibility to react to ambiguity, e.g., in product descriptions	Nissen and Sengupta (2006)
Include procurement agents that are able to act on behalf of all principals involved (e.g., managers, engineers)	Required to support procurement of complex products which involves technical as well as managerial issues	Nissen and Sengupta (2006)
Include agents that are able to learn at run-time instead of design time (growing instead of designing agents)	Identified as promising approach to handle ambiguity	Nissen and Sengupta (2006)
Include bidding agents that support multi-auction strategic bid placement	Strategy often pursued by institutional bidders	Bapna et al. (2009)
Include bidding agents that are able to infer hidden auction parameters, to estimate the current auction state,	Allows for a more informed strategy in subsequent bidding and may benefit a	Adomavicius et al. (2009)

as well as to predict future auction states of complex auction types	trader by maximizing her surplus	
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Table 6: Procurement Software Agents

The literature analysis further revealed a set of administrative and trader-related processes that B2B electronic intermediaries may support. Table 7 reveals these processes. Whereas some of these processes, e.g., a trader qualification process, are supported quite frequently, others such as processes supporting an effective decision making model for a large group of owners are rather rare.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Support instant supplier commercial assessment (SCA) by the intermediary operator	Resulting information serves for pre-qualification of suppliers	Fairchild et al. (2005)
Support a product quality assessment/control process	Reduces uncertainty for buyers	Fairchild et al. (2005), Xia and Xia (2008)
Provide a trader qualification process including an authentication for traders with the intent to join the intermediary system	Industry practice	Mola et al. (2008) Dellarocas (2005), Bandyopadhyay et al. (2005)
Support a configurable dispute resolution process	Industry practice	Fairchild et al. (2005)
Support a process for identification and expulsion of cheating traders	Protects buyers from fraudulent sellers; Increases trust into the intermediary	Dellarocas (2005)
Support a configurable supplier qualification process for buying organizations (resulting in an approved vendor list)	Industry practice	Fairchild et al. (2005), Mola et al. (2008), Zhu and Zhou (2007), Dolpanya, Land and Dick (2009), Nagle et al. (2006)
Support an effective decision making model for the stakeholders of intermediaries operated by a large group of owners	Increases the ability of an electronic intermediary operated by a large group of owners to react more timely to problems or market changes	Standing et al. (2006)

Table 7: Mediation Processes

Integration Functionality

As depicted in figure 6, the class of *Integration Functionality* can be characterized as a combination of B2B integration (B2Bi) functionality and integrated functionality of third-party service providers. The requirements analysis revealed 10 and 5 requirements for the two subclasses of this class, which are presented in the following paragraphs.

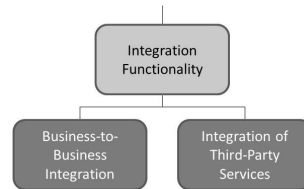


Figure 6: Decomposition of integration functionality

Especially in relatively stable supply chains, the success of an enterprise heavily depends upon effective integration along the enterprise’s supply chain. Hence, B2Bi as a core task of Supply Chain Management (SCM) is frequently supported by B2B electronic intermediaries. Requirements on B2Bi solutions enabled by B2B electronic intermediaries are listed in table 8.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Support different levels of integration reaching from a sophisticated web-interface to full integration with internal systems of traders, thereby supporting a broad variety of industry standards	Web-based interfaces allow for an incorporation of trading partners with low IT capabilities, B2B integration (e.g., automatic invoicing and payment) allows for realizing a large transaction cost savings potential	Galbreth, March, Scudder and Shor (2003), Son and Benbasat (2007), Dedrick, Xu and Zhu (2008), Christ, Schroth and Janner (2007), Dominguez, 2009), Wu, Zsidisin and Ross (2007), Bandyopadhyay et al. (2005), Mishra, Konana and Barua (2007), Chang, Wang and Chiu (2008), Gosain, Malhotra and El Sawy (2005)
Allow for centralized (via the electronic intermediary) as well as decentralized execution of business transactions	Participants are frequently unwilling to reveal transaction data to a third party (i.e., to an independent electronic intermediary)	Soh et al.,(2006), Christ et al. (2007)
Have well defined interfaces / extensibility mechanisms	Allows for the integration of customer-specific functionality	Rosignoli et al. (2006), Ravichandran et al. (2007)
Allow for context-specific customization / creation of processes and data	Provides users with the process and data subsets that are adequate in their respective individual context	Christ et al. (2007), O'Reilly and Finnegan (2008)
Provide modular, interconnected processes	Modular interfaces reduce dependencies	Gosain et al. (2005)
Provide adapters for existing (proprietary) IT-systems of traders	Facilitates full integration with respective transaction cost savings	Christ et al. (2007), Ravichandran et al. (2007), Teo, Ranganathan and Dhaliwal (2006)
Be integrated with ERP-systems of traders via SCM and	Helps partners to become better	Karimi, Somers and Bhattacharjee (2009)

CRM modules	collaborators and exploit new business opportunities	
Provide mechanisms to foster data consistency, accuracy, timeliness, coverage and relevancy	Data quality is a pre-requisite for successful B2B integration	Karimi et al. (2009), Gosain et al. (2005)
Allow for accepting or rejecting purchase order information on a line item level	Reduces downstream errors and corresponding expensive reconciliation processes	Ash (2005)
Provide a knowledge map of partner competencies and processes, and what it takes to connect them	Required to support agile inter-enterprise partnering	Gosain et al. (2005)

Table 8: Business-to-Business Integration

Some integrated services of third-party service providers serve the business needs of traders (e.g., third-party logistics, financial service providers), whereas others (e.g., industry related news services, regulatory compliance services) serve as value-adding services differentiating a B2B electronic intermediary from competitors (Mola et al., 2008). Third-party services frequently integrated into B2B electronic intermediaries are depicted in table 9.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Support third-party logistics (3PL)	Industry practice	Soh et al. (2006), Standing et al. (2006), Molla and Licker (2005), Martinsons (2008)
Allow for an integration with financial service providers	Industry practice	Soh et al. (2006), Standing et al. (2006), Molla and Licker (2005), Martinsons (2008)
Be integrated with escrow services, risk management companies and credit agencies	Helps to establish trust between trading partners	Standing et al. (2006)
Provide up-to-date industry related news service (integrate information vendors such as Bloomberg or Reuters, and/or research boutiques)	Value-adding service for organizations in highly volatile industries with rapid market changes	Son and Benbasat (2007), Montazemi et al. (2008), Mola et al. (2008)
Provide regulatory compliance services	Industry practice	Montazemi et al. (2008)

Table 9: Integration of Third-Party Services

Strategic Network Support Functionality

The tendency to low vertical integration of many industries induces the formation of production networks in these industries (e.g., automotive or ICT industry). As shown in table 10, B2B electronic intermediaries serving such industries support the operation of such production networks by offering corresponding functionality.

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Allow for CAD/CAM integration (allow for description and customization of complex products)	Allows for trading complex and/or customized products; Supports collaborative product development	Son and Benbasat (2007), Dedrick et al. (2008), Dolpanya et al. (2009), Ravichandran et al. (2007), Standing et al. (2006), Kim and Ahn (2007), Grover and Saeed (2007)
Support Vendor Managed Inventory (VMI)	Allows for just-in-time (JIT) production	Dominguez (2009), (Kim, Umanath and Kim (2006)
Support vertical information sharing (e.g., collaborative planning, forecasting and replenishment – CPFR)	Enhances supply chain efficiency (e.g., reduces bullwhip-effect and inventory levels)	Zhu and Zhou (2007), Ravichandran et al. (2007), Karimi et al. (2009), Gosain et al. (2005), Kim et al. (2006), Dominguez (2009), Wu et al. (2007), D'Aubeterre, Singh and Iyer (2008)
Allow for monitoring supplier activities (e.g., shipping/delivery schedule, production schedule)	Features required to address demand uncertainty and channel interdependence	Kim et al. (2006)

Table 10: Strategic Network Support Functionality

Non-Functional Requirements

Non-functional requirements can be defined as “concerns not related to the functionality of the software” (Chung and do Prado Leite, 2009). Throughout my literature analysis I also identified some non-functional requirements of particular importance for B2B electronic intermediaries (c.f. table 11).

Requirement: A B2B electronic intermediary should...	Advantage/Justification	Source(s)
Have low resource requirements for adoption and implementation	Increases the adoption rate of an electronic intermediary among SMEs	Guo and Xu (2006)
Provide a code of conduct and respective sanctioning mechanisms	Encourages both buyers and suppliers to behave as agents of integrity	Hsiao et al. (2009), Mola et al. (2008)
Have adequate access control-mechanisms that allow for specifying which users should have what rights to access which resources, under what circumstances	Mitigates the risk of unauthorized access, which may lead to foregone returns on information and knowledge assets; security controls significantly affect initial trust	D'Aubeterre et al. (2008), Kim and Ahn (2007)
Perform the promised service dependably and accurately	Technical problems in sensitive processes (e.g., auction event) may prejudice certain traders, leaving other traders disappointed	Standing et al. (2006), Charki and Josserand (2008)
Advertise a list of current participators, their	Potential adopting organizations may feel	Son and Benbasat (2007)

testimonials, number of listed products, and transaction volumes	mimetic pressure to join the intermediary	
Allow for charging different fees for different types of participants (e.g., buyers and sellers)	Allows for a reaction to undesired participant structure	Bakos and Katsamakos (2008)

Table 11: Non-Functional Requirements

RECOMMENDATIONS FOR DEVELOPING B2B ELECTRONIC INTERMEDIARIES

In case a development of a commercial B2B electronic intermediary based on the work at hand is desired, first of all a context-specific subset of the presented functionalities should be selected. In order to ensure an adequate functional scope, additional requirements should be gathered for each class of the presented taxonomy, e.g., by conducting case studies aiming at documenting procurement and collaboration practices of, as well as software systems typically used in the target market. It would be of tremendous importance to attract some key players of the target market as partners of such a project, however. Such partners should be able to ensure a critical mass of potential traders (buyers and sellers), as well as a certain trade volume for the resulting intermediary, as these factors are considered major success factors for the development of B2B electronic intermediaries (O'Reilly and Finnegan, 2008; O'Reilly and Finnegan, 2008).

LIMITATIONS

Of course, the work is also subject to limitations. First of all, the structured literature review is limited to eleven leading IS journals as well as three leading IS conferences, and is of contemporary nature. The resulting small number of analyzed articles implies a limited validity of my findings and conclusions. Further research will review other leading publication outlets as well. Also, although renowned rankings were chosen to select the publication outlets, there are many disagreements about the worth of such ranking systems. Finally, the presented taxonomy for software characteristics of B2B electronic intermediaries has not been evaluated yet.

CONCLUSIONS AND FUTURE WORK

The work at hand presents a transitive closure of functional and non-functional requirements on B2B electronic intermediaries, thereby providing a comprehensive overview of scientifically described software characteristics of B2B electronic intermediaries. For practitioners, it may serve as a basis for the further development of both B2B electronic intermediaries and e-procurement systems. Besides, it may to a certain extent be useful for practitioners responsible for evaluating and selecting B2B electronic intermediaries.

The work at hand does not elaborate on the relationships between the different groups of requirements. Future work may thus consist in a closer investigation of these relationships on the one, as well as the relationship between certain requirements and the resulting system efficiency on the other hand.

Future research opportunities may also arise by a comparison of the features described by the work at hand and the features of B2B electronic intermediaries in the market, as possible gaps between research and practice may be under-researched. Recently, for example, contacts from *Ariba* became available on *Salesforce.com*, a provider of Software-as-a-Service Customer Relationship Management (CRM) tools. The usage and potential of this kind of social business certainly deserves the attention of researchers.

Based on the delineation of the software characteristics of B2B electronic intermediaries provided by the work at hand, a future research endeavor may as well consist in a closer investigation of the context of B2B electronic intermediary usage. Thereby, typical activities of *Spend Management* or *Total Value Management* approaches could be examined regarding their support by B2B electronic intermediaries. Such research could be grounded in case studies on the one, as well as further literature reviews covering renowned management journals on the other hand. Such an approach may reveal potential for novel features in the Software-as-a-Service offerings of B2B electronic intermediaries which, in turn, may offer opportunities for traditional design science research.

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