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Towards an Excellence Framework for Business Interoperability

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Abstract

Organisations that wish to establish IT-supported business relationships with business partners face major challenges, among them the need for creating a win-win-situation and the effort to align business processes and link up information systems across company borders. Whereas interoperability has been widely discussed in a technical context, it has not (yet) been explored how interoperability relates to the business strategy and organisational design of the business relationship. This paper explores interoperability from a business perspective and identifies the fundamental artefacts related to business interoperability. Building on contingency theory, it outlines a comprehensive framework suggesting a fit between the level of business interoperability and environmental as well as internal contingencies.

1. Introduction and Motivation

Companies increasingly achieve competitive advantage by forming innovative networks of value creation and bundling core competencies from different partners. This is the core idea of concepts that have been published under the term of networked or virtual organisations, business networking or value networks. Although the research community sees networked organisations as an undisputable reality, companies find it very time-consuming and difficult to establish electronic business relationships with a larger number of business partners. Enterprises that wish to implement closer forms of process integration with their business partners face major challenges (Kim et al. 2001, 473f, Ross et al. 2001, 3, Jun et al. 2000, 412, Leser 2005):

- *Win-Win-Situation*: Reciprocal benefit is the prime motivation for partners to participate in collaborative processes, with lack of trust being the most important barrier. Both issues contradict buyer-supplier-relationships that focus on squeezing prices (Hoyt and Huq 2000).

- *Heterogeneity of process and information systems*: Process and data models as well as platforms differ between companies and limit "instant integration" capabilities. Despite the rapid dissemination of Internet technologies and the wide use of packaged enterprise applications, decades of isolated business models have left semantic islands with own standards and services, resulting in individual expectations and capabilities (Kling et al. 1996, 20f).
- *Responsibility gap*: Responsibility for the space between businesses is not reliably assigned. Issues like disruptions of syntactic or semantic data integrity affect collaborative processes. In contrast with internal processes, responsibilities have not been assigned and readily lead to conflicts (Kumar and Diesel 1996, 296).
- *Prohibitive need for resources*: The resources required for integrating partners exceed the capabilities of internal IT. At the same time, partners do not have such capabilities either (Dai and Kauffman 2001, 63).
- *Trust & intellectual property*: The intellectual property of collaborative process design and the exchange of information need to be protected from competitors, but shared with partners. Exchanged messages often contain confidential information that must be safeguarded against unauthorised access.
- *Many-to-many relationships*: Collaboration with one partner is a starting point. But, to reflect and improve existing flows of goods, information flows need to be optimised across several tiers and several partners (Le 2002, 117). The ability to quickly and inexpensively integrate a lot of processes and supply chain partners is the key to benefit from investments in electronic cooperation (El Sawy 2003).

These and other challenges relate to the area of interoperability. Whereas most of existing research and initiatives focus on *technical aspects* of interoperability by suggesting standards for presenting, collecting, exchanging, processing and transporting data, a systematic analysis on *strategic and organizational issues* associated with electronic integration is currently lacking. Therefore, the objective of this paper is to

1. define business interoperability (as opposed to technical interoperability),
2. identify the main artefacts which constitute business interoperability.
3. and to outline the structure of a comprehensive framework explaining the factors which influence business interoperability.

Since interoperability addresses the interplay between business strategy, organisational design and information system design, the paper follows the design-science approach outlined by (Hevner et al. 2004): Based on the review of different research streams and approaches to interoperability, it derives the relevant artefacts and comes up with a first version of a comprehensive business interoperability framework. The application and validation of this framework will be subject of future research.

2. Defining Business Interoperability

In electronic business relationships interoperability plays a decisive role. Being "interoperable" refers to being able to share information between business partners, understand and process exchanged data, seamlessly integrate it into internal ICT systems, and enable its beneficial use. On the one hand, interoperability refers to technical aspects of integration across different platforms, network devices and communication protocols, as well as the syntactic and semantic data formats. This is reflected in the definition by (ATHENA 2005) which considers interoperability as "the ability of two or more systems

or components to exchange information and to use the information that has been exchanged" On the other hand, interoperability from a business perspective is concerned with forming innovative networks of value creation and defining new ways of collaboration with partners and implementing collaborative business processes.

> *In the context of this paper, we define business interoperability as "the organisational and operational ability of an enterprise to cooperate with its business partners and to efficiently establish, conduct and develop IT-supported business relationships with the objective to create value."*

When comparing different industries, it becomes evident that they have different levels of business interoperability. In the high-tech industry, the supply chain between Original Equipment Manufacturers (OEM), contractors and component manufacturers is tightly integrated. Companies like Cisco or HP adhere to process standards (e.g. RosettaNet) and use collaboration platforms (e.g. Viacore) which ease electronic collaboration within their value chain (Leser et al. 2005). In many other areas, e.g. in facility management, the fragmentation and specialisation within the value chain is still progressing and has not yet produced stable role models. In addition, the size of the companies makes it more difficult to establish a similar level of interorganizational integration. These examples illustrate that the achievable level of business interoperability depends on industry structure as well as maturity with regard to electronic business and characteristics of the target cooperation scenario.

Based on the above definition, business interoperability describes the design of a company's external relationships. It extends the more technically focussed notion of interoperability to cover strategic, organisational and operational aspects of setting up and running IT-supported relationships. As such, business interoperability builds on the concept of *networkability* (Wigand et al. 1997, 11, Österle et al. 2001, 5) which is a continuation of coordination theory and sees coordination as the management of relationships of dependence. Among the different issues which may arise on the business level are the following:

- defining and formalising cooperation goals with business partners (e.g. by contracts and service level agreements),
- aligning business processes across organisations,
- making technology and platform choices,
- and linking information systems across company borders.

The breakthrough for networked organisations will occur when companies can cooperate with new partners without any additional cost involved and even small businesses can easily participate in electronic business relationships. This scalability of electronic relationships is called *m:n capability*.

3. Approaches to Business Interoperability

The following section discusses reviews models and frameworks explaining the fundamental concepts of interoperability in order to derive the relevant artefacts.

3.1 Existing Approaches to Interoperability

3.1.1 Interoperability Frameworks

Various interoperability frameworks, e.g. the e-Government Interoperability Framework (e-GIF), the Levels of Information Systems Interoperability framework (LISI) or the European Interoperability Framework (EIF), have emerged over the last years. These frameworks usually distinguish different interoperability dimensions. As illustrated by the underlying definition of interoperability (Figure 1), they mainly focus on information exchange and technical interoperability.

Framework	Definition of Interoperability
European Interoperability Framework (IDABC 2004)	Interoperability means the ability of information and communication technology (ICT) systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge.
European Information & Communication Technology Industry Association (Eicta 2004)	The ability of two or more networks, systems, devices, applications or components to exchange information between them and to use the information so exchanged.
Levels of Information Systems Interoperability (DoD 1998)	The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces, and to use the services so exchanged to enable them to operate effectively together."

Figure 1: Interoperability Frameworks – Definitions of Interoperability

3.1.2 Standardization

In their early study, (Benjamin et al. 1990) reported that insufficient availability of standards has been the most important barrier to interorganisational integration. Up to date standards are mostly available for communication services and on the syntactical level (Bussler 2003, McAfee 2005). Various initiatives have been launched to extend XML-based standards to comprise the semantic level, either by industrial associations – e.g. RosettaNet Partner Interface Protocols (PIPs) in the high-tech industry, ChemXML as part of CIDX in the chemical industry – or by independent providers such as Dun & Bradstreet for company identifiers. Standards on the pragmatic level are available within companies, but solutions which span across multiple organisations, such as Bolero.net which creates trust among business partners by establishing business agreements and legal frameworks, are rare. Besides the neglect of semantic and pragmatic issues in existing standards, referred to as the 'organisational gap' by (Kubicek 1992), the enforcement and the overlapping between standards remain a problem.

3.1.3 Networked Organisations and Value Model Research

A number of theories explain the emergence and success factors of new types of networked organisation and value models. Important scientific contributions have come from transaction cost theory (Williamson 1989), organisational theory (Sydow 1992, Snow et al. 1992), new institutional economics (Malkin 1995, Williamson 1991), coordination theory (Malone and Crowston 1994), business networks and information management (Malone 1987, Klein 1996, Wigand et al. 1997). These theories provide valuable input into defining business interoperability by identifying different forms of

networked organisations and defining models, methods and theories for setting up and managing interorganisational relationships. However, these theories usually do not link the design of interorganisational relationships to the design of information systems. They also lack supporting management techniques (LI 2005).

3.2 Contribution to Business Interoperability

The review of the existing approaches (c.f. Figure 2) reveals that existing interoperability frameworks mostly cover technical aspects of interoperability. They do not link technical interoperability to business aspects, such as the alignment of collaborative business processes or management issues in networked organisation. Research on networked organisations and value models covers strategic and organisational aspects of forming new models of collaboration. However, it does hardly take into account the complex issues in process and system design resulting from an increasing number of interorganizational relationships. This leads to the conclusion that a systematic analysis on business issues associated with interoperability of organisations is currently lacking.

		Domain		**Interoperability - Subject matter**								
							Information Systems					
		Industry	Region	Networked organisation forms	Network management	Business processes	Architecture	Data Syntax / Semantics	User Interface	Security	Software	Governance
Frameworks	IDEAS	G	R	M			M	M				
	EIF	I	R			R	R	R	R	R	R	
	eGIF	I	C				RP	SRP	R	RP		P
	LISI	I	C			MR	MR	MR	R	R	R	H
	EICTA	I	R				R	R			R	R
Standards	Catalog standards (e.g. BMECat, …)	G/I	G					S				
	Identification standards (e.g. EANCOM, EPC Global, …)	G/I	G/R					S				
	Classification standards (e.g. UN/SPSC, ecl@ss, SIC, …)	G/I	G/R					S				
	Message standards (e.g. EDIFACT, cXML, Chem eStandards, …)	G/I	G					S				
	Process standards (e.g. CPFR, RosettaNet, …)	G/I				S		(S)				
Net-worked Organi-sations	Business Networking	G	G	MH	M	MH	MH	MH				
	Networkability	G	G	M	M	M	M					
	Transaction Costs	G	G	MT								
	Coordination Theory	G	G			M						

Domain - Industry:
G - Generic
I - Industry-specific

Domain - Region:
G - Global
R - Regional
C - Country-specific

Interoperability - Subject Matter and Contribution to Solving Interoperability Issues
R - Recommendations
P - Policies
M - Conceptual Model
T - Theory
S - Standards
H - Methodology

Figure 2: Existing Approaches to Interoperability

Combining the different approaches to interoperability, a number of fundamental artefacts describing technical and business interoperability can be derived. These artefacts are illustrated in Figure 2 and will form the basis of our Business Interoperability Framework.

4. Business Interoperability Framework

4.1 Requirements

Business interoperability describes the business relationships between an enterprise and its external partners, e.g. customers, suppliers or service providers. The objective of the Business Interoperability Framework (BIF) is to describe the relevant artefacts describing the interoperability of this enterprise. Consequently, the BIF takes an enterprise-centric approach and assumes that an enterprise may influence its business interoperability, e.g. by choices in the organisational design or information system design.

To this purpose, it has to fulfil the following requirements:

- As a comprehensive framework, the BIF defines the relevant artefacts which constitute business interoperability, i.e. the different aspects of interorganisational design. This goes beyond the technical aspects, e.g. platforms, communication protocols, messages or data standards, and includes aspects of business processes and strategy.
- In order to assess the level of business interoperability of an organisation, the BIF has to operationalise the elements of business interoperability. Ideally, the BIF would comprise a set of criteria which are well-described and measurable and distinguish between higher and lower levels of business interoperability.
- Serving as a guideline towards excellence, the BIF has to characterise different options of interorganisational design and allow for identifying areas for improvement.
- The BIF has to take into account that interoperability requirements may differ between organisations. Since value chain or industry structure may impact the required level of interoperability, the highest level of business interoperability does not always constitute the optimum level.

4.2 Building on Contingency Theory

The BIF is based on the assumptions (1) that the maximum level of business interoperability does not necessarily represent the appropriate level in a specific business relationship and (2) that the appropriate level of business interoperability occurs if the design of interorganisational relationships "fits" external factors, e.g. environmental as well as business strategy. Similar dependencies have been outlined by the Contingency Theory of Organisational Design. (Donaldson 2001) states that the relationship between some characteristic of an organisation (variable X) and its organisational effectiveness (variable Y) is determined by contingency factors (variable W). Figure 3 exemplifies this correlation: An organisational structure (e.g. hierarchical, organic, bureaucratic or functional) which "fits" the contingency factors, such as size of the organisation, environment or organisational strategy, is more effective with regard to efficiency, profitability or innovation rate. (Donaldson 2001) distinguishes contingencies within (e.g. task uncertainty, task interdependence) and outside (e.g. environmental uncertainty) of the organisation. Consequently, if the contingency, its value and its influence on the organisational effectiveness is known to the organisation, the organisation is able to adapt its organisational design (e.g. its structure) and thereby increases its performance. On the other hand, if the organisational structure "misfits" the contingency, a negative impact on the performance will be the result.

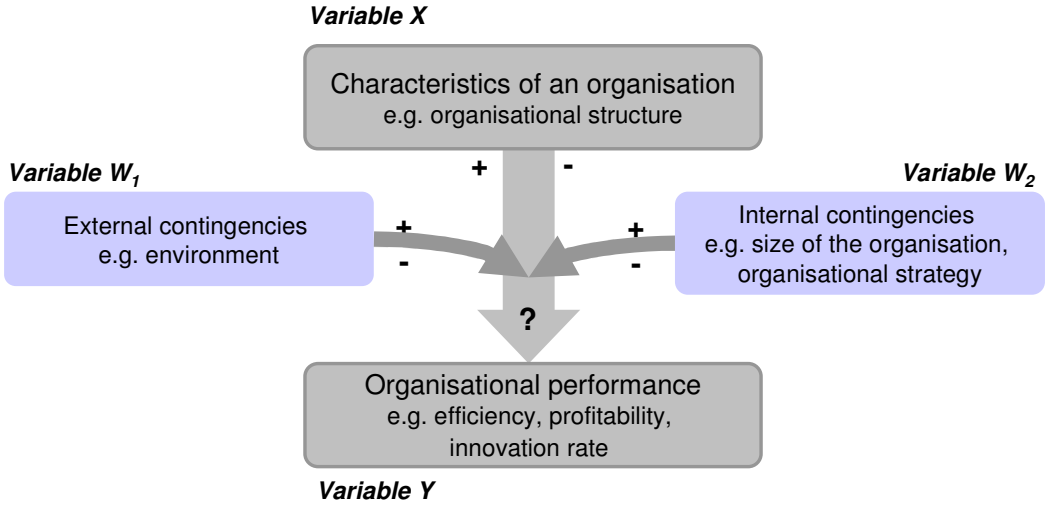

Figure 3: Contingency Theory of Organisation

Whereas universalistic organisational theories argue that the maximum level of organisational effectiveness results from the maximum level of a structural variable, e.g. specialisation, a main characteristic of the contingency theory of organisations is that it does not assert one best strategy to organise: "Contingency theory (…) sees maximum performance as resulting from adopting, not the maximum, but rather the appropriate level of the structural variable that fits the contingency. Therefore, the optimal structural level is seldom the maximum, and which level is optimal is dependent upon the level of the contingency variable." (Donaldson 2001, 4) This view is also shared by (Daft 2004) who defines organisations as "(1) social entities that (2) are goal-directed, (3) are designed as deliberately structured and coordinated activity systems, and (4) are linked to the external environment." (Daft 2004, 11). Two aspects of this definition are particularly valuable for business interoperability: Organisations are designed by purpose, i.e. the top management decides how the structure of the organisation ought to be and is able to adopt and shape the organisation in a way that it becomes interoperable. On the other hand, organisations are open systems that "must interact with the environment to survive" and "must continuously adapt to the environment" (Daft 2004, 14).

Applied to business interoperability, we consider the design of relationships with external business partners as a characteristic of the organisation (Variable X). The effect on the organisation performance (Variable Y) depends on contingencies within the organisation (e.g. cooperation model, Variable W_2) as well as outside of it, i.e. environmental contingencies (e.g. industry dynamics, legislation, Variable W_1). Following this concept, the maximum interoperability level is not necessarily the appropriate or optimum level. In a specific collaboration scenario, which can be characterized by a set of contingency factors, also lower levels may be sufficient (cf. Figure 4). As an example, trust between business partners does not play a decisive role in electronic invoicing scenarios, whereas it is a prerequisite for collaborative product development in the automotive industry. Companies that always seek to achieve the maximum level of interoperability can possibly misfit contingency factors, resulting in lower efficiency of business relationships, e.g. due to over-investments in interoperability.

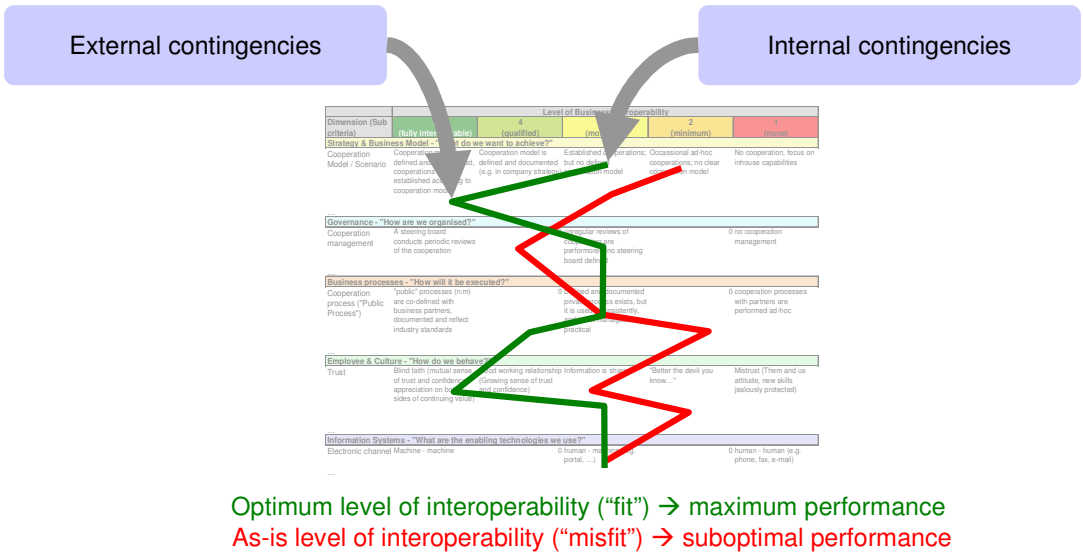

Figure 4: The Optimum Level of Business Interoperability

4.3 Structure of the Model

Reflecting existing maturity and excellence models, e.g. EFQM Excellence Model (EFQM 2006)), we suggest to structure the Business Interoperability Framework as follows:

- A number of *categories* represent the fundamental concepts of business interoperability as identified in the state of the art analysis.
- Each of these categories is operationalised by a set of *criteria* (or sub-categories) which outline the key business decisions companies have to solve when establishing interoperable electronic business relationships.
- The *life-cycle aspect* of the criteria is covered by the dimensions approach, deploy and assess & review.
- The *interoperability levels* per criteria serve as a basis for assessment and a guideline towards higher levels of interoperability.

The categories of business interoperability as well as the external and internal contingencies are illustrated in Figure 5 and will be further detailed in the following sections. Interoperability levels and the life-cycle aspects are topics for future research and will not be covered by this paper.

Business Interoperability (= Organisational design of the external business relationships)		
Category	*Perspective*	*Description*
Management of external relationships	"How do we manage and control external relationships?"	Interoperable organisations manage and monitor their external business relationships.
Collaborative Business Processes	"How do we collaborate with business partners?"	Interoperable organisations can quickly and inexpensively establish and conduct electronic collaboration with business partners.
Employees & Culture	"How do we behave towards our external business partners?"	Interoperable organisations promote relationships with business partners at an individual, team-based and organisational level.
Information Systems	"How do we connect with business partners?"	Interoperable ICT systems can be linked up to other ICT systems quickly and inexpensively and support the cooperation strategy of the organisation.
Contingencies (= Factors which impact the organisational design)		
Category	*Perspective*	*Description*
Cooperation Model (internal)	"What is the strategic intent of cooperating with external partners?"	Business strategy and cooperation model impact the required level of business interoperability.
Collaboration Space (external)	"Which baseline exists for collaborating with business partners?"	The collaboration space comprises proven cooperation models, processes and infrastructure which are available in the specific context.
Industry and general environment (external)	"Which environmental factors affect the external business relationships?"	Industry dynamics, legislation and other environmental factors determine requirements to business interoperability.

Figure 5. Business Interoperability Framework – Categories and Contingencies

4.4 Category "Management of External Relationships"

Management of networks figures among the most important success factors highlighted by many authors (Daft 2004, Schuh et al. 2005). It starts with planning and defining the cooperation, e.g. selection of partners and contractual agreements, and covers all aspects of realisation, implementation and monitoring of the cooperation. The BIF includes the following criteria with regard to "Management of External Relationships":

- *Cooperation process:* Guidelines for initiation, realisation, control and monitoring of the cooperation exist and are applied.
- *Cooperation targets:* Plans and objectives that partners pursue in the cooperation, are defined, reconciled with partners and monitored.

4.5 Category "Collaborative Business Processes"

In many B2B relationships, responsibilities of partners are unclear and activities are performed ad-hoc, which results in resource conflicts as well as coordination effort.

Business interoperability builds on the vision that companies can quickly and inexpensively establish and conduct a business relationship with corresponding partner processes. Prerequisites are the clarification of responsibilities between the business partners, e.g. by agreements on collaborative business processes, as well as the creation of a common terminology (Alt 2006, Clark and Stoddard 1996). Since cross-organisational business process design tends to be complex and not very practicable, the BIF builds on the concept of "Public Processes". Public processes define the inputs and outputs in cross-organisational business processes in the sense of loosely coupled interfaces, thereby hiding all private details to the business partners.

The BIF includes the following criteria with regard to "Collaborative Business Processes":

- *Public process*: Business partners can rely on a clear and well documented public collaboration process that is practical and reflects industry standards. In the vision, this public process should not be subject to lengthy bilateral discussions, but are applicable in a broader context (m:n instead of bilateral agreements).
- *Process visibility*: Business partners gain a certain visibility of the corresponding business processes which allows them for better planning and aligning their private processes.
- *Business semantics*: The semantics main activities, documents / messages and master data are defined, commonly accepted and reflect industry standards.

4.6 Category "Employees & Culture"

Networkable enterprises promote cooperation by being open to change and by basing cooperation between business partners on a relationship of trust instead of mutual checks. In practice, collaboration cannot be neither ordered nor imposed on someone. Mechanisms to reach a climate of trust and confidence are openness, identification and control of goal conflicts as well as trust creating measures. Since organisations tend to expose their internal complexity to their business partners, partnership management becomes more important with an increasing number of external relationships. As a result, a clear communication route between the partners, which is not overly dependent on key individuals, is necessary. This is facilitated by specific roles which serve as contact points for external partners as well as communication paths, e.g. escalation procedures for the early identification of conflict.

The BIF includes the following criteria with regard to "Employees & Culture":

- *Trust*: Business partners cooperate in a climate of trust and confidence.
- *Partner management*: Specific relationship roles (e.g. partner managers) are introduced within the organisation and well defined communication paths will be established.

4.7 Category "Information Systems"

The core of the Business Interoperability Framework describes the organisational design of a company with regard to the external IT-supported relationships. In this context, the category "information systems" is considered an integral part of the organisational design. This reflects a business driven view on IT. With regard to the level of technical integration, different interaction types with external partners can be realized (McAfee 2005, Reimers 2001):

- *"human-to-human"* describes traditional forms of interacting between humans which may be supported by fax, phone, or e-mail communication.

- *"human-to-machine"*: Customer or supplier portals bundle data and applications on the basis of users and roles, and thus support human-to-machine connections with external partners.
- *"machine-to-machine"* denotes consistently automated processes and thus an interorganisational linkage of applications. EDI is the standard example for machine-to-machine interaction, but has been excelled by XML and internet technologies.

Today, portal solutions represent the dominant collaboration strategies as they have the lowest integration requirements. In the medium- and long-term, companies will prefer to directly link their applications with those of their business partners. Since information systems are not as flexible as humans in interpreting documents, these higher levels of integration are associated with the need for additional agreements. These agreements have to go beyond the basic transport level, e.g. use of standard internet protocols such as HTTP, and cover payload (e.g. data definitions and document syntax defining the contents and structure of messages) as well as process-level alignment (e.g. sequence, exceptions). Until now, standardisation has only partly been successful in creating this common terminology, since many standards, including XML and core Web Service standards, relate only to the syntactical layer. In the future, service-oriented architectures could promote semantic integration by providing standardised interfaces which follow industry norms (Papazoglou and Georgakopoulos 2003). An additional factor in B2B relationships is the necessity to conduct transactions over the Internet that meet user's privacy and security requirements as well as existing e-business legislation. This typically involves questions of authorisation, authentication, encryption etc.

The BIF includes the following criteria with regard to "Information Systems":

- *Type of interaction*: The interaction type describes the level of technical process integration (human-human, human-machine or machine-machine).
- *Connectivity*: A high connectivity is achieved by replacing individual connections (1:1) with m:n connections.
- *Security & Trust:* The ability to conduct transactions over the internet that meet the business partner's privacy and security requirements as well as existing e-business legislation.

4.8 Contingencies

The cooperation model, which is a result of the business strategy, as well as the general and industry environment are considered contingencies since they both impact the enterprise's appropriate level of business interoperability.

4.9 Cooperation Model (Internal Contingency)

The cooperation model determines coordination requirements and interaction intensity as well as the relevant network of business partners. As outlined in Section 0 existing research on networked organisations provides input for characterising the nature of the cooperation model.

***Table 1**: Criteria "Cooperation Model (Internal Contingency)"*

Criteria	Description / Possible Values
Cooperation scenario	e.g. Collaborative Product Design
Cooperation target	Develop new resources with existing core competencies in a new business segment (→ virtual organising, insourcing) Externalise resources with non-core competences in an old business segment (→ outsourcing) Pool resources with partners in a new business segment without having all required core competencies to be competitive in this field (→ virtual organising) Strengthen resources with an existing core competence in an old business segment (→ insourcing) …
Cooperation partners	Partner type (customer, supplier, service provider, competitor) Number and size of partners
Cooperation dynamics	Stable – dynamic
Network configuration	Hierarchic – heterarchic
Initiator	Internal – external – consortium
Interdependence among cooperation partners	Pooled interdependence – sequential interdependence (e.g. in supply chains) – reciprocal interdependency
Product complexity / customisation	Low – middle – high

4.9 Industry and General Environment (External Contingency)

Every enterprise is part of a specific (industry) environment and its specific dynamics (Daft 2004). Moreover it is bound to legislation and regulations set up by authorities. These external factors highly influence an enterprises internal decisions and strategies, and have an impact on its interoperability. The Business Interoperability Framework considers the industry and general environment as external contingencies which are not changeable by the enterprise.

***Table 2**: Criteria "Industry and General Environment (External Contingency)"*

Criteria	Description / Possible Values
Legislation	Compliance with national (including city, state, federal) and international laws and legislation
Regulation	Existence of industry-specific, national or international regulation and standards
Industry dynamics	High – middle – low

4.10 Collaboration Space (External Contingency)

The collaboration space relates to the existing baseline for electronic collaboration in the specific context of the networked enterprise. This includes experiences with cooperation models and processes, the use of standards or the availability of industry platforms which may ease m:n integration.

***Table 3**: Criteria "Collaboration Space (External Contingency)"*

Criteria	Description
Public process	Existence of commonly accepted public processes, e.g. VMI in the chemical industry.
Business semantics	Availability of standards and their maturity with regard to defining semantics of the specific domain
Sociocultural aspects	Degree to which electronic communication and partnerships are tolerated or postulated by partners and organisations
Dominant interaction type	The dominant interaction type (1:1 – 1:n – m:n) is depending on the availability of platforms that provide for m:n scalability (e.g. SWIFT in the financial industry).
Technical infrastructure	Availability of communication infrastructure (e.g. Internet, private networks)

5. Conclusion and Outlook

Organisations that wish to engage in IT-supported business relationships face major challenges related to interoperability. Whereas the technical aspects of interoperability have gained wide attention in research and standard initiatives, business interoperability is not yet thoroughly analysed. This article contributes to filling this gap by outlining a Business Interoperability Framework (BIF):

- Based on the existing approaches to interoperability, the BIF comprises the relevant artefacts which constitute business interoperability. It operationalises them in terms of categories and criteria.
- As a comprehensive framework, the BIF takes into account that requirements to business interoperability vary between organisations. Using the Contingency Theory of Organisational Design. (Donaldson 2001) , it defines a set of internal and external contingencies that affect the appropriate level of business interoperability.

In its current version, the Business Interoperability Framework can be used in order to

- describe the level of business interoperability of an enterprise,
- compare the level of business interoperability between different enterprises,
- and explain different levels of business interoperability by different internal and external contingencies.

If complemented by a performance assessment, the BIF can assist in identifying the "fit" or "misfit" of the interorganisational design of business relationships given the internal and external contingencies.

So far, the BIF represents a generic framework which has been built based on the analysis of existing models in the area of networked organisations, interorganisational process and system design as well as interoperability. Following the design-science approach and process as outlined by (Hevner et al. 2004), further research is necessary in order to justify and evaluate the model. Its' application to specific cases or an empirical analysis will allow for validating and further enhancing the framework. In order to derive meaningful results, it may be helpful to narrow the scope of the model to a specific cooperation model (e.g. supplier integration) or specific industry contexts.

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