THE ENTERPRISE INTEROPERABILITY CENTER – AN INSTITUTIONAL FRAMEWORK FACILITATING ENTERPRISE INTEROPERABILITY

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Abstract

During the last years, electronic collaboration between enterprises has significantly increased. To seamlessly integrate applications across company boundaries, all stakeholders have to adhere to common standards. Currently, cross-organizational business relationships are setup based on a plethora of standards that involve different technical representations, semantics, process specifications and also vary with respect to scope and granularity. The resulting business standards dilemma prevents corporations from seamlessly cooperating with each other. State-of-the-art standards tackle parts of this interoperability issue by providing flexible and semantically more precise specifications, but have not yet been widely adopted. The abundance of different standards, but also the frequently divergent interests of stakeholders involved in the development and adoption of standards prevents enterprises from seamlessly interconnecting their applications. In this work, we leverage institutional economics to elaborate on a novel approach to facilitating enterprise interoperability. Not the creation of yet another standard, but the establishment and fostering of a proper institutional framework will significantly reduce the stakeholders' uncertainty in deciding for and adopting a standard and thus drive seamless cross-organizational interoperability. A key outcome of the ATHENA-project, the Enterprise Interoperability Center (EIC) is expected to provide such an institutional framework. This work is devoted to analyzing this center on the basis of institutional economics in order to derive essential recommendations for it to emerge as the prevailing reference point for e-Business standards and to thus accelerate the seamless and efficient electronic collaboration between enterprises.

Keywords: Enterprise Interoperability, Innovation Diffusion, Cross-organizational Business Collaboration, Enterprise Interoperability Center, EIC, Institutional Economics, Institutions, Institutional Change, e-Business Standards, Development and Adoption of Standards

1 INTRODUCTION

During the last years, electronic collaboration among enterprises has significantly increased (Ruggaber 2005, European Commission 2005). Companies that adopt e-Business solutions may capitalize from reduced operating costs and improved gains, increased customer satisfaction and retention, faster and more efficient internal processes, improved supply chain integration, and technological advancements (Hoyer 2006, Malone 2001, Porter 2001). To seamlessly integrate applications across company boundaries and to thus realize networked organizations, all stakeholders have to adhere to common protocols, processes and document standards. As described in (Stuhec 2005), cross-organizational value chains are currently being established on the basis of long-term cooperation contracts and Service-level Agreements (SLAs). Such agreements are often setup on the basis of a wide variety of existing industry standards that involve different technical representations, semantics and process specifications. Frequently, additional proprietary adaptations are applied to those standards in order to meet individual business requirements which lead to a business standards dilemma (Stuhec 2005, Chau 2001) and business collaborations tend to become unmanageable and hardly changeable and prevent corporations from seamlessly collaborating with each other. A further drawback of the majority of existing standards for performing electronic business transactions is the lack of semantic integration. Different perceptions of the same piece of information in different systems and applications have not been addressed by most existing e-Business standards and represent considerable "silo walls" (Sippl 2006) that need to be taken down on the way to true enterprise application interoperability. State-of-the-art standards such as RosettaNet (Sundaram 2001) are more precise with regard to the definition of both business data and processes and also allow for more flexibility, but have not yet been widely adopted. Not the creation of yet another e-Business standard, but the joint agreement and implementation of an adequate standard among a critical mass of companies will foster enterprise interoperability.

The Enterprise Interoperability Centre (EIC) has been established in April 2006 as a non-profit organization by the EU project “ATHENA” [1] under the FP6 Information Society Technologies (IST) Programme which addresses the key challenges inherent to enterprise interoperability. Its major goal is to address the above mentioned challenges by establishing, promoting and providing a hub for debate on interoperability issues and to act as a provider of commonly accepted rule sets for implementing cross-organizational electronic interconnections. Instead of defining yet another messaging standard, the EIC follows a consensus-driven approach that aims at providing users a platform to jointly create reference business processes and documents that work as templates for the setup of cross-organizational business collaborations.

In this work, we leverage institutional economics as a theoretical groundwork to elaborate on this center which can be considered as institutional framework rather than a conventional organization. The EIC differs from classical organizations as it is an abstract entity that does not act in a wealth-maximizing fashion while adhering to pre-determined constraints, but rather prescribes formal constraints itself. We derive essential recommendations for this center on how to reduce uncertainties involved in electronic interaction of enterprises and to sustainably prevail among the different already existing institutions. The remainder of the paper is structured as follows: Chapter two presents the challenges inherent to cross-organizational business collaboration and elaborates on the major classes of stakeholders involved in the development and adoption of related standards. In Chapter three, we introduce the “new” institutional economics as published by North (North 1990) as the research approach which underlies this work. Chapter four presents the EIC as a novel, institutional approach to facilitating enterprise interoperability and also provides recommendations for this institution on how to operate as effectively as possible. Chapter five concludes the work with a brief summary.

[1] http://www.athena-ip.org/

2 CHALLENGES OF INTER-ORGANIZATIONAL ENTERPRISE INTEROPERABILITY

Despite the rapid emergence of new technologies, application interoperability remains an unreached goal for numerous companies. However, on-demand and short-term product development, increasing global competition and highly dynamic corporate structures foster the need for companies to be able to quickly and efficiently setup seamless cross-organizational supply chains. Such inter-company business processes in many industries have become complex, involving multiple tiers of globally distributed companies that usually adhere to a multitude of different e-Business standards. The agreement on a commonly used standard that provides a basis for setting up such business processes and defines the structure and semantics of the exchanged business documents is a crucial prerequisite for seamless enterprise interoperability. The Boston-based Yankee Group (Yankee Group 2006) performed a survey among enterprises about their use of business-to-business (B2B) standards, and 26 percent of respondents cited there were too many vertical industry-specific standards as the second-largest impediment - after cost - to the adoption of B2B standards. The lack of commonly accepted inter-company processes and the inconsistent implementation of standards prevent from seamless m:n connectivity and increase the effort for setting up electronic collaboration in particular with a larger number of partners. Often, bilateral and thus proprietary agreements on the details of a cross-company business process prevail, leading to a rising number and complexity of electronic business relationships.

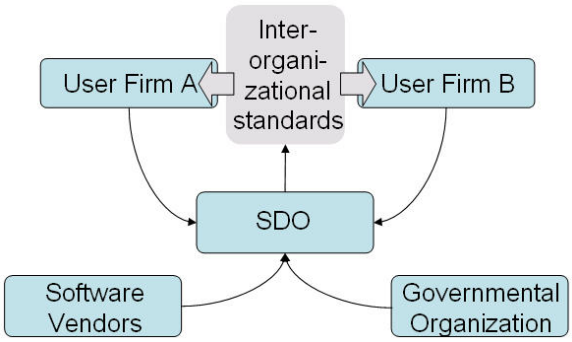


Figure 1: Development of inter-organizational standards (Löwer 2006)

The involvement of different stakeholders who pursue potentially different goals in the development and adoption of inter-organizational standards as depicted in Figure 1 represents a further major barrier to standards adoption. **User Firms** represent the first stakeholder: They are supposed to implement the standards in order to connect their applications across company boundaries. Depending on the alignment of user interests and the expected benefits from participation in standardization efforts, their strategy may be to drive, to only observe, to adopt or to even contribute to a standard (Löwer 2006). Users might decide to play a merely observing role in case the involved Standards Development Organization (SDO) does not cover "the industry of the firm in question, just as CIDX targets the chemical industry, but not the requirements of the related pharmaceutical industry...If the firm expects the costs of actively changing the situation to be higher than its benefits, it will decide only to observe the existing SDO's activities, while using proprietary solutions for its IO relationships."(Löwer 2006, p. 220) In case several users decide to only observe the development of a standard, its universal validity and applicability will be limited and only few players may benefit from a common solution to some extent. **SDOs** build a highly interwoven mesh of competing players who pursue partially overlapping activities: According to (Löwer 2006), they may coordinate the development of a new specification, participate in other SDOs or promote the adoption of its specifications. SDOs currently suffer from the lack of a clear coordination of the relationships and

fields of responsibility between them. Also, a "reasonable intellectual property rights policy is a critical factor for an SDO's success. If contributors have to transfer all the rights of their contributions or can even be sued for damages caused by their specification, the motivation to participate will be very low." (Löwer 2006, p. 226) **Software vendors** are part of this game as they are supposed to incorporate the standards into the solutions they sell to the end-users. As opposed to users who only need to consider certain industry-specific SDOs, such vendors have to cope with the almost unmanageable variety of different SDOs, which are active in very different specification fields. "Especially large vendors that cover almost any industry should systematically decide on their participation in different SDOs" (Löwer 2006, p. 229). Again, depending on the alignment of interests and the benefit of participation, software vendors may take over an observing, an adopting, a contributing or a driving role. Last, **governmental organizations** also impact the development of IO specifications as they can impose specifications as norms to enforce their acceptance, support SDOs to lower costs of the standards development and coordinate the different SDOs' work to prevent collusion between them. As they frequently pursue their very own interests and aim at developing or driving standards that match their specific requirements (e.g. for public procurement purposes), they act similar to the user firms described above.

Summing up, the high number of partly overlapping standards of different scope and granularity as well as the complex interrelationship between stakeholders involved in the development and adoption of e-Business standards prevents users from seamlessly interconnecting their enterprise systems. An agile intermediary framework which facilitates the adoption of existing standards, mediates between the different stakeholders and incorporates incentives for all of them to actively engage is now required. As mentioned above, an important factor decelerating the adoption of a common e-Business standard is the fear of a standard not to become widely accepted. Therefore, a coordinating entity is needed that acts as a trustable standardization reference point which consequently follows the goal to reduce uncertainty involved in the development and adoption of e-Business standards.

3 RESEARCH APPROACH: INSTITUTIONAL ECONOMICS

This section is devoted to introducing **institutional economics** as an underlying framework for understanding the emergence, characteristics as well as the change of institutions. In chapter four, we will apply this theory in a practical case and argue that the EIC can be regarded as an institution. Finally, we try to derive implications of this classification as an institution on how the EIC should be positioned and operated in order to prevail among the different already existing institutional rule sets and to optimize the reduction of transaction costs among users firms.

First of all, it must be conceded that "institutionalism lacks a systematic core theory" (Hodgson 1998, p. 174). There are numerous approaches to the institutional phenomenon existing whose initiators have failed to agree on a consistent set of theoretical building blocks. In this work, we decided to leverage the highly influential "new" institutionalists such as North (North 1990), Posner (Posner 1973), Schotter (Schotter 1981) and Williamson (Williamson 1975). In (Hodgson 1998), Hodgson provides an excellent overview of the historical development: He sketches how institutional economists proceed in practice, defines and elaborates the core concepts of habits and institutions, as rooted in the early institutionalist theory of Veblen and Commons, elaborates on the new institutionalist vein, and presents real-world cases where individual agents need to rely on constraints. "Not only are habits and rules ubiquitous, but we are typically required to rely on them whether or not (bounded) optimization is possible" (Hodgson 1998, p.168). The emergence and the characteristics of institutions represent a cornerstone of institutional economics and shall be presented in the following paragraph. Due his outstanding influence in this scientific field of activity, we adhere to North's (North 1990) approach which relies on two major facts which lead to the establishment of institutions:

The individual agents' spectrum of **motivations** and their **inability to comprehensively decipher the environment** lead to uncertainties in their mutual interaction as they cannot be considered as fully rational individuals. Second, transaction costs for measurement and enforcement represent significant

hurdles to efficient interaction. “To explore the deficiencies of the rational choice approach, both the individual agents’ motivation and their ability to deciphering the environment must be investigated” (North 1990, p. 20). North elaborates on the human motivation and argues that individuals do not merely aim at maximizing wealth and utility, but also frequently show “altruism and self-imposed constraints, which radically change the outcomes with respect to the choices that people actually make” (North 1990, p.20) Uncertainties in the interaction of individual agents also arise from the agents’ computational limitations which are determined by the “capacity of the mind to process, organize, and utilize information.“ (North 1990, p. 25) “In practice, individual agents cannot be a “lightning calculator”, quickly, effortlessly, and inexplicably finding the optimum just as we can readily locate the lowest point of a U-curve in a simple textbook diagram. Even with given and unambiguous information, complex optimization problems typically involve difficulties not only of specification but of computability.” (Hodgson 1998, p. 187) Decision-making in the context of complexity or uncertainty requires individuals to rely on relatively simple procedures and decision-rules which structure the interaction of agents and limit their choice sets (Simon 1957). On the one hand, North’s theory of institutions is constructed from a theory of individual agents’ behaviour which focuses on individual motivation and on the inability of the individual to comprehensively and objectively decipher the environment. On the other hand, it builds upon a **transaction cost theory of exchange**. North quotes the costs that incur when measuring the value of exchanged goods as well as enforcement costs as major components constituting transaction costs. “Commodities, services, and the performance of agents have numerous attributes and their levels vary from one specimen or agent to another. The measurement of these levels is too costly to be comprehensive or fully accurate.” (North 1990, p. 29) Information asymmetries increase the uncertainty involved in measuring the value of exchanged goods or services. Enforcement costs incur for monitoring and metering the various attributes that represent the performance of agents and thus contribute to transaction costs as well.

As a consequence of the **uncertainties** involved in the interaction of individual agents (due to the unpredictable behaviour, the inability to comprehensively and objectively decipher the environment as well as the resulting high transaction costs), rules and structuring frameworks evolve which North refers to as institutions. Institutions represent the structure for interaction between agents that in turn determines the cost of transaction and thus also impacts an economy’s efficiency. “How well institutions solve the problems of coordination…is determined by the motivation of the players (their utility function), the complexity of the environment, and the ability of the players to decipher and order the environment (measurement and enforcement).” (North 1990, p. 34)

After elaborating on reasons for institutions to emerge, their **core characteristics** shall be presented. Many definitions of institutions exist: Schotter (Schotter 1981, p. 11) considers them as “general regularities in social behavior”, while North (North 1990, p. 3) regards them as “the rules of the game in society or…the humanly devised constraints that shape human interaction.” We have identified some core characteristics of institutions which are common to most of the highly influential theories: First, they involve the interaction of agents and provide them with information. They are non-purposeful, frequently abstract entities (“the rules of the game” (North 1990)), which are created and changed by the individual agents. Despite of the possibility to change, they mostly sustain, and are sustained by, shared conceptions and expectations and have self-reinforcing and persistent qualities. The values incorporated are supposed to play a normative role and exist in the form of informal or formal constraints that need to be enforced to be effective. The **action-information loop** depicted in Figure 2 shows the interdependent relationship between agents and institutions. Individual agents require an institutional framework to reduce manifold uncertainties (such as those induced by individual motivation and limited capacity for deciphering the environment), and institutions provide information and direction to individual interaction.

It must be stressed that institutions are **different from organizations**: “A crucial distinction…is made between institutions and organizations. Like institutions, organizations provide a structure to human interaction…Conceptually, what must be clearly differentiated are the rules from the players. The purpose of the rules is to define the way the game is played. But the objective of the team within that

set of rules is to win the game – by a combination of skills, strategy, and coordination…Organizations are created with purposive intent in consequence of the opportunity set resulting from the existing set of constraints…and in the course of attempts to accomplish their objectives are major agents of institutional change." (North 1990, p.5)

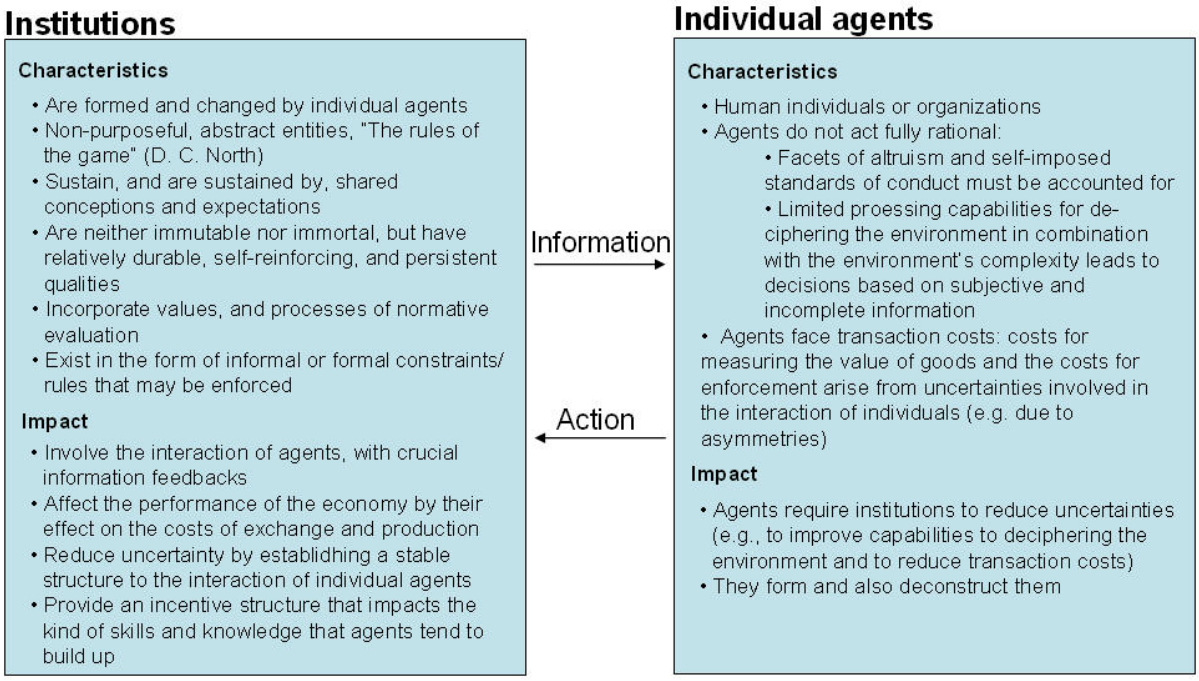


Figure 2: Action- Information loop of institutional economics

According to North, institutions can be realized in the form of **informal constraints or formal rules**. "In our daily interaction with others, whether within the family, in external social relations, or in business activities, the governing structure is overwhelmingly defined by codes of conduct, norms of behaviour, and conventions." (North 1990, p. 36) These informal constraints help to reduce the complexity and uncertainty in the interaction of agents. "The difference between informal and formal constraints is one of degree…Formal rules can complement and increase the effectiveness of informal constraints. They may lower information, monitoring, and enforcement costs and hence make informal constraints possible solutions to more complex exchange." (North 1990, p.46) North thereby envisions a "continuum from taboos, customs, and traditions at one end to written constitutions at the other" and differentiates between political/ judicial rules, economic rules and contracts.

One further important point is the **incentive structure** of institutions which heavily impacts the direction of knowledge and skills that agents will build up and thus may influence the success of whole industries. Individuals and organizations are considered "purposive entities designed by their creators to maximize wealth, income, or other objectives defined by the opportunities afforded by the institutional structure of the society." (North 1990, p.73) North argues that "the institutional framework will shape the direction of the acquisition of knowledge and skills and that direction will be the decisive factor for the long-run development of that society…If the firm or other economic organization invests in knowledge that increases the productivity of the physical or human capital inputs or improves the tacit knowledge of the entrepreneurs, then the resultant productivity increase is also consistent with the growth of the economy. But what if maximizing behavior by the firm consists of burning down or sabotaging competitors…?"(North 1990, p.78).

After elaborating on the emergence and major characteristics of institutions as defined by North, we briefly present agents, reasons and typical patterns of **institutional change**. As North states, organizations "and their entrepreneurs engage in purposive activity and in that role are the agents of,

and shape the direction of, institutional change." (North 1990, p.73) The individual agents respond to incentives incorporated in the institutional framework. Fundamental **changes of relative prices** and changes in individual taste are quoted as the two major triggers for institutional change. The above mentioned wealth-maximizing behavior of firms can take the form of decision-making within the existing set of constraints or of changing the constraints. Organizations may acquire the necessary skills and knowledge to efficiently deal with an existing institutional framework. But an alternative is to devote resources to changing the institutional constraints. Which direction the individual agent takes depends upon its subjective perception of the payoffs. Individual agents compete to benefit from opportunities existing under the given institutional structure. If organizations perceive that they have better opportunities under a different set of rules (where the relative price of interacting is significantly lower than in the existing one), then they will devote resources to changing rules in case they recognize reasonable possibilities of success. As North states, in the modern U.S. economy, economic organizations devote resources to both dealing with existing constraint frameworks and to modifying them. As a case study, North (North 1990, p.84) argues that the shift from property rights in human beings to property rights in land in the medieval Europe was a result of an increase in population and in the scarcity of land which in turn increased the relative price of land. To change and enforce property rights in land enabled the creators of this formal institution to securely invest into land and subsequently benefit from the related rights. An important question that must be posed in this context is: When do such relative price changes lead to institutional change and when are they simply a source of re-contracting within the existing institutional framework? In the case of **institutional equilibrium** (North 1990), where with regard to a given bargaining strength of the players and the set of contractual bargains that constitute the total economic exchange, none of the stakeholders would consider it advantageous to spend resources into restructuring the agreements and resulting constraints. Institutional change is caused in case a "change in relative prices leads one or both to an exchange, where it is political or economic, to perceive that either or both could do better with an altered agreement or contract. An attempt will be made to renegotiate the contract. However, because contracts are nested in a hierarchy of rules, the renegotiation may not be possible without restructuring the higher set of rules (or violating some norm of behavior). In that case, the party that stands to improve his or her bargaining position may very well attempt to devote resources to restructuring the rules at a higher level." (North 1990, p.86). As the break-up of slavery shows, not only the change of relative prices may act as trigger of changed constraints. It was rather the intellectual power of the antislavery movement per se (which North refers to as "**taste**") which enabled and also forced the politicians to act. In this particular case, the costs for changing constraints and rules were not too high as the democratic political institutional framework allowed people to freely express their opinions without having to fear any form of repression.

Institutional change has been proved to be **slow and incremental** in most cases. Only wars, revolutions or natural disasters may trigger disruptive changes. "The process of change is overwhelmingly an incremental one…Change typically consists of marginal adjustments to the complex of rules, norms, and enforcement that constitute the institutional framework. The overall stability of an institutional framework makes complex exchange possible across both time and space." (North 1990, p.83) North particularly emphasizes how economies of scope, complementarities, and network externalities of an institutional matrix make institutional change mostly incremental and path dependent. Path dependence occurs because the direction of institutional change will be impacted by the knowledge and skills that the agents have invested in beforehand. Besides following consistent paths, change will mostly be incremental because disruptive changes would create strong opposition among the individual agents. Institutions are established to remove uncertainties in individual interaction and therefore are supposed to provide stability to a certain degree. According to North, stability is achieved by a set of constraints nested in a hierarchy, where each level is more costly to change than the previous one.

4 THE EIC AS AN INSTITUTIONAL FRAMEWORK AND DERIVATION OF RECOMMENDATIONS

The goal of this section is to apply institutional economics to the case of the Enterprise Interoperability Center (EIC) and to derive recommendations for this institutional framework to effectively reduce uncertainties in electronic interaction between enterprises as well as to sustainably prevail among the different existing other institutional frameworks.

4.1 The Enterprise Interoperability Center: An Institutional Framework

Can we **transfer institutional economic theory to the field of information technology**? To review the major assumptions of new institutionalism as promoted by North: The varying and partly irrational motivation of individual agents and their inability to comprehensively decipher their environments, taken together with high transaction costs due to measurement and enforcement costs lead to uncertainties in the interaction of agents. Institutions emerge which may exist in the form of informal or formal constraints that need to be enforced to be effective and can be considered as the rules of the game which agents have to comply with. Agents are assumed to act in a wealth-maximizing fashion and thereby are impacted by the incentives inherent to the institutional framework. This framework is changed by individuals or organizations primarily as a consequence of a change in taste or due to fundamental changes of relative prices, while changes mostly occur incrementally rather than in a disruptive manner.

The Enterprise Interoperability Centre (EIC) has been launched in April 2006 by the EU project “ATHENA” under the FP6 Information Society Technologies (IST) Programme which addresses the key challenges inherent to enterprise interoperability. The major goal of the EIC is to establish, promote and provide a hub for debate on interoperability issues and to act as a provider of commonly accepted rule sets for implementing cross-organizational electronic interconnections. Within a five year time horizon, the EIC is envisioned to become a permanent European hub with a critical mass of participants that acts as a reference point in enterprise interoperability in both the research and industry communities. The EIC is characterized by the following major paradigms which are also considered as key differentiators from existing standardization approaches: It is an open, neutral, credible and independent entity that encourages participation by all stakeholders in interoperability without geographic restriction, to both private and public sectors, to legal entities or private persons. It follows an end-user and consensus-driven approach as it aims at bringing users, solution providers and standards organizations together in Business Forums to analyze requirements and to define interoperability requirements for business processes. Finally, **Interoperability Profiles** will be developed consisting of consensus-based common processes in combination with selected and interpreted messaging standards, while using existing standards. EIC Interoperability Profiles also specify how open message and platform standards should be applied and interpreted to implement afore defined business processes. Profiles are intended to provide guidance regarding implementation alternatives like optional data fields or message variants. They are different from standards as they are devoted to facilitating the adoption and implementation of existing standards rather than inventing a new one from scratch. Interoperability Profiles sharpen verbal specifications and reduce ambiguities in the original specifications. Identified weaknesses or gaps are, in turn, reflected back to standards organizations by providing them with a gap report. The Forums will deliver tools, conformance testing, analysis, training and other services to facilitate broad adoption in the community. The EIC can also be considered as living system as it collects the requirements from users, encourages stakeholders to jointly work on them and produces Interoperability Profiles which are meant to be adopted by the users again. As opposed to most other entities that tackle interoperability issues, the EIC does not aim at defining yet another new and supposedly universally valid standard for implementing cross-organizational business process. Instead, it intends to emerge as and then remain a hub for continuous discussion that reflects the actual business requirements that its members and

contributors are facing. The EIC is envisioned to play a mediating role between end-users, standardization organizations and solution providers: on the one hand, the requirements identified by industry are supposed to be effectively and comprehensively communicated to standardization entities. On the other hand, the highly effective validation and implementation of standardization outputs can be realized by the mediator as well. In this way, the EIC neither acts as a standardization organization nor a user consortium but as a mediating abstract entity that brings all different stakeholders together. Figure 3 summarizes the mission the EIC is pursuing: As opposed to conventional standardization organizations which mostly develop message-oriented, vertical standards and only rarely offer specifications of collaborative business processes, the EIC facilitates the definition of uniform inter-organizational processes and provides guidelines on how to use different existing message formats in the context of these common business processes.

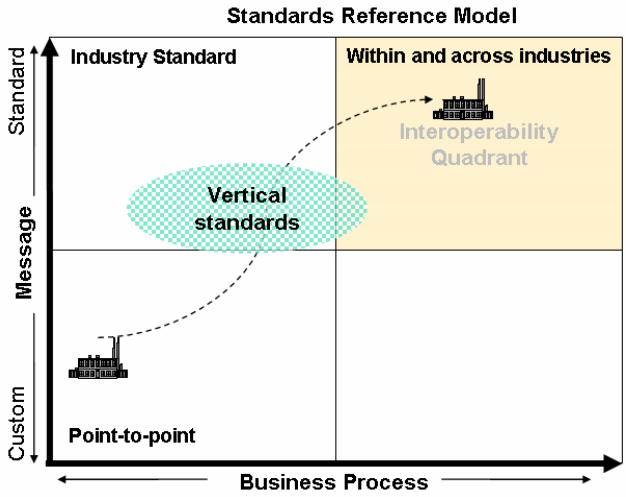


Figure 3: The EIC standards reference model

As the EIC acts as a reference point for implementation guidelines and support, for the results of standards testing, training curricula and community building as well as the results of consensus building processes between the different stakeholders, it can be considered as an **institution** in a sense as defined by the new institutionalists such as North. A wide unmanageable variety of standards exist which lead to huge uncertainty of the potential users: High costs incur for creating proprietary, bilateral solutions which are not apt for the wide mass of firms. For this reason, users face the challenge of a high environmental complexity and a limited insight into the most efficient and widely accepted way to implement cross-organizational electronic interconnections. Uniform rules and procedures need to be developed and agreed upon to simplify this process and to thus reduce the costs for interacting. Verbal specifications must be sharpened and ambiguities in original specifications must be reduced. The consequent institutional framework EIC, by structuring the interaction of enterprises, limits the choice set of the actors and thus reduces complexity and uncertainty. The EIC differs from classical organizations as it is an abstract entity that does not act in a wealth-maximizing fashion while adhering to pre-determined constraints, but rather prescribes formal constraints itself. It is in this context no new organization, but an institutional framework that provides formal constraints and thereby impacts the different stakeholders' activities. The EIC defines the rules of the game, while users, standardization organizations and governments influence and finally comply with it and in turn receive information about constraints as depicted above in the form of an information-action loop. All different stakeholders certainly significantly contribute to these formal constraints and agree on them in a consensus-driven procedure. The individual players drive the institution, but still comply with the currently existing rules to minimize transaction costs.

There is a clear **need for such an institution which is not solely operated by a government**. As argued above, governments may also act in a mediating fashion, facilitate the adoption of existing

standards and coordinate the different SDOs'activities to prevent any kind of collusion (Löwer 2006). However, governmental organizations act from a central entity's perspective and do not properly emphasize the importance of all the stakeholders' consensus. The EIC regards them as relevant stakeholders in the establishment and management of constraints and rules, but significantly extends their role as it pursues a more forum-oriented approach where highly sophisticated and motivated stakeholders are supposed to agilely agree on and prescribe common guidelines and profiles.

4.2 Recommendations

This section is devoted to presenting recommendations for the EIC as an institution to reduce uncertainties in electronic interaction of enterprises and to sustainably prevail among the different existing rule sets. First of all, we elaborate on the essential factors for the EIC to successfully establish and operate during the next years. Second, we derive implications on how to handle change from institutions theory as presented above.

As argued by North, people's "perceptions that the structure of rules of the system is fair and just reduce costs; equally, their perception that the system is unjust raises the costs of contracting (given the costliness of measurement and enforcement of contracts)." (North 1990, p. 76). The subjective perception of **fairness** of all stakeholders is crucial to facilitate their willingness to actively contribute and also adhere to the constraints and rules imposed by the EIC. As opposed to large firms, small- and medium-sized enterprises (SMEs) have only little financial or human resources available to contribute to and drive the development of standards, for example. To avoid an overwhelmingly predominant position of larger corporations and an unfair situation for the smaller stakeholders, all participants should be provided the same right to vote (independent of the number of involved representatives). The incorporation of adequate **incentives** is related to this point as user firms, for example, must receive significant return from investing in building skills and knowledge within the EIC framework. In case they do not recognize direct benefits from actively involving and complying with the given rule set, they might take over a merely observing role or invest into alternative constraint frameworks. For this reason, the free-riding of user firms who only observe and wait for other players to invest in the elaboration of a framework that reduces transaction costs is not acceptable and must be accounted for by the EIC. Only those players should benefit from the advantages of a comprehensive rule set who commit to further developing it. "The incentives that are built into the institutional framework play the decisive role in shaping the kinds of skills and knowledge that pay off" (North 1990, p. 78). The most relevant stakeholders involved in the establishment of standards as defined by Löwer (Löwer 2006), user firms, SDOs, software vendors and governmental organizations all must be provided proper incentives to actively contribute and also permanently adhere to the EIC institutional framework. User firms may influence the industry-wide adoption of standards, become first movers by participating in EIC forums and also benefit from comprehensive access to implementation guidelines and testing results. As an intermediary between the different stakeholders, the EIC allows SDOs to integrate users into development efforts and to thus incorporate industry-driven input at an early stage in order to facilitate the adoption of their products. Software vendors are provided valuable insights into the different existing SDOs and their respective activities. Due to the participation of user firms into the forums, vendors have early access to user feedback on the different standards and are enabled to take this into account earlier than their competitors. Finally, governments may use the EIC as hub for identifying proper solutions for their own purposes (e.g., public procurement).

Besides the incorporation of fairness and incentives, the actual **intent of the stakeholders**, **their capabilities** and the **complexity** of the interactions that are governed by the institution represent central prerequisites for EIC's success. "How well institutions solve the problems of coordination…is determined by the motivation of the players (their utility function), the complexity of the environment, and the ability of the players to decipher and order the environment (measurement and enforcement)." (North 1990, p.34) For this reason, potential contributors to this institutional framework should be examined with respect to their motivation and capability to actively engage in the continuous

development of the rule sets before being admitted. Also, the complexity and scope of the interactions which are subject to certain constraints should not be overwhelmingly huge. In order to avoid having too many different industries with their respective requirements comply with one single set of formal rules, focused councils with possibly different objectives should be established which ensure a feasible degree of complexity. Users as well as software vendors require pragmatic solutions for their industry rather than a complex, unmanageable framework that tries to integrate all options that could ever be relevant for some industry. As argued by Löwer, not only the subjectively perceived benefit of participating, but also the alignment of the stakeholders' interests plays a critical role in encouraging all different stakeholders to contribute to an agreement on or the development of an e-Business standard. The alignment of an overwhelmingly huge, cross-sectoral group of users, software vendors, SDOs and governmental organizations may be hard to achieve. For this reason, ensuring the **alignment of focus and objectives** of groups of stakeholders represents an essential prerequisite of EIC's success.

After providing recommendations on how to emerge as a strong institutional framework that enables its users to reduce transactions costs, we turn to elaborating on **institutional change** and which approach the EIC specifically should follow to sustainably take over a prevailing role. First of all, a state of **institutional equilibrium** should be obtained. Interests of stakeholders mostly differ to some extent. However, as argued above, given the bargaining strength of the stakeholders and the set of contractual bargains that constitute their interaction, none of them should find it beneficial enough to spend resources into restructuring the agreements and the underlying institutional framework. Individual agents will change institutions as soon as this is more profitable than investing in existing constraints and rule-sets. For this reason, the institution EIC must be flexible to a certain degree to be able to account for changing external requirements that may emerge as a consequence of new technologies, for example. The **permanent observation** of the surrounding relevant standards-landscape as well as other factors which might impact the equilibrium of the different stakeholders' interests is essential. As stated above, the reduction of complexity represents a key value proposition of institutions. By taking over the task of comprehensively deciphering the environment, the EIC will be recognized as an "expert" that provides optimal constraints and rules for the realization of inter-organizational electronic business relationships.

On the other hand, the EIC must take care to facilitate **incremental**, slow changes rather than permanent, disruptive modifications to ensure stability and the easy exchange between users. If major changes occur frequently, the motivation for stakeholders to adhere to this institution will be limited as they have to cope with uncertainty and may even feel wasting the resources which they devoted to gaining knowledge and skills under the existing set of constraints. "Stability is accomplished by a set of constraints that include formal rules nested in a hierarchy, where each level is more costly to change than the previous one." (North 1990, p.83) As argued by North, there should be a hierarchy of rule sets of different durability and changeability. In the EIC context, specific semantic annotations that only concern a limited number of users should be more easily changeable than the design of a central reference business process which numerous users rely on. Also, in order to avoid frightening off users, the focus of the Forums (manifested in charters) should not be changed frequently. Participants are supposed to invest in the working groups' activities and would feel wasting their resources if basic agreements are modified frequently. To identify a proper balance between flexibility and reliability of the resulting institutional framework represents a major challenge.

5 CONCLUSION

In this work, we have motivated the need for a novel approach to facilitating inter-organizational interoperability. The abundance of different standards, but also the frequently divergent interests of stakeholders involved in the development and adoption of standards prevents enterprises from seamlessly interconnecting their applications. Institutional economics provide a sound theoretical foundation for elaborating on the EIC which acts as a central reference point for user firms, SDOs,

software vendors as well as governmental organizations with the goal to reduce uncertainty involved in their mutual interaction. As argued above, the EIC can be considered a hub that provides, among others, Interoperability Profiles, implementation recommendations and testing results. In this way, it accelerates the convergence of partly overlapping and vertical standards towards a smaller number of more widely accepted and sharper specifications. A valid question is whether the institution EIC is still useful at a point of time when optimal convergence, detailing and adoption of proper standards has been reached. We agree with institutionalists such as North who promote the enduring need for institutional frameworks (such as the EIC) since environmental factors always change and must be accounted for in a proper fashion. Even if all industries have semantically precise, widely accepted standards available, the EIC plays a beneficial role for all major classes of stakeholders as it is able to adequately take into account changing technologies, business models, industry preferences, the potentially varying "tastes" (North 1990) of agents as well as changing relative prices.

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