Handbook of Research on E-Business Standards and Protocols:

Documents, Data and Advanced Web Technologies

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Chapter 6

BOMOS:
Management and Development
Model for Open Standards

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ABSTRACT

E-Business standards, or standards for interoperability, are developed outside the traditional standard development organizations, often within industry specific domain organizations. These organizations need some guidance in how to develop and manage standards for their specific domain in order to achieve long lasting standards that actually achieve interoperability between organizations. The Dutch government, together with the standards community, decided to publish a tool called BOMOS for giving guidance to the management and development of open standards. BOMOS is not profoundly grounded on scientific evidence, but it builds on the best practices already used in domain standardization. This chapter will present two highlights of BOMOS: the activity model for management of standardization, and a development approach for standards.

INTRODUCTION

The management and development of standards is no easy task. Nevertheless, standards are often developed without considering the further development and management of the standard. The cause of this is often the use of project funding to develop a standard, or a corresponding facility. This does not fit well with the continuous development and management of standards.

The purpose of this chapter is to assist organizations in managing and improving standards. The main question for this chapter is:

How can we as an organization develop (and continue to develop) and manage the standard?

The Netherlands Open in Connection, a Dutch government program stimulating open standards, received many questions on how to develop and maintain open standards, in particular since the use of open standards has become obligatory in many cases. Based on these questions it was decided to set up a working group to share best practices between different standardization communities from different domains. Participating domains included education, government, building and construction, temporary staffing standards, etc. Also standardization experts from NEN (Dutch formal standardization institute), TNO and Novay participated. The result was captured in what is called BOMOS, a management and development model for open standards, which aims to support and inspire standardization communities and their clients in the structural design of the management and further development of standards.

Following the first publication in 2009, a new series of workshops took place in 2010. The users of the first version were also represented. In total 6 workshops took place, and 17 experts representing 13 organizations involved in standardization. Their experiences and new insights were used to develop and expand BOMOS further into version 2, which is in 2011 available in both Dutch and English language (Folmer & Punter, 2011).

This chapter continues with the background including setting the scope of this research. Thereafter the state of the art in this research domain will be described, before the activity model from BOMOS is being presented. The chapter will then continue with the development approach captured in BOMOS and will end by a discussion and conclusion section.

BACKGROUND

The main reasons for organizations to aim for interoperability are effectiveness and efficiency in cooperating with, for example, partners, suppliers and customers within the chain. A lack of interoperability is costly, as a range of studies show. For example, the cost of the lack of interoperability in the automobile industry in the United States is estimated at a billion dollars, and a design period that is two months longer than is strictly necessary (Brunnermeier & Martin, 2002). The government also has an interest in aiming for interoperability, but has an additional reason from a social point of view. For example, consider the consequences of an emergency if the various emergency services were not interoperable. In addition, issues of interoperability arise in themes such as the electronic patient record and the young people at risk referral index. Standards are an important model in achieving interoperability, and in addition, important for supplier independence.

Standards come in all shapes and sizes. There are a great many classifications of standard types (De Vries, 2006), but within government the European Interoperability Framework (European Commission, 2004) is used as a guiding principle. This distinguishes between technical and semantic interoperability, which also means a distinction between technical and semantic standards. The technical (infrastructural) oriented standards can often be transferred one-on-one from international consortia. Standards of a semantic nature often require a national user group (community) in order to develop a national profile. In the context of national law and/or national specific business (and government) processes, it is necessary to adapt international standards to the national situation. Features of semantic standards:

- They are often a specific interpretation of international standards.
- They are often for a specific intrinsic problem:

◦ e.g. 'vertical': information exchange for a particular sector: Geo domain, Education, Care, etc.
◦ e.g. 'horizontal' information exchange for a particular function: Purchasing, Billing, etc.

- They are often developed and managed within the domain (the sector), and not by formal standardization organizations.
- The core of the standard is the semantics (meaning), not the technique.

This chapter is somewhat less applicable to technical standards which are often developed in an international context within formal standardization organizations or large industry fora. The formal international SDOs (Standard Development Organization) include (Cargill, 1989; Frenkel, 1990; Simons & De Vries, 2002; Song, Jiang, & Wu, 2007):

- Global: ISO, IEC en ITU
- Regional (Europe as an example): CEN, CENELEC, ETSI
- National: ANSI, NEN, DIN, BSI, etc.

Other standards organizations in the area of technical standards are for example W3C, UN/CEFACT, IEEE, IETF, OASIS.

A semantic standard never stands alone, and often has multiple relationships with other international standards, including technical ones. We also often see stratification within the semantic standard: The international semantic standard which standardizes the basic semantics for a particular problem domain and offers room to standardize additional agreements within a specific context (such as a country). These extra agreements on top of the international standards are sometimes called an application profile, but are also regularly designated with the term 'semantic standard'. Vocabularies (code lists etc.) are often set within the application profile or semantic standard and beyond the standard as they have their own dynam-

ics and therefore other management procedures may apply. This gives us three levels of semantic standard: the international, the specific context (e.g. national), and the vocabularies. Keeping the development and management organizations of these international standards in harmony is an important task.

With time many authors have included lists of semantic IS standards, including (Chari & Seshadri, 2004; Hasselbring, 2000; Lampathaki, Mouzakitis, Gionis, Charalabidis, & Askounis, 2009; Nelson, Shaw, & Qualls, 2005; Steinfield, Wigand, Markus, & Minton, 2007; Von Westarp, Weitzel, Buxmann, & Köning, 2000). Since the list on xml.org has ceased, a new list is available on semanticstandards.org, containing nearly 100 standards and growing. Many of those are "industry specific" (vertical) for instance electronics (RosettaNet), chemicals (CIDX), Assurance (ACORD), petroleum (PIDX) (Steinfield et al., 2007).

STATE OF THE ART

A structured literature review on semantic standards (Folmer, Berends, Oude Luttighuis, & Van Hillegersberg, 2009) shows the distribution of studies on different topics within this research area. Although in general literature in this area is scarce and some topics like quality of semantic standards have been declared as research gap, in some other areas more interesting studies have been identified. One of these areas is the development of standards, mainly based on case study research of interesting standards like MISMO ((Markus, Steinfield, Wigand, & Minton, 2006; Steinfield et al., 2007; Wigand, Steinfield, & Markus, 2005) and RosettaNet (Boh, Soh, & Yeo, 2007); two well known successful examples of semantic standards. These studies also help to get a better understanding of the topic and to define semantic standards: "Standards at the presentation and application levels are often referred to as semantic standards,

while standards below these levels are called syntactical standards. The internet protocol is an example of a syntactical communication network standard; and EDI standards are an example of semantic information systems standards – the type on which we concentrate here. Semantic standards can focus on a single industry sector or purport to be applicable across sectors. An example of a cross-industry standard (under development) is electronic business XML (ebXML). Our focus is on industry specific semantic IS standards, which we refer to as vertical IS standards" (Steinfield et al., 2007). We do not want to exclude cross sector semantic standards, hence we stick to the term semantic standards and by doing so we include both "vertical" and "horizontal" standards. We avoid the word "industry" as we do not want to exclude government oriented standards. This leads us to the following description: "Semantic standards are designed to promote communication and coordination among the organizations; these standards may address product identification, data definitions, business document layout, and/ or business process sequences" (Adapted from (Steinfield et al., 2007)).

Semantic standards are important for e-business in achieving interoperability between trading partners. It is generally accepted that standards are needed to achieve interoperability: "Setting and adopting a common standard for B2B transactions, therefore, is a natural step to enhance compatibility or interoperability among companies, generating great value for individual firms and the industry overall" (Zhao, Xia, & Shaw, 2007). As described in the previous section we are dealing with semantic interoperability as part of the framework of technical, semantic and organizational interoperability from the EIF. Another often used framework for interoperability is ISO 11354, that defines the interoperability concerns: Business, Process, Service and Data (Dogac, Pattenden, & Zelm, 2010). However there are many other interoperability frameworks (Folmer & Verhoosel, 2011), including ones for

specific industries. Also to add some complexity other terms like interconnectable, interworkable and interchangeable, are used sometimes as synonyms but more often with slightly different but not consistently used definitions (Kosanke, 2006; Stegwee & Rukanova, 2003). Jian & Zhao developed an interoperability framework in which the relevant standards are including and visualize semantic standards on the top layer (Jain & Zhao, 2003).

Semantics deal with the meaning of signs, symbols, words and phrases in the special sense of how these notifiers relate to reality, how they represent, designate and signify things (Rukanova, 2005). Problems related to semantic mismatch and misunderstanding are common, while some think they will vanish over time whilst others think they won't (Rebstock, 2009). If everyone were to use a single standard then semantic referencing would not be necessary, and although developments like core components are steps towards standards convergence, one universal standard would be an illusion. This means we have to cope with multiple e-business standards permanently, which will keep changing, resulting in a lasting situation of semantic variety, and will then be the source of mismatch and misunderstanding (Rebstock, 2009). To be useful in real business, standards need semantic profiles that define restrictions for a specific context (e.g. specific domain, business processes, country, etc.) (Brutti, Cerminara, D'Agosta, Sabbata, & Gessa, 2010). This is especially needed for horizontal semantic standards, but sometimes also for vertical ones. Otherwise, these standards have too much redundancy and uncertainty that limits interoperability in practice.

Other than the standards development organizations, some expert organizations exist to try to professionalize the process of standards development, including SES (Standards Engineering Society, IFAN (International Federation for the Application of Standards) and EURAS (European Academy for Standardization). The SES devel-

Figure 1. Framework for interoperability, including example standards (adapted from Jain & Zhao (2003))
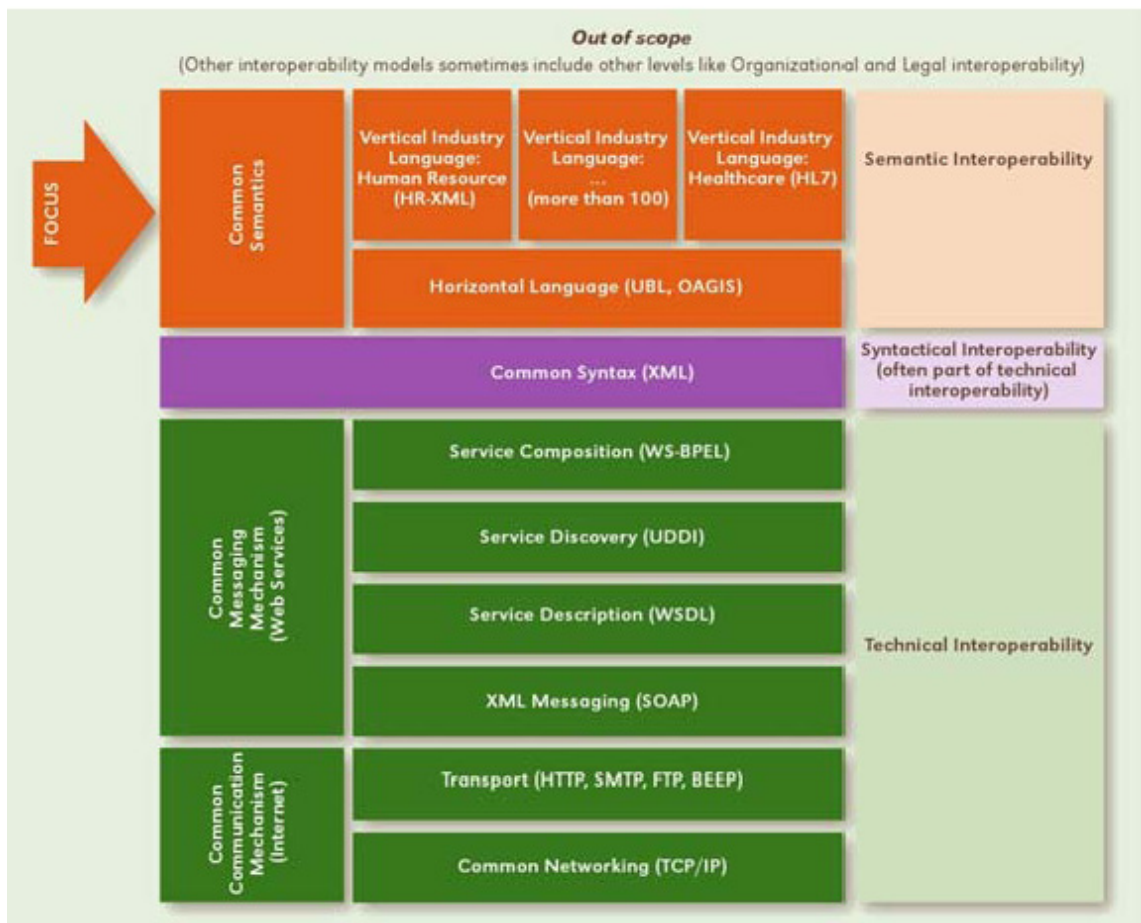
oped a standard on standards (Spivak & Brenner, 2001), and at the moment those are ANSI/SES standard ANSI/SES-1-2002 - Recommended Practice for the Designation and Organization of Standards and SES 2:2006 - Model Procedure for the Development of Standards. Concomitantly, ISO has availed its ISO/IEC Directives Part 2, Rules for the structure and drafting of International Standards. The British Standards Institution (BSI) released a standard for standards as guidance in the development process of standards. To professionalize the volunteers involved in standards making, several organizations developed guidelines for the development process (Freericks, 2010), some of which are specific for service standards:

- CEN: CHESSS: Guidance document for the preparation of service standards
- ISO/IEC: Guide 76: Development of service standards
- IFAN: Guide 3: Guidelines to assist members of committees in preparing user-oriented European standards.

These are however not focused on semantic standards that differ in nature. They are different on many aspects, we list several that are explicitly mentioned in other studies:

- Ongoing maintenance (user requirements change often) (Steinfield et al., 2007)

- Evolving of standards as newer technology arrives ((Steinfield et al., 2007; Zhao, Xia, & Shaw, 2005))
- Open sharing of knowledge (Boh et al., 2007; Zhao et al., 2005)
- Focused on problem solving, quick standard setting process (Boh et al., 2007)
- No standards wars (Cowan, 1991; Zhao et al., 2005)
- Significant role of User Groups (Zhao et al., 2005)
- Divergent preferences of stakeholders (Zhao et al., 2005)

Although there does not exist a guide for development semantic standards (not counting BOMOS), there are studies performed on the development of semantic standards often in relation to adoption. According to (Zhao et al., 2007) development and adoption are interrelated since choices in development phases will influence adoption. Zhao defines a three-stage model of consortium based e-business standardization, simulating firms' strategic decisions:

1. First stage: Consortium participation
2. Second stage: Standard Development
3. Third stage: Standard Adoption

In addition, Zhao et al. (2007) notices that developers are adopters and most probably the early adopters. Moreover, the members' contribution is critical to the sustainability and success of a standards consortium and thus of the adoption of the standard. Another important contribution of Nelson et al. (2005) is the inter-organizational system (IOS) standards development cycle, containing the following phases:

1. Choreography & Modularity (key cross-company business processes)
2. Prioritize & Schedule (planning of business processes)

3. Document & Standardize (develop specifications sets, including technology)
4. Review & Test (permit user community to provide feedback)
5. Implement & Deploy (provide implementation support and forecast adoption)
6. Compliance & Certification (validate standards conformance to ensure interoperability)

A framework is presented for studying vertical e-business standards, which components are interrelated and determine the performance of the SDO, implying that the SDO should address all three components in an efficient and balanced way. The three components consist of the following features (Zhao et al., 2005):

- Participants (number, sector, bargaining power)
- Technical contents (maturity)
- Institutional structures (structure, procedures, openness)

Since semantic IS standards are being developed by many different organizations, it might be expected that they will make a lot of (re)-use of each other's specifications. However the contrary seems true. There seems to be a lot of re-inventing of the wheel, based on a study of 33 organizations (Löwer, 2005) (including horizontals like ebXML, cXML, W3C, etc. and verticals like ACORD, OTA, etc.). Exceptions are RosettaNet, which makes significant use of the specifications of 8 other SSOs, and the specifications of UN/CEFACT are used by 10 other SSOs. The 33 organizations that were studied only make marginal use of other specifications (Löwer, 2005).

The Case Studies

This section started by stating that several case studies have been performed specifically related to the development of semantic standards. What can be learned from them?

Lessons learnt in the building and construction sector show that a plan of action for standardization must include a strategy for promotion, development, implementation and maintenance of vertical standards (Thissen & Stam, 1992). The strategies that have been used for standards development in RosettaNet are:

- Commitment of resources to the milestone program
- Clear roles and restrictions
- Validation beyond full implementation
- Informal norms and social networks.

Boh et al. (2007) also discuss the adoption case of RosettaNet and derives some lessons learnt on the development process:

- Only involve the organizations that are committed to solving the problem.
- There is no one right approach for the standards development process, not even a full open approach.

The presented lessons learnt from the RosettaNet case related to adoption are (Boh et al., 2007):

- Investing significantly in standards adoption.
- Adoption strategy should be aligned with the development process.
- The set of adoption strategies should be locally adapted.

Markus et al. state in relation to the MISMO case that to successfully develop a vertical standard that meets the business needs for interoperability it is necessary to ensure participation of representative members of heterogeneous user groups, and avoid the natural tendency to splinter into rival homogeneous groups (Markus et al., 2006). Thus, the challenge is to involve all stakeholder groups (and thus not all individual stakeholders) and to make sure they do not drift

apart during standardization. Thus, semantic IS standardization must find a way to ensure the collective participation of representative members of heterogeneous user groups (including IT vendors). Based on the MISMO case four propositions are formulated for semantic standards development and adoption in general:

1. Semantic IS standardization must find a way to ensure the collective participation of representative heterogeneous users.
2. Semantic IS standard initiatives must ensure user groups participation whereby both have committed themselves to adoption but are also able to influence other organizations to adopt the standard.
3. Each semantic IS standard initiative should set up a set of tactics that bring together the development and the adoption dilemmas.
4. The chosen tactics for development will influence the adoption of the standard, because the tactics for development will influence the content (quality), which also (the content) will influence adoption.

The following section will advance on this knowledge by introducing the activity model for development and management particularly aimed at semantic standards.

THE MODEL: ACTIVITIES FOR DEVELOPMENT AND MANAGEMENT

Figure 2 depicts the main model of BOMOS: a stratified structure of activities required for the development and management of an open standard. The structure comprises a number of elements:

- Three main layers: strategy, tactics and operational.
- Two supporting layers: implementation support and communication.

Figure 2. BOMOS activity model
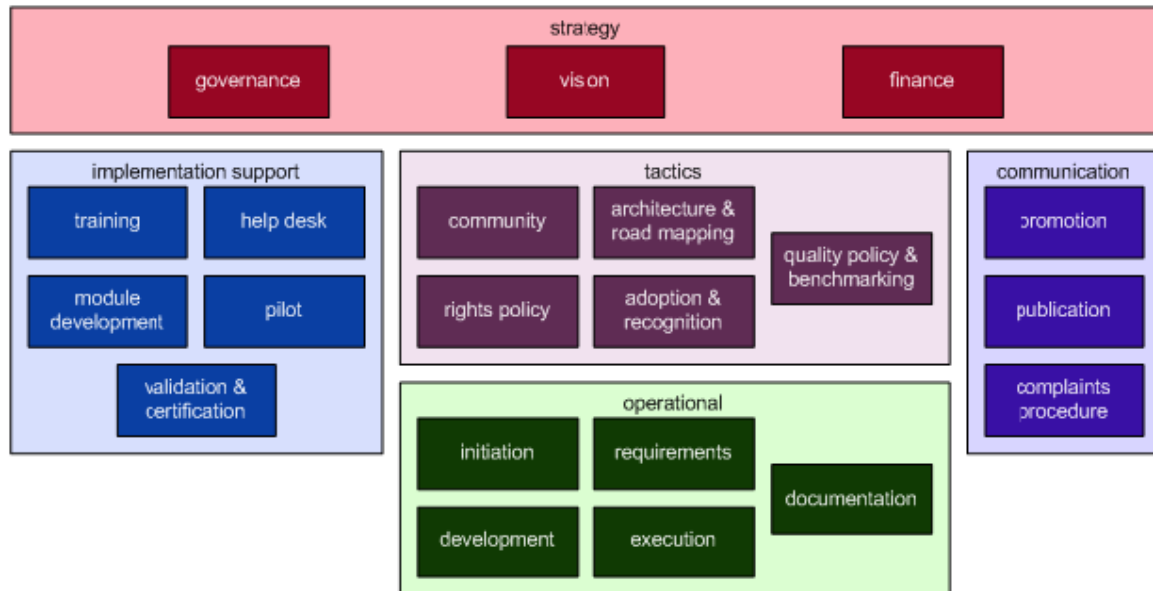
- Multiple activities per layer which can be carried out.

Implementation Varies According to Situation

The implementation of the development and management activities are situation-dependent: this means that different situations can lead to different implementation and still lead to an optimum result. In the case of all activities, this can be carried out in a 'minimum' or 'maximum' scenario, or may not be relevant to a particular organization. The model describes only which activities may be necessary. It is down to the founder of an organization for the development and management of standards to select and set up the relevant components on the basis of the model provided here. Where relevant, any advantages and disadvantages of a specific interpretation are given.

It is also impossible to indicate core activities due to the situational dependence, but it should be clear that 'governance' should always be organized so that decisions can be made. Depending on the situation it can then be determined which activities are to be prioritized. The figure shows the three traditional layers: strategy, tactics and operational. They are flanked by two supporting processes: communication and implementation support.

The model may give rise to the suggestion that the activities are isolated, as no relationships between them are indicated. The opposite is true: many activities are related, both within each main group and between them. The harmonization of activities is therefore essential. The model does not say anything about the organizational form or layout of a management organization. In practice, multiple activities can be carried out for a single part of the organization or multiple parts of the organization can be involved in a single activity.

The Activities from the Model

The stated activities refer to the following:

Strategy: Directing activities related to the strategic (long) term:

- ○ *Governance:* spreading policy through one's own administrative organization (such as the legal form); the household rules (the charter), as well as forming alliances with other organizations. Controlling decision-making is crucial (see box).
- ○ *Vision:* developing an intrinsic vision of the direction of development. The spot on the horizon in the long term.
- ○ *Finances:* having a financial model for the long term that guarantees income in accordance with the needs.

Governance decision-making: This strategic activity also includes the implementation of all decision-making, including establishing specifications, setting up new working groups, communication activities, the implementation support that will or will not be supplied etc. It must always be clear what we are deciding on. In particular, clarity regarding what is determined by the working group, the executive organization and the management is essential.

Tactics: Steering activities at tactical level, including:
- ○ *Community:* It is essential that the right stakeholders take part in the community and that an imbalanced community is not created in which only a certain type of stakeholder (e.g. supplier) actively participates in the community. This task encompasses the monitoring and promotion of a good composition of the community.
- ○ *Adoption and recognition:* Creating an adoption strategy to ensure that the market adopts the standards. Part of the adoption strategy may be striving for recognition by external 'status providers', for example the 'comply or explain' list from government (Lammers, Folmer, & Ehrenhard,

2010), or publishing the standard as formal standardization document (e.g. ISO).
- ○ *Rights policy:* Implementing policy in the field of intellectual property and copyright around the community's intrinsic products. Also the community access policy and the rights (and obligations) of the participants in the community. A distinction can possibly be made here between the various roles that participants in the community may have with other rights and obligations.
- ○ *Architecture and road mapping:* Marking out and testing the intrinsic lines and monitoring in outline the cohesion between the intrinsic products of the community, and also products from outside the community such as bordering standards to prevent overlapping. What deserves special attention is the relationship with the international standardization community. By road mapping we mean marking out the intrinsic line; for example, outlining the standardization agenda for the years ahead. The version management policy is another important part of road mapping.
- ○ *Quality policy and benchmarking:* It is important to attend to the quality of the standards through a quality policy. This may result in the introduction of a quality check, for example, before a standard is published. Benchmarking involves comparing one's activities to similar organizations in order to identify any potential improvements. Monitoring the use of the standard can play a significant part here in arriving at concrete steering measures.

International standardization: Harmonizing with the international standardization is an important activity within architecture and road mapping. The standards must match as well as possible, so that interoperability can also be achieved at an international level. Specific preferences and needs must also be brought into the international standardization community. Some sectors (such as the geo domain) are very internationally oriented, and in practice, international harmonization is a substantial activity in such cases (15% of the budget).

Operational, the executive activities that lead to new versions of standards such as:

- ◦ *Initiation:* identification of new ideas (for example, for a new specification and new working group) and all activities associated with setting them up successfully (e.g. analysis of interests, business case, agenda).
- ◦ *Requirements:* drafting the requirements of the specification to be developed and managed, also known by the name Maintenance Requests (MRs).
- ◦ *Development:* at conceptual level, the intrinsic development of solutions for the ideas, preferences and requirements set during previous phases. These solutions are, separate from technology where possible, intended for further elaboration in the specification or a new version of it.
- ◦ *Execution:* implementing the actual amendments based on the conceptual solutions in the specification and any technical filling in.
- ◦ *Documentation:* providing a suitable reflection of the results of the primary management process. Not only the availability of the specifications but also offering the possibility of a historical overview of requests for amendments (maintenance requests) and their current status.

Implementation support, supporting activities aimed at promoting the implementation of the standard, including:

- ◦ *Training:* Offering training opportunities to the various user groups, varying from an information meeting to a course (also online).
- ◦ *Help Desk:* Offering support to various user groups, by phone or e-mail according to a service level agreement (e.g. responding to queries within 24 hours). Drafting and updating a frequently asked questions list can also be a help desk activity.
- ◦ *Module Development:* (Encouraging the) development of widely distributed software modules implementing the standard. This can be done by encouraging the market to develop software, or, if the market is stagnant, developing and distributing one's own software in order to get the market moving.
- ◦ *Pilot:* Testing the implementation of the specifications. With some standardization organizations, holding one or more pilots is mandatory before the standard can be released officially
- ◦ *Validation & Certification:* Providing opportunities to test the accuracy of the implementations (validation). This may have an official procedure that leads to the certification of an organization or product. Making the validation and certification processes mandatory is also an option.

Module development and Certification are risky activities which actively intervene in the market. They should be carried out as carefully

as possible and outside the organization where possible.

Most management organizations provide aids for the validation of the use of standards, such as:

- Geonovum (Geo domain): http://www. geonovum.nl/diensten/valideren
- Kennisnet (Educational domain): http:// contentketen.kennisnet.nl/validatie
- SETU (Temporary Staffing domain): http://www.setu.nl/validatie (only accessible for SETU participants).

The technology that enables the validation of semantic standards is highly generic. This also makes it easy and inexpensive to offer a validation test. The validation services for the EduStandaard (educational domain) and SETU (temporary staffing) standards use the same eValidator (www. evalidator.nl) in the background.

Communication: supporting activities aimed at creating support for the standard, including:
  ◦ *Promotion*: Propagating the usefulness/necessity/advantages of the standard.
  ◦ *Publication*: Making the standard accessible/known, as well as the current state of affairs, preferably on the internet.
  ◦ *Complaints Procedure*: Guaranteeing that complaints are taken seriously by handling them according to a meticulous procedure. Complaints can also be viewed as suggestions for improvement.

THE DEVELOPMENT AND MANAGEMENT ORGANIZATION

This section goes into the organizational aspects in greater depth: what is the organization's structure and how can it be organized?

Organizational Structure

The previous section summarizes the various activities which may take place within a standardization community. Figure 3 outlines a rough organizational structure for this. An important point is the separation of activities in the executive organization and decision-making by management.

The management commissions an (not-for-profit) executive organization that is responsible for a large share of management tasks. The management unites the needs of its backers and is mandated by them to decide on matters which concern the standard. Management and the executive organization prefer to work with monocratic points of contact. The management is largely responsible for the 'decision-making' task. In practice, management meets a few times a year, which must not hinder the required decision-making. The management must give the executive organization sufficient mandate. In practice, we see that some decisions are also submitted in writing (e-mail) to board members for approval, or that the responsibility for certain activities (e.g. communications) is placed with a single member. This makes it easier to hold bilateral consultation between the executive organization and the board member responsible and also to make intermediate decisions (and may serve as an alternative to the monocratic points of contact).

The main thing is that it should be clearly established which decisions are to be made during the management meeting, which ones can be submitted in writing (e-mail), which ones can be made by a specific board member, and for which decisions the mandate lies with the executive organization.

In practice, annual plans are often used to formulate the management's commissioning of the executive organization. On the basis of reports on the annual plan, the executive organization then reports back to the management. The annual plan describes which tasks are to be carried out, which

Figure 3. Organizational structure
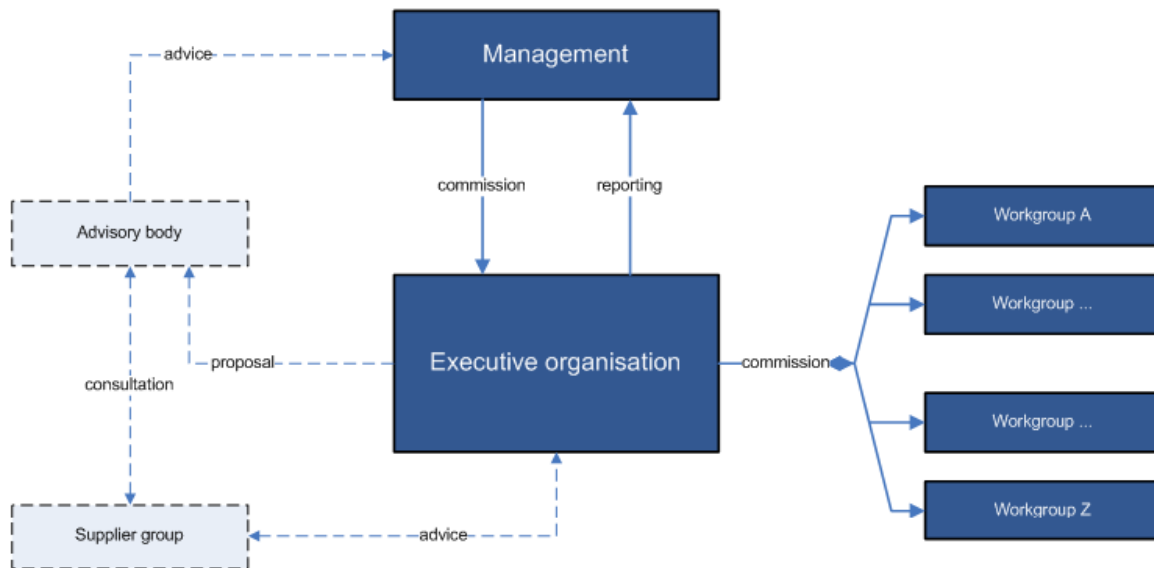
working groups exist or are to be set up, the objectives of the working groups etc. The annual plan is approved by the management and is as such the commission for the executive organization. The model in chapter 4 can serve as a stepping stone for designating tasks in the annual plan. The annual plan also enables reaching agreements on the tasks to be outsourced (see next section).

The actual development of the standard takes place in working groups in which the users of the standards take part. The working groups are coordinated by the executive organization. Often, the actual developments are drawn up by the executive organization on the basis of discussions within the working groups. The results of the working group, a new version of the standard, can be established by the management and released as a new version. The decision-making regarding who determines what (management/working group) must be clearly defined.

Preferably, a distinction is made between different levels of changes to standards, so that the more minor changes can be dealt with by the working

group concerned or the executive organization itself, and only the most fundamental changes require the involvement of the management up to a management decision. A working group that is continuously overruled by management is not tenable.

An advisory body may be set up if necessary in order to assist the management with advice, both requested and unrequested. The results of a working group will in that case go to the advisory body as a proposal, and that body will advise the management. The advisory body should preferably consist of independent and undisputed experts, and may be a means of strengthening independence and expertise. It is important that these experts are selected on the basis of their knowledge and experience and not on the basis of interests or the representation of an organization; after all, they are only asked for advice. Interests are represented by the management.

A typical categorical demarcation of working groups takes place according to the following (stratified) lines:

- architecture
- processes/services
- data/messages
- technical standard/transaction standard
- security

Another commonly used definition is on the basis of the problem domain: for example, work-groups for ordering and invoicing. In practice, in the case of more complex standards, certain categories of working group (e.g. 'data') will be divided into working groups according to problem domains (e.g. 'billing') which achieve a combination of the two classifications.

(Software) Suppliers deserve special attention. This is often a controversial issue among not-for-profit management organizations. They are often crucial to the success of a standard ('no working standard without correct implementation') but suppliers can also have conflicting interests. In principle, suppliers can also act simply as participants in the standard and take roles in the working groups up to participation in management. In practice, software suppliers often make useful contributions in working groups, and it is therefore highly recommended that suppliers are granted access to the working groups. There is often some fear that suppliers will make too emphatic a mark on the standard. A separate supplier group as indicated in Figure 2 is an option in that case, offering suppliers a platform on one side while on the other they can be kept out of the working groups and management. Software suppliers are then united within a supplier group which can advise the executive organization and hold talks with the advisory body.

The decision-making within the working group may be dependent on the potential participation of suppliers and also the positions of the suppliers. In practice, the choice of the extent of influence will also depend on the way the community is organized; if the development of the standard is driven by the interests of the software suppliers, then they will want to exert a greater influence on 'their' standard. If the development is driven by the needs of a (government) user then they will want to exert a greater influence.

The figure outlines a simple basic structure of management, executive organization and working groups. An advisory body and/or supplier group may optionally be added. In addition to these outlined possibilities there are many other alternatives, some simple, some more complicated. Whichever structure is chosen, the reports of the various bodies should preferably be made public.

Management Tasks in Implementation

There are a range of options for the interpretation of development and management tasks in an organizational structure, varying from placement within an existing formal standardization organization to handling the whole thing in one's own organization. The aim is not to set up a management and development organization for every standard. Practice shows that few existing organizations are geared to the full range of tasks, and as a result many standardization communities have still opted to set up their own organizations. Some of the tasks are then placed with the internal organization while some can also be placed with other types of organization. See Figure 4 for the options.

The model distinguishes between not-for-profit and profit organizations. This distinction is relevant in the scope of openness. If the management of a standard is placed with a profit organization then it cannot be an open standard! This does not mean that commercial organizations cannot develop open standards on the commission of a management (organization), or donate them to a not-for-profit management organization post-development. The standard should always be developed and managed in a not-for-profit way, making a not-for profit organization the most obvious choice.

Figure 4. Placing management and development tasks
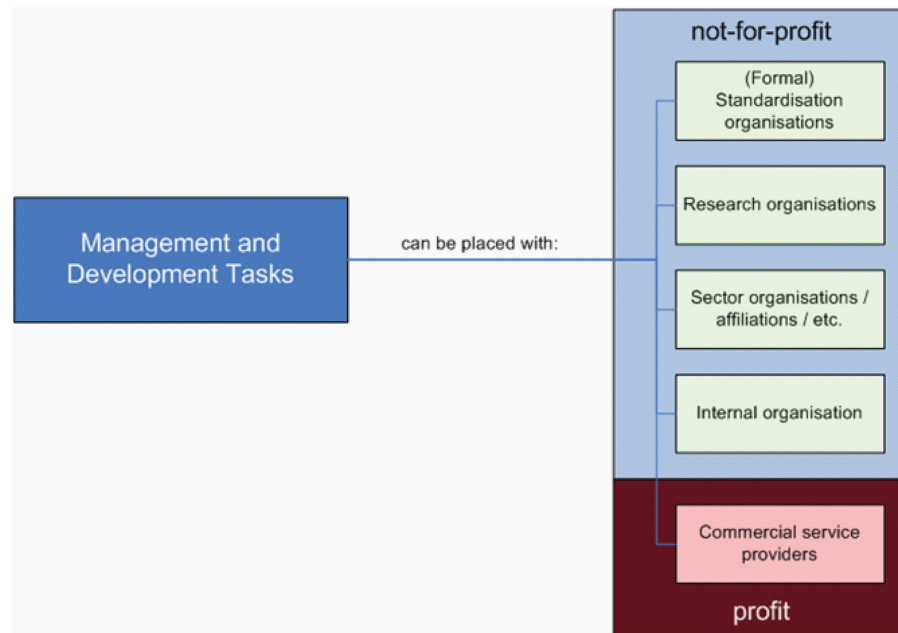
Formal standardization organizations are: ISO, IEC & ITU at global level and for instance CEN/CENELEC, ETSI on regional (European) level and NEN, DIN, ANSI on national level,. Other well-known organizations such as W3C, OMG and IETF are not in principle formal standardization organizations, and are often designated as industry consortia.

An initially obvious option is placing the management tasks with formal standardization organizations. The world has however changed in comparison to twenty years ago when the majority of the standards were developed by these formal organizations. These days, most standards are developed outside of the formal standardization organizations in a variety of forms of consortia, and the number is growing. This is extremely significant in the case of semantic standards. This is partly due to the slowness of processes within formal standardization organizations, but particularly the lack of actual knowledge and expertise. Knowledge of the domain is essential for semantic standards.

This does not mean that formal standardization organizations[7] do not have their value; quite the opposite is true. They possess a potential added value on a number of points. For example, in raising the status of the standard. As such, NEN3610 was developed by Geonovum, but also released as a NEN standard for extra status. In addition, secretarial support for working groups is another area that can be placed externally. However, one must always organize the intrinsic knowledge oneself.

Research organizations such as universities and institutes are another possibility for placing tasks. The advantage is the wealth of knowledge but there may be a lack of domain knowledge or knowledge of the specific use. The opposite applies to sector organizations; the advantage here is the superb domain knowledge but the disadvantage is a lack of intrinsic standardization/ICT knowledge. Standards, including the semantics, are often far beyond the scope of sector organizations. The subject is quickly dismissed as a matter for the

boffins, which it is not in essence: domain knowledge is actually of great importance for semantics.

Setting up one's own organization is an option, as is deploying commercial service providers. The latter is somewhat in conflict with the principles of openness. The internal organization is the most common option for the core of development and management tasks. Many domains now have their own organizations with knowledge of the domain and standardization, such as for instance in the Netherlands: Geonovum, EduStandaard, CROW, Informatiehuis Water, SETU, KING, etc. The core of their work includes the strategic management activities as identified in the model, and to a great extent the tactical and operational activities also. In this case, some activities can easily be outsourced, which may even be the better option.

A number of suggestions:

- **Module Development:** Module development is risky to place within the development and management organization. This makes one both supplier and rival of parties within the community. It is better to encourage module development outside the development and management organization, possibly in the form of open source software. This may also encourage other suppliers to support the standard and/or get involved in its development. The best approach depends on the characteristics of the community.
- **Certification:** The independence of the certifying body is essential in the case of certification. Normally, the development and management organization sets the framework for testing and then outsources the actual testing (on the basis of this framework) to external parties specifically aimed at testing and certifying.
- **Architecture/Road Mapping/Benchmarking;** The support and execution for this suits research organizations in the broad sense (in addition to knowledge in-

stitutions, organizations such as CBS for benchmarking). For benchmarking in particular, this is better placed with an external organization.
- **Communication;** often suits a sector organization which already has a communications system. This must of course be an organization that is a perfect match for the standard and is prepared to take on the communication as an important task. Communication around the management and development process of a standard demands specific knowledge of this management and has a specific target group, such as software suppliers. This should be recognised by the sector organization. Other options include the communications divisions of other or partner organizations.

We can broadly conclude that there are options for placing the development and management tasks with:

1. Existing organizations
2. New organizations
3. A combination of the two

Placing all tasks with an existing situation may sound ideal, but there is no organization that is equipped for the complete range of tasks on its own. Therefore, in practice it is often necessary to set up a new organization, if there is no organization aimed at standardization within the domain. Option 3, the combination of the two, means that certain tasks are picked up by this (new) specific domain standardization organization while others are handled by other types of organizations, in accordance with the description in this section on outsourcing tasks.

This section largely describes the relatively 'hard' interpretation of the organization; the pitfall is to lose sight of the 'soft' facets. In the case of standardization, the soft factors are often essential to the success of a standard. Forming a consortium

in which parties trust each other and can work together constructively without every incident jeopardizing the existence of the consortium is an exceptionally social and organic process.

OPERATIONAL PROCESS FOR THE DEVELOPMENT AND MANAGEMENT

The primary standardization activity is the operational process: How will the standard ultimately be developed?

A number of aspects are significant here:

* How are the requirements collected?
* How are the requirements translated into concrete proposed changes?
* How are decisions made regarding proposed changes?

Collecting Requirements

The most important step is perhaps the gathering of requirements. This has to be done when drafting a new standard and when modifying an existing standard.

A feature of the open standard is that everyone can submit his or her requirements. This group is ideally as large as possible – after all, this increases the support for the standard. It might be that the management of the standardization organization has set certain directions which may restrict this. This limitation may, for example, affect the overall functional scope of the standard.

There are a range of options for collecting requirements:

* Setting up a **website** or **wiki** where users can post their ideas. Users can also discuss ideas or proposed changes.
* Via **formal consultation**. This poses the parties involved in the standard a formal question regarding future developments, preferences or requirements.

* By organizing **workshops** or **discussions** with stakeholders from the community. Current developments can be discussed during these meetings. For example, one of the participants may have a new development that is also relevant to the others.

Whichever form or combination of forms is chosen: ultimately, this process should lead to a list of requirements which have to be evaluated.

Gathering requirements is an ongoing process. It may sometimes be worthwhile for the management organization to actively encourage the community to provide requirements.

EXAMPLE: PRESSURE COOKER – A STANDARD IN A WEEK IN THE WASTE SECTOR

A comment that is heard often is that developing standards is a slow process that can take years. That is the traditional view, but who says that you have to follow the old, traditional process?

It can clearly be faster. The concept of 'Pressure cooker' is used in the waste sector to develop standards. In the space of a week, the interfaces between different systems in the waste sector were standardized. For example, the interface between the mini-container and the refuse truck, and the interface between the refuse truck and the back office of the municipal waste processor.

After a working group week, with an average of 15 participants from the waste processors and the suppliers, in which the standards were examined one by one, there were two weeks of computation by an external supervisor, and then a two week review period by the working group before the standard was delivered to the steering group. From the start of the working group, there was a standard within two months.

The Quality

There is a danger that this will affect the quality: a poor standard could cause a lot of trouble in the future. The quality of the standard is strongly related to the participants in the pressure cooker. A remarkable phenomenon is that members of the working group form contacts within their organization to collect extra information. Directly related to this is the Achilles heel: if a working group has not prepared adequately and lacks the necessary local information, this cannot be included in the pressure cooker. The quality and preparation of the working group members are therefore very important.

An important initial indicator is the review process; if a lot of fundamental choices are put up for discussion again during the review process and lead to changes to the intended standard, this is not a positive indication of the quality. After all, the first version of a standard is never perfect. New insights and errors are always discovered during implementations, regardless of the use of a pressure cooker. A perfect standard is not the aim: a workable standard that helps to solve the problem is.

Important points to learn from are:

- A pressure cooker is an excellent means of efficiently developing a standard. The quality still has to be proven, but there is an impression that the working group determines the quality of the standard.
- A clear scope; what is known in standardization circles as 'scope creep' is a greater risk in the pressure cooker process.
- Not wanting too much, too long: more experiences are required to determine the optimum length and content, but there is certainly an optimum; at a certain point, the magic is gone.

The pressure cooker is not used much in the world of standardization yet, although the idea comes from international standardization meetings where the working group members sometimes spend days concentrating on a standard. The 'pressure cooker' can greatly reduce the length of the standardization process. This can also make the development of standards more efficient and therefore cheaper, which is always a good thing.

Preparing Proposed Changes

Not all requirements automatically lead to a proposed amendment to the standard. There are, roughly speaking, the following options:

- The idea is more a question which is specific for the implementation with a certain party: for example, if an organization has little experience with the standard. In such cases, support may be offered from the community or the management organization in resolving the problem. There is then no need to amend the standard.

- A wish or idea concerns the amendment or expansion of the existing standard. This may arise from changed legislation, changed processes or of other changed needs.
- The proposal relates to fundamental changes to or broadening of the standard. For example:
  - Functional expansion
  - In addition to semantic standardization, also establishing how data is to be exchanged at transport level. For example: establishing that certain XML messages can only be exchanged via SOAP.
  - Applying the standard in new sectors.

When indicated by the submitting party, the requirement should be recorded as a 'request for change'. Depending on the set-up of management organization, secretaries or supporting experts can perform an initial sorting using the categories stated. An initial estimate can also be made of the

impact of a proposed amendment. Allowing secretaries or supporting experts to do this can make the final evaluation run more smoothly later on. It is important that a neutral role is taken primarily: in the case of an open standard, this is ultimately decided by the standardization community.

Sometimes, requirements may fall outside the operational process and require decision-making by the board of the standardization organization at tactical and strategic levels. They can then be passed on to the management.

Evaluation and Decision-Making

The list of 'requests for change' must be checked over periodically. The requests should be evaluated and decisions made on whether to apply the change to the standard.

Method of Decision-Making

There are various ways of organizing the decision-making. An open standard requires a majority decision or consensus. In the case of consensus, everyone must agree on the proposed change. In the case of a majority decision, at least half plus one must approve the proposed change.

Sometimes, decisions can be made by a working group, and sometimes by a higher body. In that case, a working group will usually provide important advice on the change. Ultimately, it is important that all parties concerned can be involved in the decision-making process.

Points to Note

A range of aspects must be examined during evaluation and decision-making:

- The method of fitting into the standard: is it technically possible to adapt the standard and what steps are required to do this?
- The impact of the change on existing systems and processes.

- The added value of the change (in ITIL terms, the business justification): what will it bring in and is this proportionate to the costs?

Working Groups and Stakeholders

Working groups are an important tool in collecting, preparing and evaluating change requests. Despite openness, the participation in working groups can be limited. A distinction is often made between types of stakeholder, partly because the working group should reflect the stakeholders. NEN, the Dutch formal standardization organization, uses a stakeholder analysis, in which the stakeholders are identified by using a generic value chain. They are as follows:

EXAMPLE: THE WEB 2.0 METHOD – XCRI IN EDUCATION

A modern method of developing standards could also mean using the new working methods offered by "Web 2.0": interaction via the internet. This makes valuable meetings on site necessary less often and can add dynamics to the development of the standard. In addition, the information is highly open, and it works on building a community to bring development, management and support closer together. Using Web 2.0 means in practice the use of a wiki and/or forum; on a wiki, people work collectively on a piece of intrinsic knowledge (the standard), and online discussions can take place in a forum. Other Web 2.0 options include video (or speech) conferencing over the internet, using for example Skype or other tools. This may be a cost saving in relation to the traditional standardization telephone conference where calls are made to expensive international numbers. There are also Web Seminars nowadays, in which the latest information on the standard is shared. This last form is in practice more 'broadcasting' than interactive exchange. Web 2.0 has a low threshold

Table 1. Stakeholders in the value change (source: NEN (Folmer & Punter, 2011)

	Stakeholders	Description
1	Direct users Sector organizations direct users	End user of service, process or product As a group, in the form of interest groups
2	Favorable organizations / clients Sector organizations of favorable parties	Organizations which set the conditions the product or service must fulfil. For example, clients. Legal conditions are set by lawmaking bodies (see 9).
3	Advisory organizations Sector organizations of advisory parties	Organizations which can advise other interested parties (e.g. engineering firms, consultancies etc.)
4	Executive / user / service-providing organizations Sector organizations of executive / user / service-providing parties	**Product standardization**: organizations which use/apply the product in their services towards end users (e.g. contractors, installers). **Service standardization**: organizations which provide a process of service to the end user (e.g. debt counselors).
5	Producers / suppliers of main product Sector organizations of producers / suppliers of main product	In the case of **product standardization**, this is the main producer/supplier. In the case of **service standardization**, this category is not used. The role of 'producer/supplier' is fulfilled by the executive, service-providing organization
6	Producers/suppliers of attached products and services Sector organizations of producers/suppliers of attached products and services	In the case of **product standardization**, this concerns producers / suppliers of products which appear in the product chain as raw materials, semi manufactures or residual/waste products. In the case of **service standardization**, this concerns the providers of supplementary products.
7	Research and knowledge institutions	Institutions which supply knowledge or carry out research without a direct commercial interest. For example, educational establishments, laboratories, research institutes.
8	Inspecting bodies	E.g. inspection services, certifying bodies
9	Legislative bodies	Governments
10	Existing/new initiators	Parties undertaking alternative initiatives comparable to NEN (standards, certification schemes, guidelines etc.)
11	Those who determine the context of the greater whole	Organizations (e.g. foundations, platforms) involved in a generic way.

and is generally lower in cost than the traditional possibilities.

A standard developed using this Web 2.0 method is the XCRI standard (www.xcri.org) in education (Wilson, 2010): XCRI uses 3 methods of involving the community online:

1. Forum: For discussion and queries regarding anything to do with XCRI.
2. Blog: For news and announcements.
3. Wiki: For the documentation of the standard and the development of the documentation for the new versions of the standard.

The application of Web 2.0 possibilities can make the development of standards more efficient. The extent and the options which can be successfully applied depend on the context of the standard. There are numerous standards which have set up a Forum and closed it again after some time due to a lack of active participation in the Forum.

XCRI is a relatively simple standard; it standardizes education-related information for exchange. The exchange takes place in a small, active community. This may be why it works in this situation. A small community, and not too complex in terms of content, can mean, for ex-

ample, that discussions about a standard can be held in a forum easily and that the group can work together in a Wiki. In the case of complex (and also sensitive) subjects, in a large community, the question remains whether these options will work.

DISCUSSION

The previous sections contain two parts of BOMOS, however it is evolving into a broader tool for standards organizations. For instance it includes also guidance on openness based on the 10 requirements on openness (Krechmer, 2006, 2008, 2009). It is experienced that these ten requirements give more guidance than the strict definition of EIF 1.0 officially used by the Dutch Government. EIF 1.0 has been superseded by version 2.0 that includes a new definition on openness, based on a long on-going debate. However this new definition has not been well received, resulting that governments keep using the definition of EIF 1.0.

Another debate related to openness, amongst others the costs of the standardization document, is the role of formal and informal, and also the role of European standardization organizations. Many authors describe the process of national, European and international formal standardization, most probably because it is fairly complex (Blind, 2004; Cargill, 1989; Cargill & Bolin, 2007; De Vries, 2007; Hesser & Czaya, 2007; Jakobs, 2009; Simcoe, 2007; Spivak & Brenner, 2001). However the world has changed, which many studies (Branscomb & Kahin, 1995; Cargill, 1995; Updegrove, 1995; Wagner, Cargill, & Slomovic, 1995) have shown, but was accurately described by (Hawkins, 2009): *"By the late 1980s, spurred largely by the burgeoning Internet phenomenon, most of the significant standardization activity in computing and much of the telecom activity (especially in the higher value-added segments) was occurring in a rapidly expanding array of independent consortia that were dominated by major ICT vendors."*

Although ISO created a special committee for Information Technology (JTC1), consortia that have no relation to JTC1 are increasingly producing the important IT standards (Rada, 1998). The result is that important IT domain standardization organizations are not part of the formal SDO world, including organizations like W3C, OMG, OASIS, OAGI, GS1, and more specifically, all sector specific standardization organizations. This consortia movement has led to the fragmentation of standardization (Van Wegberg, 2006), and consortia now dominate the world of IT standardization (Rada & Ketchell, 2000). But if this an ideal situation, and how to deal with it from the perspective of governments and formal organizations is still under debate.

Although the advantages are evident, the uprising of these semantic standards also bring new issues to the horizon. Amongst others, these are (Markus et al., 2006):

1. The relation between standards initiatives: To what extent are they borrowing from each other or proceeding independently? And thus trying to invent the wheel again?
2. What problems, if any, are created by the many industry-specific initiatives currently underway when it comes to cross-industry interconnection, and how can those problems be solved?
3. Differences between semantic standardization and other standardization research. Semantic standards are developed by many different organizations. Does this division of labor lead to a decrease or an increase of standards diffusion?

The first question relates to the trend of a changing standardization world, and to which developments like BOMOS have been initiated. The second question will become more important in the next few years, when vertical based standards become more and more adopted resulting in achieved interoperability within the vertical

domain, and challenges in cross-sector interoperability. The first conflicts have been reported in literature, for instance competences that have been standardized within different domains (e.g. HR-domain and Education domain) leading to conflicting standards and the need for models to deal with it (Grant & Young, 2010).

Since its development BOMOS has been used frequently in the Netherlands. Although parts of it are common sense, it still was seen as a novelty that easily can be used in practice. However, with the exception of the Geonovum case (Folmer & Punter, 2011), the cases are often not publicly documented. Sometimes organizations are mentioning the use of BOMOS on their website or within their procedures. Most often it seems that certain parts of BOMOS are used specifically to address the needs of the standards organization. However more research on the usage needs to be done. This is also needed for validation of the current best practices and to add even more guidance. For instance on which activities are best suited for outsourcing, or which test procedures are best suited, etc. Next to validation, we also see the need for more guidance on how to use BOMOS in practice, this might include a procedural model on how to start with developing standards. Although BOMOS is heavily linked to current practices of semantic standardization, it can become better linked to formal standardization and by doing that contribute to bridging the gap between the traditional standardization world and the semantic standardization world. In the future, BOMOS version 3, can become a validated best practice model, that are guiding standards organizations and make optimal use of experiences of both formal standards organizations and scientific studies in this area.

CONCLUSION

This chapter has touched the topic of development and management of semantic standards. It presented BOMOS as solution to an important gap in the knowledge of development and management of standards. This chapter tries to act as a guide for establishing a development and management process within an organization. This chapter also states that the development and management of standards is complex matter, with many different tasks that may or may not be specified, and may be specified in various ways, depending on the context of the standard.

The goal is and remains creating a sustainable standard that contributes to interoperability. It can only be sustainable if the development and management process has been established at a high-quality level. This document provides a contribution to lift the development and management of standards to a higher level and, as a result, create sustainable standards. It speaks for itself that a sustainable standard is an open standard that is managed in a sustainable way!

To conclude, two concrete tips:

1. Create continuity of development and management of a standard by:
   ◦ Taking care of a stable/structural funding model.
   ◦ Putting core tasks in the hands of a structural not-for-profit organization.
2. Describe the activities for the standard carried out based on the BOMOS activities model.

Just like a standard, BOMOS is never finished; new insights may be added based on new experiences. Different opinions about the subject matter are also possible. Since several standards organization are already using BOMOS as guiding principle for designing their development and management organization, it is expected that BOMOS itself will become a standard itself including a development and management organization.

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REFERENCES

Blind, K. (2004). *The economics of standards; theory, evidence, policy*. Cheltenham, UK: Edward Elgar.

Boh, W. F., Soh, C., & Yeo, S. (2007). Standards development and diffusion: A case study of RosettaNet. *Communications of the ACM*, *50*(12), 57–62. doi:10.1145/1323688.1323695

Branscomb, L. M., & Kahin, B. (1995). Standards processes and objectives for the national information infrastructure. In Kahin, B., & Abbate, J. (Eds.), *Standards policy for information infrastructure* (pp. 3–34). Cambridge, MA: The MIT Press.

Brunnermeier, S. B., & Martin, S. A. (2002). Interoperability costs in the US automotive supply chain. *Supply Chain Management*, *7*(2), 71–82. doi:10.1108/13598540210425821

Brutti, A., Cerminara, V., D'Agosta, G., Sabbata, P., & Gessa, N. (2010). Use profile management for standard conformant customisation. In Popplewell, K., Harding, J., Poler, R., & Chalmeta, R. (Eds.), *Enterprise Interoperability IV - Making the Internet of the Future for the Future of Enterprise* (pp. 449–459). London, UK: Springer. doi:10.1007/978-1-84996-257-5_42

Cargill, C. F. (1989). *Information Technology standardization: Theory, process, and organizations*. Bedford, UK: Digital Press.

Cargill, C. F. (1995). A five-segment model for standardization. In Kahin, B., & Abbate, J. (Eds.), *Standards policy for information infrastructure* (pp. 79–99). Cambridge, MA: The MIT Press.

Cargill, C. F., & Bolin, S. (2007). Standardization: A failing paradigm. In Greenstein, S., & Stango, V. (Eds.), *Standards and public policy* (pp. 296–328). Cambridge, UK: Cambridge University Press.

Chari, K., & Seshadri, S. (2004). Demystifying integration. *Communications of the ACM*, *47*(7), 58–63. doi:10.1145/1005817.1005822

Cowan, R. (1991). *High technology and the economics of standardization*. International Conference on Social and Institutional Factors Shaping Technological Development.

De Vries, H. J. (2006). IT standards typology. In Jakobs, K. (Ed.), *Advanced topics in Information Technology standards and standardization research* (*Vol. 1*, pp. 1–26). Hershey, PA: Idea Group Publishing. doi:10.4018/978-1-59140-938-0.ch001

De Vries, H. J. (2007). Fundamentals of standards and standardization. In Hesser, W., Feilzer, A., & De Vries, H. J. (Eds.), *Standardization in companies and markets* (2nd ed., pp. 1–43). Hamburg, Germany: Helmut Schmidt University.

Dogac, A., Pattenden, S., & Zelm, M. (2010). *Future Internet enterprise systems (FInES) standardization task force report*.

European Commission. (2004). *European interoperability framework for pan-European e-government services*. Retrieved February 15, 2010, from http://ec.europa.eu/ idabc/ servlets/ Doc?id=19529

Folmer, E., Berends, W., Oude Luttighuis, P., & Van Hillegersberg, J. (2009). *Top IS research on quality of transaction standards, a structured literature review to identify a research gap*. Paper presented at the 6th International Conference on Standardization and Innovation in Information Technology, Tokyo, Japan.

Folmer, E., & Punter, M. (2011). *Management and development model for open standards (BOMOS) version 2*. Netherlands Open in Connection.

Folmer, E., & Verhoosel, J. (2011). *State of the art on semantic IS standardization, interoperability & quality*. Enschede, The Netherlands: TNO, University of Twente, CTIT, NOiV.

Freericks, C. (2010). *Workable service standard guides through meta-standards.* Paper presented at the 15th EURAS Annual Standardization Conference "Service Standardization", Lausanne.

Frenkel, K. A. (1990). Politics of standards and the EC. *Communications of the ACM, 33*(7), 40–51. doi:10.1145/79204.79208

Grant, S., & Young, R. (2010). Concepts and standardization in areas relating to competence. *International Journal of IT Standards and Standardization Research, 8*(2), 29–44. doi:10.4018/jitsr.2010070103

Hasselbring, W. (2000). The role of standards for interoperating Information Systems. In Jakobs, K. (Ed.), *Information Technology standards and standardization: A global perspective* (pp. 116–130). Hershey, PA: Idea Group Publishing. doi:10.4018/978-1-878289-70-4.ch008

Hawkins, R. (2009). Business models and the dynamics of supply and demand for standards. In Jakobs, K. (Ed.), *Information communication technology standardization for e-business sectors: Integrating supply and demand factors* (pp. 31–51). Hershey, PA: Information Science Reference. doi:10.4018/978-1-60566-320-3.ch004

Hesser, W., & Czaya, A. (2007). The standardization policy of the European Union. In Hesser, W. (Ed.), *Standardization in companies and markets* (pp. 455–510). Hamburg, Germany: Helmut Schmidt University.

Jain, H., & Zhao, H. (2003). *A conceptual model for comparative analysis of standardization of vertical industry languages.* Paper presented at the Workshop on Standard Making: A Critical Research Frontier for Information Systems, Seattle, WA.

Jakobs, K. (2009). Perceived relation between ICT standards' sources and their success in the market. In Jakobs, K. (Ed.), *Information communication technology standardization for e-business sectors: Integrating supply and demand factors* (pp. 65–80). Hershey, PA: Information Science Reference. doi:10.4018/978-1-60566-320-3.ch006

Kosanke, K. (2006). ISO standards for interoperability: A comparison. In Konstantas, D., Bourrières, J.-P., Léonard, M., & Boudjlida, N. (Eds.), *Interoperability of enterprise software and applications* (pp. 55–64). London, UK: Springer-Verlag. doi:10.1007/1-84628-152-0_6

Krechmer, K. (2006). Open standards requirements. In Jakobs, K. (Ed.), *Advanced topics in Information Technology standards and standardization research* (*Vol. 1*, pp. 27–48). Hershey, PA: Idea Group Publishing. doi:10.4018/978-1-59140-938-0.ch002

Krechmer, K. (2008). Open standards requirements. In Jakobs, K. (Ed.), *Standardization research in Information Technology: New perspectives* (pp. 49–65). Hershey, PA: Information Science Reference.

Krechmer, K. (2009). Open standards: A call for change. *IEEE Communications Magazine,* (May): 88–94. doi:10.1109/MCOM.2009.4939282

Lammers, R., Folmer, E., & Ehrenhard, M. (2010). *Narrowing the gap between open standards policy and practice: The Dutch e-government experience.* Paper presented at the EGES 2010 (part of WCC2010).

Lampathaki, F., Mouzakitis, S., Gionis, G., Charalabidis, Y., & Askounis, D. (2009). Business to business interoperability: A current review of XML data integration standards. *Computer Standards & Interfaces*, *31*(6). doi:10.1016/j.csi.2008.12.006

Löwer, U. M. (2005). *Interorganizational standards - Managing Web services specifications for flexible supply chains*. Heidelberg, Germany: Physica-Verlag - A Springer Company.

Markus, M. L., Steinfield, C. W., Wigand, R. T., & Minton, G. (2006). Industry-wide information systems standardization AS collective action: The case of the U.S. residential mortgage industry. *MIS Quarterly: Management Information Systems*, *30*, 439–465.

Nelson, M. L., Shaw, M. J., & Qualls, W. (2005). Interorganizational system standards development in vertical industries. *Electronic Markets*, *15*(4), 378–392. doi:10.1080/10196780500303045

Rada, R. (1998). Corporate shortcut to standardization. *Communications of the ACM*, *41*(1), 11–15. doi:10.1145/268092.268096

Rada, R., & Ketchell, J. (2000). Sharing standards: Standardizing the European information society. *Communications of the ACM*, *43*(3), 21–25. doi:10.1145/330534.330552

Rebstock, M. (2009). Semantic ambiguity: Babylon, Rosetta or beyond? *Communications of the ACM*, *52*(5), 145–146. doi:10.1145/1506409.1506444

Rukanova, B. (2005). *Business transactions and standards: Towards a system of concepts and a method for early problem identification in standard implementation projects*. Enschede.

Simcoe, T. (2007). Delay and de jure standardization: Exploring the slowdown in Internet standards development. In Greenstein, S., & Stango, V. (Eds.), *Standards and public policy* (pp. 260–295). Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9780511493249.009

Simons, C. A. J., & De Vries, H. J. (2002). *Standaard of Maatwerk, Bedrijfskeuzes tussen uniformiteit en verscheidenheid*. Schoonhoven, The Netherlands: Academic Services.

Song, M., Jiang, H., & Wu, H. (2007). International standardization. In Hesser, W. (Ed.), *Standardization in companies and markets* (pp. 347–380). Hamburg, Germany: Helmut Schmidt University.

Spivak, S. M., & Brenner, F. C. (2001). *Standardization essentials: Principles and practice*. New York, NY: Dekker.

Stegwee, R. A., & Rukanova, B. D. (2003). *Identification of different types of standards for domain-specific interoperability* (pp. 161–170).

Steinfield, C. W., Wigand, R. T., Markus, M. L., & Minton, G. (2007). Promoting e-business through vertical IS standards: Lessons from the US home mortgage industry. In Greenstein, S., & Stango, V. (Eds.), *Standards and public policy* (pp. 160–207). Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9780511493249.006

The Netherlands Open in Connection. (2007). *An action plan for the use of open standards and open source software in the public and semi-public sector*. Retrieved January 20, 2010, from http:// appz.ez.nl/ publicaties/ pdfs/07ET15.pdf

Thissen, W. A. H., & Stam, W. J. (1992). Electronic data interchange in an industrial sector: The case of The Netherlands' building industry. *Information & Management*, *23*(1), 15–30. doi:10.1016/0378-7206(92)90051-G

Updegrove, A. (1995). Consortia and the role of the government in standard setting. In Kahin, B., & Abbate, J. (Eds.), *Standards policy for information infrastructure* (pp. 321–350). Cambridge, MA: MIT Press.

Van der Pols, R., & Backer, Y. (2006). *ASL - A management guide*. Zaltbommel, The Netherlands: Van Haren Publishing.

Van der Pols, R., & Backer, Y. (2007). *BiSL - A management guide*. Zaltbommel, The Netherlands: Van Haren Publishing.

Van Wegberg, M. (2006). Standardization and competing consortia: The trade-off between speed and compatibility. In Jakobs, K. (Ed.), *Advanced topics in Information Technology standards and standardization research* (*Vol. 1*, pp. 111–127). Hershey, PA: Idea Group Publishing. doi:10.4018/978-1-59140-938-0.ch006

Von Westarp, F., Weitzel, T., Buxmann, P., & Köning, W. (2000). The standardization problem in networks - A general framework. In Jakobs, K. (Ed.), *Information Technology standards and standardization: A global perspective* (pp. 168–185). Hershey, PA: Idea Group Publishing. doi:10.4018/978-1-878289-70-4.ch011

Wagner, C. S., Cargill, C. F., & Slomovic, A. (1995). Open systems standards in manufacturing: Implications for the national information infrastructure. In Kahin, B., & Abbate, J. (Eds.), *Standards policy for information infrastructure* (pp. 178–197). Cambridge, MA: The MIT Press.

Wigand, R. T., Steinfield, C. W., & Markus, M. L. (2005). Information Technology standards choices and industry structure outcomes: The case of the U.S. home mortgage industry. *Journal of Management Information Systems*, *22*(2), 165–191.

Wilson, S. (2010). Community-driven specifications: XCRI, SWORD, and LEAP2A. *International Journal of IT Standards and Standardization Research*, *8*(2), 74–86. doi:10.4018/jitsr.2010070106

Zhao, K., Xia, M., & Shaw, M. J. (2005). Vertical e-business standards and standards developing organizations: A conceptual framework. *Electronic Markets*, *15*(4), 289–300. doi:10.1080/10196780500302690

Zhao, K., Xia, M., & Shaw, M. J. (2007). An integrated model of consortium-based e-business standardization: Collaborative development and adoption with network externalities. *Journal of Management Information Systems*, *23*(4), 247–271. doi:10.2753/MIS0742-1222230411

KEY TERMS AND DEFINITIONS

Community: Each specific community or group in the field which is involved in the development and/or management of a specific standard or set of standards on the basis of an explicit collective need. As such needs are often felt in both private and public domains, a community can be a form of public-private partnership.

Management and Development of Standards (in short: management): All activities aimed at working structurally on, making available and keeping a standard or set of standards which always fits the current needs of the parties concerned. A distinction can be made between development and management. The **management** of standards concerns making available and updating of existing standards on the basis of new preferences and requirements without actual functional expansion. This includes, therefore, distributing the standard through a website, for example, providing support, collecting preferences and requirements and issuing new versions. The **development** of standards relates to the development of a standard as a solution for a new functional area. This may mean that on the basis of this development, the existing standard is expanded or a new standard is created. Management and development, in the broad sense, for a standard also includes topics like adoption and certification. The development and management of standards differs from the development and management of other products such as platforms and software. A platform is a combination of information, system, organization and interface for the purpose of service. Both in-

ternally within the platform and on the interface of the platform with the world beyond, various types of standards may be used including semantic standards. This relationship between a standard and platform applies equally between a standard and software. Standards have different users and other challenges such as harmonizing with communities and international standards. This doesn't mean that the semantic standardization discipline cannot learn from other disciplines such as the world of software. Models from these disciplines may be usable. In particular, the ASL (Van der Pols & Backer, 2006) and BiSL framework (Van der Pols & Backer, 2007) for functional management can be used to some extent.

Open Standard: An 'open standard' refers to a standard which complies with the following requirements, in accordance with the Dutch government policy (*The Netherlands Open in Connection - An action plan for the use of Open Standards and Open Source Software in the public and semi-public sector*, 2007) and the European Interoperability Framework (Commission, 2004): The standard is adopted and will be maintained by a not-for-profit organization, and its ongoing development occurs on the basis of an open decision-making procedure available to all interested parties (consensus or majority decision etc.). The standard has been published and the standard specification document is available either freely or at a nominal charge. It must be permissible to all to copy, distribute and use it for no fee or at a nominal fee. The intellectual property - i.e. patents possibly present - of (parts of) the standard is made irrevocably available on a royalty free basis. There are no constraints on the re-use of the standard.

Semantic Interoperability: This means that cooperating parties allocate the same meaning to the data that is exchanged.

Semantic Standards: Agreements on the meaning of data. The term business transaction standards is often used as a synonym for semantic standards, which gives a good impression but in principle excludes vocabularies (value lists) or dossiers (e.g. patients dossier) as standards as they are not transactions. Other terms used are for instance e-business standards, interoperability standards, etc. The semantic standards to which this chapter applies may apply in the every context (B2B, B2C, B2G, G2G, G2C).

Working Group: A group within the community with a demarcated sub activity with a clearly defined end result as its objective.