TECHNICAL REPORT

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Knowledge management of health information standards

Gestion des connaissances des normes en information de la santé

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this Technical Report may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 13054 was prepared by Technical Committee ISO/TC 215, *Health informatics*.

Introduction

Health informatics standards are in progressive production by different standards development organizations. They respond to current challenges in health information system implementation. These standards are intended to promote more effective systems in coherent evolution and provide benefits in many different contexts, for developed and developing countries. Of importance therefore is that these standards can be accessible and understandable by many different health information system protagonists and implementers.

With the increasing number of health informatics standards and health information system implementations, there is an imperative need to support different categories of person who need to know about these standards. These persons include developers, implementers, planners, and health information system users, health informatics standards developers and standards developers in domains other than health.

It is expected that the increasing availability of knowledge will:

— improve awareness between standards developers, including different contextual needs,

— ensure more rapid understanding and uptake by system developers,

— ensure better, more supportive understanding of the role and importance of standards by information system implementers and general users of health information systems.

The word ‘informatics’ rather than ‘information’ is chosen a) with reference to the title of ISO/TC 215, b) in recognition of the broad meaning now assumed by informatics rejoining technological and information management issues, However this word is less familiar to some sector communities working in areas where standards of information processing and management are relevant to a successful health system; an example might be SDMX for health indicator reporting. Such standards are deemed within the purview of this Technical Report.

This Technical Report contributes to the emerging use of electronic communications in the development and evaluation of standards. It is noteworthy in addressing communication between standards developers and users.

This Technical Report was developed in meaningful conjunction with ISO/TR 14639, *Health informatics — Capacity-based eHealth architecture roadmap*, with a view that this usefully provides an integrated context for understanding the role of different health information standards, as well as a test for the relevance of individual standards for countries developing health information systems and their policies. Also considered is the potential to provide feedback to standards developers.

NOTE The World Health Organization-sponsored The Registry of Open Access Data Standards (ROADS) initiative also provides input for considerations of availability of health information standards to developing countries.

Knowledge management of health information standards

1 Scope

This Technical Report describes a standards knowledge management (SKM) methodology and metadata to support the easy identification of the existence of a health informatics standard, its developmental status, and its associated Standards Development Organization (SDO). In particular, it describes a knowledge-based navigation methodology to enable rapid appreciation of the contextual roles and purposes of a standard, including the relationship between one standard and others, particularly in the same standards domain.

This Technical Report also gives information about the design of tools to support knowledge management of health informatics standards.

This Technical Report is intended for use by:

a) health informatics standards developers and standards development organizations;

b) developers, implementers and managers of health information systems, clinical information systems and clinical decision support systems;

c) all users of health information systems clinical data, such as health statisticians, researchers, public health agencies, health insurance providers, health risk organizations, data analysts and data managers.

Possible cases where it might be used include:

1) supporting the discovery and contextual understanding of relevant standards by system implementers and policy makers;

2) supporting the discovery of standards with those wishing to identify which standards do or do not exist to cover a particular subject area;

3) supporting standards developers and working groups to identify subject areas in which there are gaps in available standards;

4) assisting those formulating a New Work Item Proposal to specify a scope that avoids overlap with other standards or omissions in the coverage of a subject area;

5) helping member bodies to verify the need for a proposed new work item;

6) enabling those promoting or educating on the use of standards to develop resources that focus coherently on a portfolio of related standards.

2 Terms and definitions

2.1
concept
units of thought constituted through abstraction on the basis of properties common to a set of objects

[ENV 12443:1999]

2.2
framework
logical structure for classifying and organising complex information

[FEAF:1999]

2.3
knowledge management
range of practices used by organizations to identify, create, represent and distribute knowledge to support learning and decision making

2.4
maturity
⟨of an information system⟩ state of a system, demonstrated by special characteristics and behaviour, that permits it to operate better in accordance with its business goals as a result of transformation and adoption

NOTE Adapted from OSIMM.

2.5
maturity model
means of and scale for evaluating and assessing the current state of maturity

NOTE Adapted from OSIMM.

2.6
ontology
organization of concepts for which a rational argument can be made

NOTE Adapted from ISO/TS 17117.

3 Symbols and abbreviated terms

SKMT Standards Knowledge Management Tool

HIS-KR Health Informatics Standards — Knowledge Resource

4 Overview

4.1 General

In 2008 the joint initiative council for different standards development organizations (SDOs) determined the need for the provision of methods and tools so that clear basic information about existing and developing health information standards by the different SDOs could be available from a single source. The importance of creating a common glossary was emphasized and there was endorsement of the web portal, the Standards Knowledge Management Tool (SKMT) to host this need www.skmtglossary.org developed within ISO/TC 215.

The starting point in health informatics standards developed by ISO/TC 215 and CEN/TC 251 involving other SDOs such as HL7 and IHTSDO is the evolution of a single common health informatics glossary. The SKM approach is meant to be comprehensive and not exclude for example standards being developed by particular countries contributing to overall health informatics standards knowledge.

A major objective is to be able to discover gaps in current standards and help orientate future standards development and utilization, as well as enhanced communication between standards developers and standards users.

4.2 Issues of knowledge management

Knowledge management has two primary components, learning and decision making. It relates to particular contexts and affects individuals as well as teams and collaborators. It has the characteristic of being cyclical in that learning changes decisions and results of decisions enable learning.

Issues concern:

— access to knowledge;

— understanding of knowledge which relates to interest, education and experience;

— quality of knowledge representation and clarity of specified underlying arguments;

— sensitivity to feedback and critique;

— adequate maintenance.

4.3 Knowledge structure

4.3.1 General

Knowledge in documents needs a logical structure understandable to the reader. The searching within the document is enabled by the way the knowledge is indexed, including by word search, key word, term, and theme.

Some knowledge is organized in databases.

Health informatics is of course interested in standardization of terminologies and ways of making links between concepts of related meaning. This is an area of active research in health and bio-informatics. The knowledge found in standards however is not entirely made up of nuggets of discrete information that can be precisely labelled for relatively independent scrutiny, but carefully nuanced descriptions providing context and interpretation. Thus it makes more sense to be able to refer to a particular knowledge area or theme at the same time providing context information that may be provided in different ways, also ensuring that this is done meaningfully to the particular user seeking this knowledge.

4.3.2 Ontologies and frameworks

4.3.2.1 General

Knowledge areas can be represented in ontologies, that is a formal modelling showing these areas and their relationships. In line with the argument of 5.2 it should be possible to model relationships between knowledge areas, but difficult to model detailed content of a given knowledge area. A major criterion for choosing an ontology should be that this model should have pragmatic usefulness, in that it makes sense to a broad group of users and can enable rapid location of a knowledge area while understanding the role of that knowledge area in relation to the whole. The model has a visual representation that is coherent to the person who wishes to explore the perspectives of knowledge captured by the model. An example would be that the ontology of a home has components such as a house with kitchen, bedroom etc., and a garden with swimming pool. shed etc. Each component might have a sub-ontology e.g. a kitchen has sink, counters etc. Suppose that you are interested in building materials and their deployment, a different ontology for materials could be useful such as plumbing, masonry, carpentry, paint etc. Again each component could have a sub-ontology such as properties, colours and prices of paint.

Clearly a component of one ontology such as paint could be of relevance to several components of another ontology such as the different rooms in the house. It is then possible to make a link between the kitchen and a subset of paints that are suitable for indoor kitchen use; thus a link is made between ontologies.

The notion of an *ontology* in this discussion is strongly related to that of a *framework* defined in ISO/TS 18308 as ‘a logical structure for classifying and organizing complex information’. In general, an ontology may have more components than a framework and can represent in more detail the relations between components.

4.3.2.2 Linking or merging ontologies

A natural tendency is to enable as many cross-links between concepts as possible so that none are missed. However as discussed above in the example of a house it is easier to move between domains or sub-domains of knowledge to observe and understand relationships between them, rather than a plethora of point to point relationships. An example might be that different health care delivery settings relate to a common set of role identifier and management standards. The link would point to the set rather than each standard, possibly helped by an explanation explaining relation and noting limitations if any.

In this respect it should be easier to enable links between ontologies rather than merging. Each ontology is easier to maintain.

4.3.3 Knowledge indexing: terms, keywords and word associations

The powerful rapid search engines that detect word presence and word associations can be efficient exploratory tools, to show presence and use of a given word and locating knowledge areas related to that word.

Terms have an important role as they are associated with definitions that become norms with glossary harmonization. Definitions enable preciseness of meaning thus supporting the role of the standards document as well as the development of ideas.

Keywords can be identified to help sub-classify document content, however they are difficult to maintain and may not be much more efficient than word search.

4.3.4 Cognitive aspects

Knowledge management should be in harmony with respect to the cognitive interactivity of the user. This implies that persons who have general responsibilities but not specialist understanding in a given area of enquiry should be well orientated and have a reasonable idea of the possible role of the knowledge they are seeking to access. It should at the same time direct all users including specialist users to the best and most pertinent information available.

The human enquirer is also interpreting the knowledge in relationship to their experience and expertise. Access to knowledge may dynamically stimulate other questions. Knowledge tools should support dynamic interaction and exploration so eventually the different knowledge accumulated by these enquiries tends to support a particular individual's needs.

4.3.5 Providing context information

Many factors affect context such as resources, types of information, type of care provision. The recent development of the notion of maturity model is intended to take into account how information system capacity can vary with maturity of system applications. The notion of maturity is being considered in ISO/TR 14639-2. The standards developer also has a possibility to signal important variation according to context that can be noted in the scope at the beginning of the standard or within the text or annex.

4.4 Sharing knowledge between standards developers and standards users

At the core of this Technical Report is the motivation to better share knowledge between standards developers and standards users.

Feedback on the use and usefulness of standards is not systematically obtained. Expert teams can vary in composition over time and this can relatively influence choice of subjects and content. At the same time the application domain is in constant evolution.

More can be done both to promote standards and to record and communicate about their adoption.

5 Health informatics standards classification

5.1 General

This clause reviews different approaches to the classification of health informatics standards and recommends a preferred approach for standards knowledge management that can influence design of supporting tools. This approach is expected to evolve over time with use experience.

5.2 Classification considerations

5.2.1 General

In line with the preceding knowledge structure discussion, a classification can be expected to group standards documents in a way that is meaningful to the majority of users and which enables the user to review similar standard

documents in the same group as well as seeing how other standards documents are in closely or less closely related groups. Furthermore, the structure of the classification should be intuitively understandable to the user.

5.2.2 Standards documents

As noted in 5.3, ISO documents can be a report, a specification or a standard. In this discussion of classification no direct distinction is made between these types of document and all are referred to as a standards document. In essence these documents all serve the aim of enabling useful standardized approaches in a given application domain.

5.3 Classification review

5.3.1 General

Five approaches that influence health informatics standards classification are reviewed. These are 1) the ACHI Advisory Committee on Health Infostructure framework developed in Canada, 2) the Enterprise E-Health Architecture developed in Uganda, 3) the HIPF Health Informatics Profiling Framework developed by ISO 215, 4) the GCM Generic Component Model developed in Germany, and 5) The NIMM National Infrastructure Maturity Model developed in the United Kingdom.

The review is made at the level of major content rather than variations in the expression of detail.

5.3.2 The ACHI framework

This framework proposed in 2002 for classifying standards documents was extensively reviewed in 2005 just prior to establishing in Canada the Standards Collaborative managed by Infoway and coordinates Canadian contribution and awareness of all health informatics standards development organizations activity. The schema produced by the 2005 meeting is shown in Figure 1.

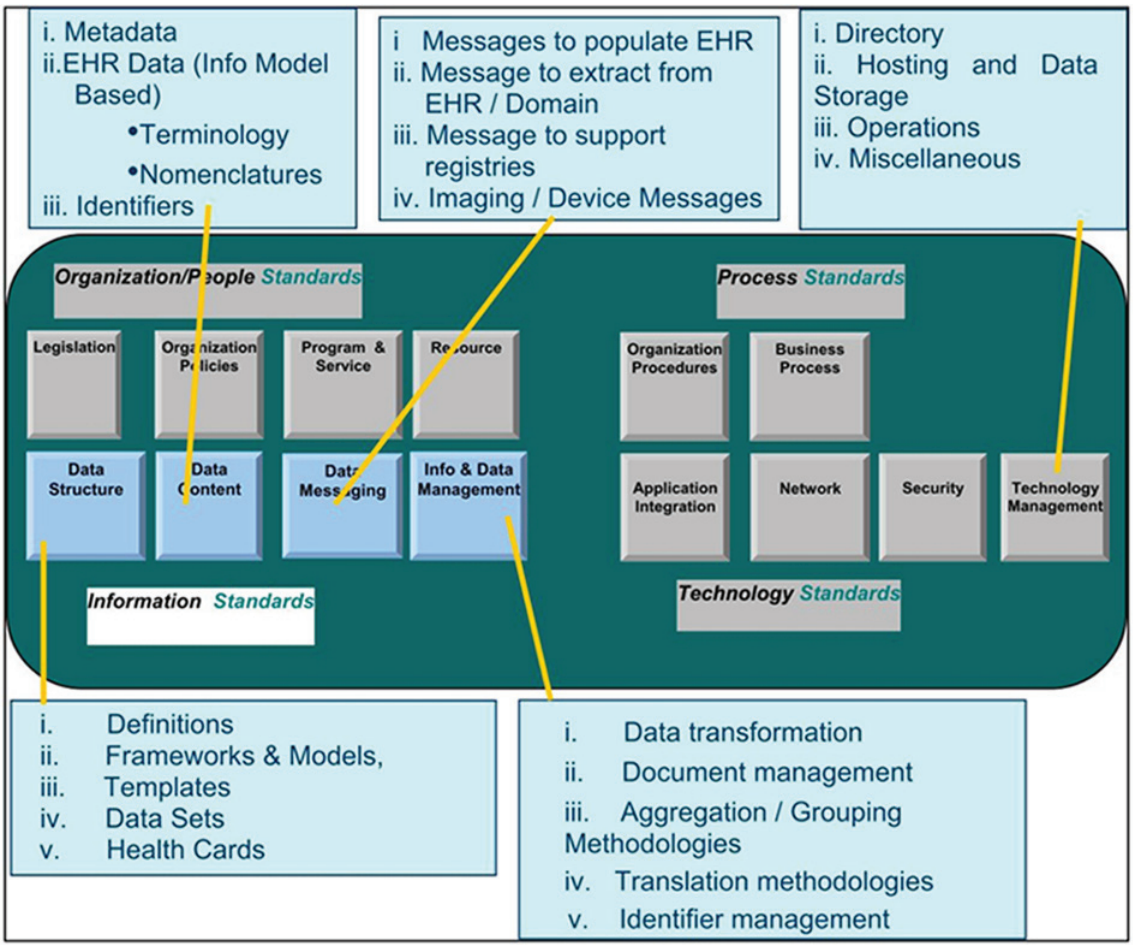

Figure 1 — Updated ACHI framework for information standards

It has four main sections of Organization/People, Process, Information and Technology. As the figure shows each has sub-categories, in fact better defined in the Information and Technology sections.

5.3.3 The Enterprise E-Health Architecture framework

This framework is the subject of ISO/TR 14639-2. It is shown in Figure 2. It resembles the Parthenon and will be informally referred to as such.

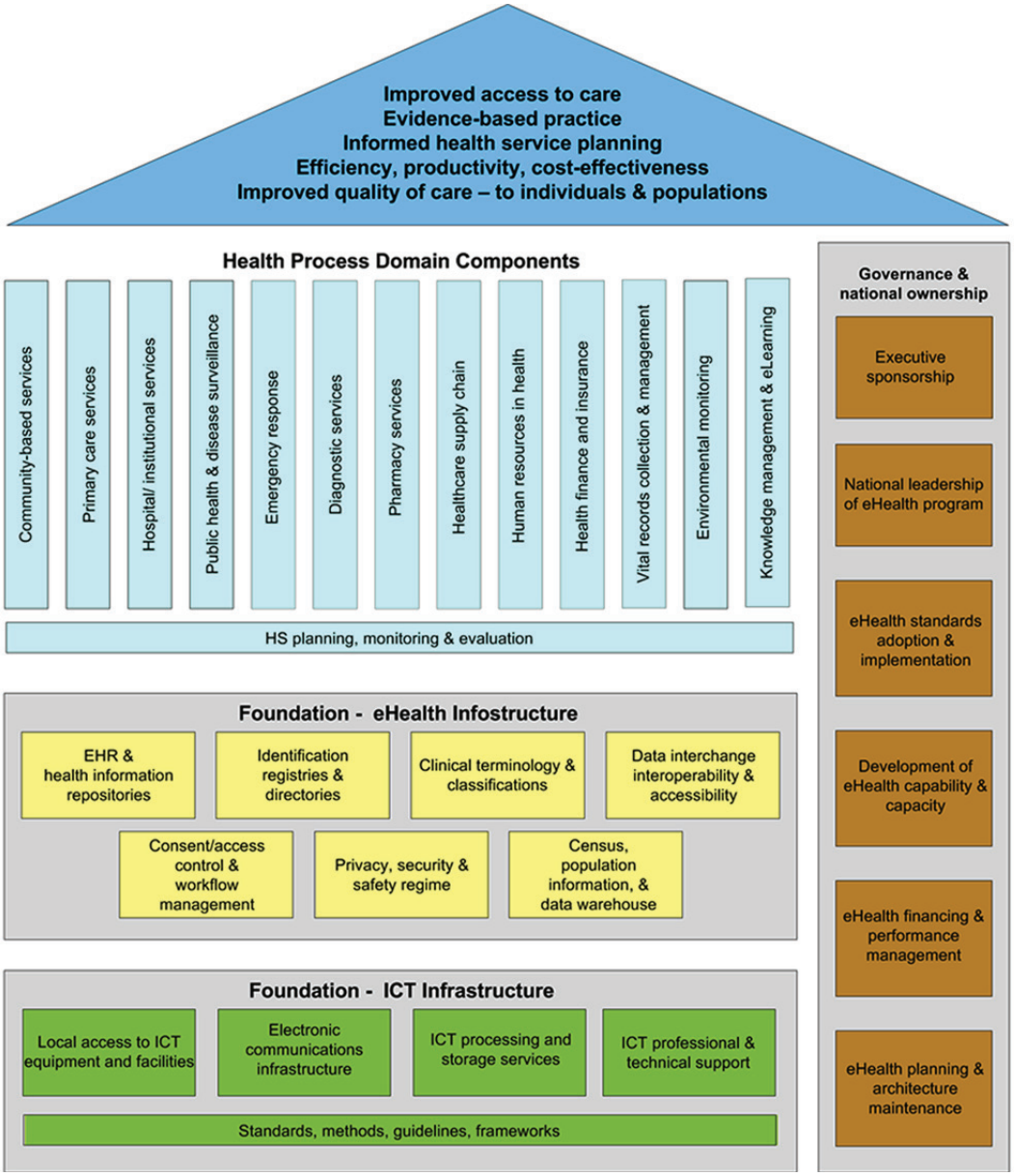

Figure 2 — Enterprise E-Health Architecture framework

Similarity exists between Infostructure and ACHI Information section, as well as between Infrastructure and ACHI Technology section. More explicit in the parthenon framework are application domains, policy and governance and also as the 'roof' the ultimate aim that data quality and appropriate analysis means better heath care. The ACHI gives opportunity for expressing governance and policy in its organization/people section. Whereas the health care supply chain of the parthenon framework domain components could be located in the process ACHI section.

5.3.4 The Health Informatics Profiling Framework - HIPF

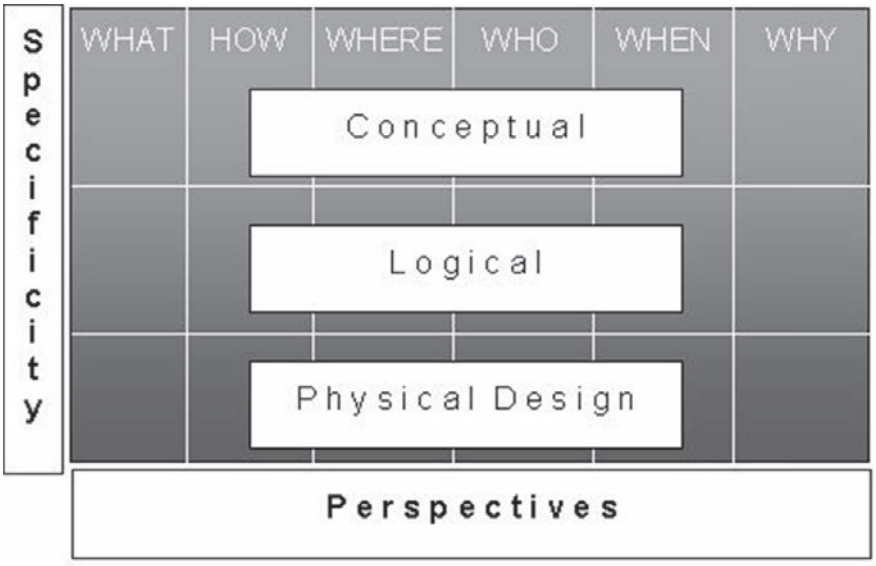

Figure 3 — Health Informatics Profiling Framework classification matrix

Although maybe not at first obvious there is in fact similarity between the HIPF[4] and the other classification candidates here reviewed. The HIPF directly relates to the Zachman framework[7] . The three levels of specificity can be found in each model; for example in the ACHI framework conceptual, logical, physical is closely similar to organization/people/process, information and technical.

HIPF with basic perspectives of who, when, where etc., is less intuitive to relate to than the other models, and this is maybe a disadvantage taking into account the requirement of a classification that can be understandable by a broad range of users.

5.3.5 The Generic Component Model (GCM)

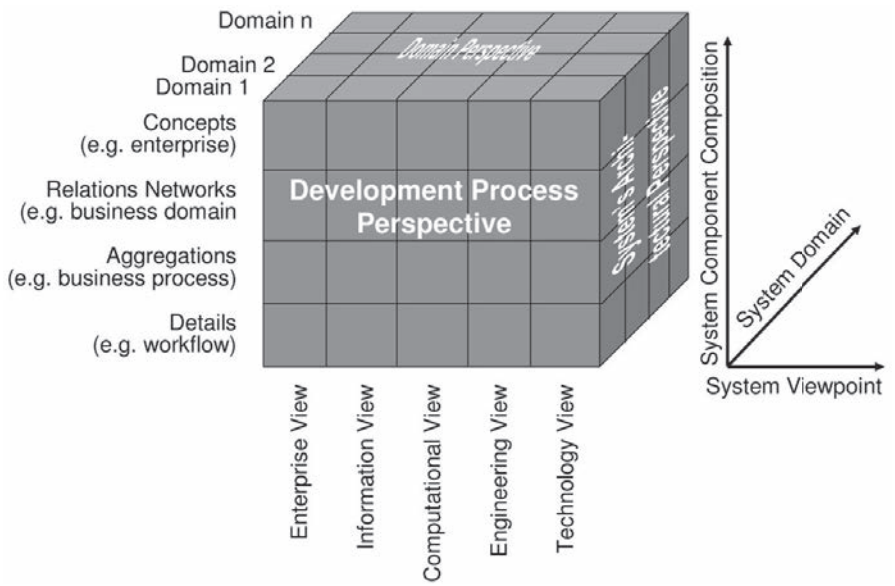

Figure 4 — The Generic Component Model

This model[8] has a strong emphasis on interoperability and the nature of the relation between levels and components. It does identify application domains and also the relation between data quality, data aggregation and analysis and health care quality.

5.3.6 The National Infrastructure Maturity Framework

Figure 5 — The National Infrastructure Maturity Framework perspectives

This United Kingdom based detailed maturity framework analysis[9] describes 74 capability parameters; a capability can be assessed from each of the five perspectives to obtain a rounded view. The perspective diagram thus resembles an integrated health information system model comparable to the other models here presented. The identified perspectives put more emphasis on governance, people/organization and process in relation to technology, as well as the relation between information system performance and quality of health care delivery. KPI in Figure 5 = key performance indicators.

5.3.7 Summary of classification review

All of the five models considered have a Zachman like consideration of business/process, logical/information and technology levels. Models differ more in emphasis than in the way components are classified.

The parthenon model achieves the most comprehensive visual representation and should be understandable by a broad range of health information standards users. The ACHI model is closer to an information architecture view yet retains good user understanding particularly for system implementers. The other three provide complementary information for deeper understanding of particular aspects.

6 Improving knowledge exchange between developers and users

6.1 General

Different approaches might be envisaged to improve developer-user knowledge exchange. These include more organized information for users included in published standards, standardized contributions to knowledge resource tools, and opportunities of user feedback.

6.2 Organized information for users in published standards

6.2.1 General

As distinct from the organization of content of the standard there are currently different opportunities for the standard developer to indicate to the user contextual ‘meta’ information that clearly indicates the role of the standard, its relation to other standards and its main application areas. To provide a guide prior to acquisition of the

standard, publicly available information includes the title, the introduction and scope statements of the document as well as, for ISO/TC 215 documents, an abstract by the ISO editorial office made available on the ISO website.

The introduction and scope statements are for a general audience. It is important to use descriptions that can be widely understood. A more structured approach could be envisaged with required sections including as candidates: Role of the standard; relation to other standards; main application areas; areas outside the scope of the standard.

6.2.2 Metadata

In complement to the contextual 'meta' information described in 7.1, other searchable metadata associated to the document can help its location and status such as the associated Standards Development Organization, the responsible working group, its stage of development, its date of publication, its classification based on a classification framework, etc.

6.2.3 Use case scenarios

Use case scenarios that demonstrate the application of health informatics standards in application settings should be strongly encouraged as is also discussed in the Annex. This is a powerful way to show how these standards can relate to the health system need.

6.3 Standardized contributions to knowledge resource tools

Knowledge resource tools can be updated automatically if the standards document is included in a database or marked up format. Thus a policy for timely registration of the document including its publically available components, notably title, introduction, scope, glossary, if that database is available to the knowledge resource, will enable the knowledge resource tool to be up to date.

6.4 User feedback

Standards once published are regularly reviewed to be improved or discontinued. A new opportunity with electronic communication is to increase and make more systematic user feedback. The current approach for collecting user feedback depends on country standards organizations and committees and it is difficult to organize communication at large.

A web based knowledge resource that is regularly updated can include functions that accept user feedback. Whereas immediate response could be difficult to organize except within specific projects, such response can be collected and fed back to SDO work groups for vetting and reaction. In turn this might lead to update of the knowledge resource with acknowledgement that user feedback had motivated update.

7 Knowledge management tools

7.1 General

This is a broad subject as any tool that supports management of information is assisting processing of knowledge. More sophisticated tools respond to the basic functions of knowledge management namely learning and decision making. Neither of these activities occur in isolation but always with respect to local groups and organizations. Frequently there is a context of mix of different experience and expertise and need and opportunity for communication and explication.

Thus there are general criteria of easy access and understandable organization of knowledge content. There need to be mechanisms of feedback and maintenance to ensure durability as well as awareness of user understanding and education needs.

With respect to knowledge management of health informatics standards, the aim is to associate the knowledge of standards documents, which represent international consensus on best practice, with applications that can nevertheless vary extensively in context and capacity. Examples as close to reality as possible help persons to compare their own situation with that of others.

Knowledge about standards is usefully stored in a database whereas knowledge about standards use is more easily managed in well structured text creating a textbook with high quality explanation and interpretation. Such an online textbook can be ‘dynamic’ in that it is richly hyperlinked so that you can move to illustration or to associated knowledge in orientation with the goals of the enquiry.

7.2 Tools for visual exploration

Visual exploration tools help the user to navigate across subjects displayed on the screen for example as a network. The association between subjects is rapidly evident as well as the nature of the association such as near or distant. At any time you can pause and, through a mouse-click or similar, access more information about the subject which can also reveal other associations. Increasing sophistication of these tools can mean that if you click on a remote part of the network then it streams into view, somewhat similar to techniques that allow you to virtually enter a room and navigate to a picture in the room, choose to see it in close-up etc. Thus a tool can explore three or even more dimensions, although visual clutter must be avoided and each area of knowledge being explored should have adequate representation.

Such tools dynamically can show relationships which might be less evident in a text, enable rapid exploring and comparison, and also to see more clearly the rich areas and also areas less rich or gaps in knowledge that might be improved. Hence such a tool could potentially be an aid for developers or users to talk about a group of standards, such as those linked to security, and through rapid comparison of description of content show how this group might have strong and less strong areas, leading to closer examination of this hypothesis by detailed look at standard content.

Annex A
(informative)

Description of HIS-KR/Spider/SKMT toolset

A.1 General

A toolset has been developed that accords with the principles developed in this Technical Report. It incorporates the SKMT, the standards document and glossary database. The SKMT – Standards Knowledge Management Tool is publically available at www.skmtglossary.org. It has detailed scope information about ISO/TC 215 and CEN/TC 251 standards with contributions from CDISC and HL7 as well as from Canada, Australia and the Netherlands. It has a list of all terms and definitions under ongoing review to achieve the important aim of a harmonized vocabulary.

A dynamic textbook wiki has been developed called the HIS-KR that is the Health Informatics Standard-Knowledge Resource. In addition there is a visual exploratory tool called the spider, readily accessed from the HIS-KR and which is alimented by a database which also incorporates the SKMT.

As the overall aim is to link applications to standards, two ontologies have been incorporated in the spider, one for applications and the other for standards. Of the categorizations examined in the document, the parthenon is the most explicit with reference to applications, governance and use integration whereas the ACHI framework offers an information management perspective for health informatics standards classification. Both have reasonable intuitive understanding of their classifications. Hence the two ontologies use the structure of the parthenon and of the ACHI framework respectively. In the spider it is therefore possible to navigate between the ontologies thus for example linking ‘community health’ as an application to ‘patient identification’ as a standard.

It is easy to navigate between interpretative text in the HIS-KR, the spider navigation tool and the SKMT database. If a new standard is included in the SKMT it is automatically available in the spider.

A bank of use cases is being developed as well as education resources.

The HIS-KR being based on a wiki lends itself to collaborative editing. The user feedback component is in development.

Continuous evolution of the toolset and its content is anticipated.

A.2 The HIwiki.org web portal

This web portal gives access to the HIS-KR/spider/SKMT toolset. The portal is intended to encourage the bringing together of health informatics standards users and standards developers in the respective Standards Development Organizations.

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1) Under preparation.

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