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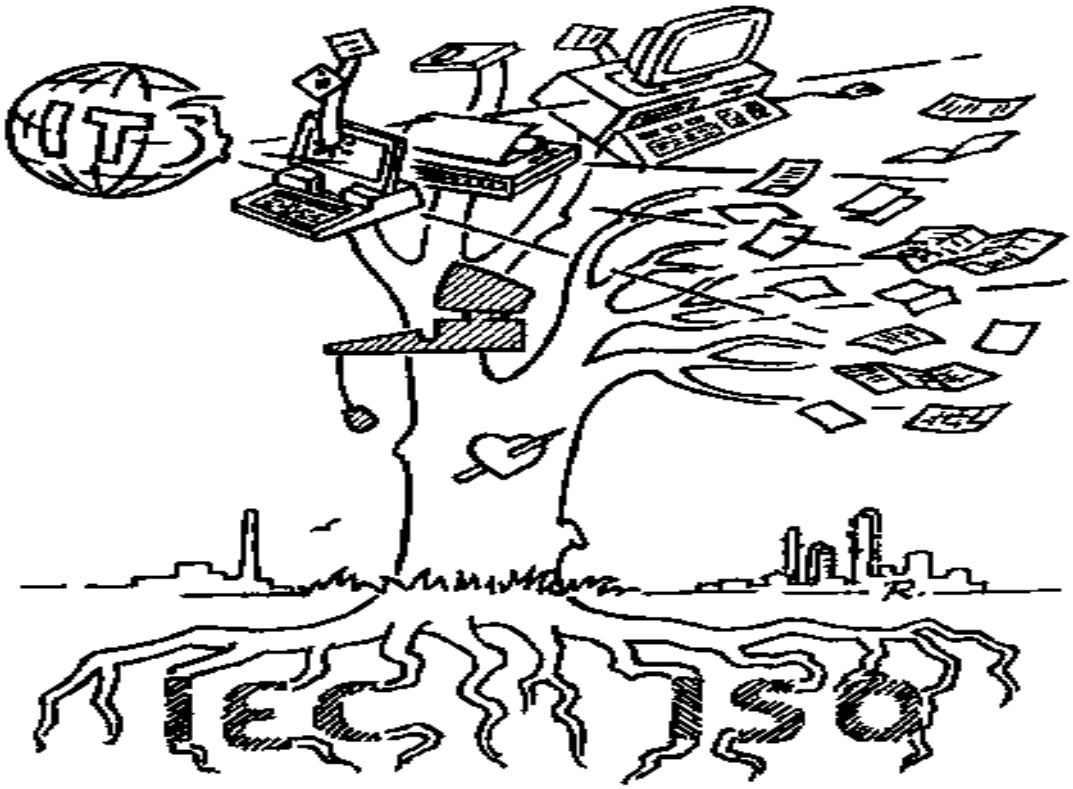
Special Joint Working Group IEC/TC3-ISO/TC10 SJWG13

Future standardization needs in the field of documentation



This report is submitted to IEC/TC3 and ISO/TC10 for commenting.

The report was considered at the meeting of IEC/TC3 in London in November. TC3 decided that the report should be circulated to the National Committees of IEC and the member bodies of ISO for commenting, as an implementation of the first step of the recommendations. The report shall then be revised and used as a basis for further activities.

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1. Introduction to the report

The report has been prepared as a result of decisions taken in IEC/TC3 and in ISO/TC10 to set up a joint working group to study "Future standardization needs in the field of documentation. The working group was to prepare its report for presentation at the plenary meeting of IEC/TC3 in London in November 1995.

The working group, called IEC/TC3-ISO/TC10 SJWG13, has had the following composition:

Mr. J. Aagaard,	Denmark,	*(ISO+IEC)*
Mr. N.J. Bos,	Netherlands	*(IEC)*
Mr. H. Ikeda,	Japan	*(IEC)*
Mr. K. Jensen,	Denmark	*(ISO+IEC), corresponding*
Mr. W.-D. Kisselmann,	Germany	*(IEC)*
Mr. J. Radtke,	Germany	*(ISO)*
Mr. O. Schjelde,	Denmark	*(ISO+IEC)*
Mr. L. Weissenberger,	Germany	*(ISO)*

In addition

Mr. H.-W. Geschke,	*Secretary ISO/TC10*
Mr. F. Reuter,	*Chairman IEC/SC3B*
Mr. P.-Å. Svensson,	*Secretary IEC/TC3 and SC3B*
Mr. H.W. Wagner,	*Chairman ISO/TC10*

have attended some of the meetings, and the Secretary of TC3 has compiled the final report.

The SJWG13 has had four meetings, in:

Berlin,	Germany,	1995-03-15--16
Vienna,	Austria,	1995-05-15--16
Kista-Stockholm,	Sweden,	1995-09-04--05
Munich,	Germany,	1995-10-25--26+27,

and additionally worked by correspondence, mainly e-mail.

2. Summary and conclusions

The working group has studied areas that describe the context in which the standardization needs to take place.

This has resulted in three scenarios describing:

- the public environment;
- the business environment; and
- the technological environment.

The *public scenario* explains what impact the information technology is expected to have on society. Education, public networks, teleworking, internationalisation are some keywords.

The *business scenario* explains how borders between disciplines and locations will disappear and how the ways of organizing business processes and working habits will be changed.

The *technological scenario* describes how supporting technologies such as database technology and data networks will be the keys to these developments.

In all scenarios it is established that the information technology will play an important role, and that this will affect the way in which documentation is prepared and managed in the future.

The scenarios are used to derive anticipated needs for standardization in the area of documentation.

These needs will have to be converted into concrete standardization projects.

Most of the identified needs are known throughout all disciplines as “to do “. Companies and organizations are invited to comment on them by confirming, modifying or extending the proposals.

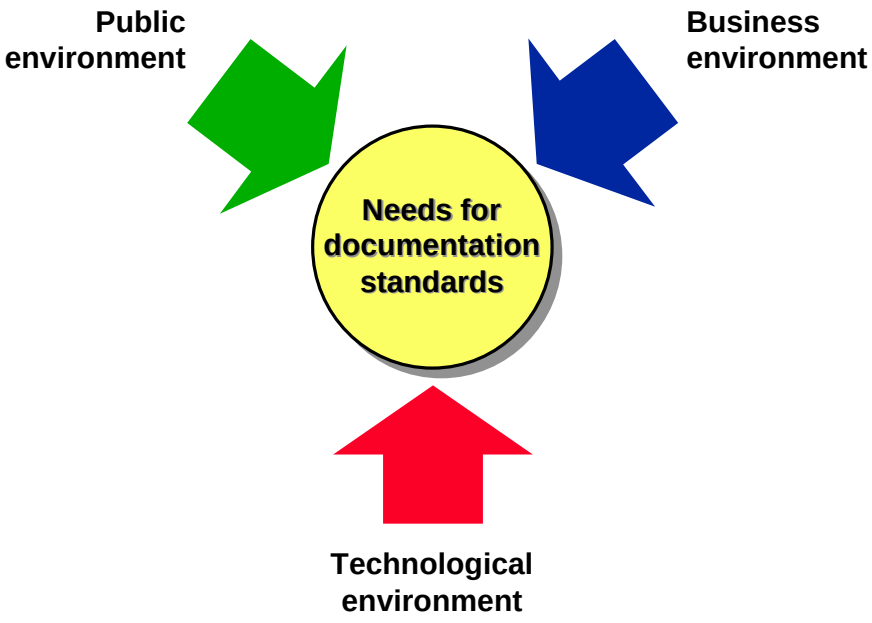

Fig. 1 The Scenario

3. Recommendations

1. The report should be circulated for consideration and commenting in IEC/TC3 and ISO/TC10. The comments shall be used to revise the report.

2. The revised report should be a basis for marketing activities, involving other committees in IEC and ISO but also bodies outside of these organizations. It is very important to reach out to users or potential users of the documentation standards. Therefore, articles in technical magazines, journals, etc. and publications on the Internet (WWW) should be made use of.

   Annex A describes how a project with this aim can be run.

3. The revised report should also be the basis for standardization projects. To define these projects, a specific joint working group is foreseen.

4. Due to the expected rapid changes and development in the information handling and documentation area, the future standards cannot not be developed unless we get better and faster procedures for the standardization. This refers to:

   - greater sensitivity to user requirements. More direct connections have to be established from the users to the international standards bodies.
   - better procedures for the definition of standards projects and for ensuring that we have an extensive, consistent and compatible set of standards within each defined area;
   - better and quicker procedures for the development of a standard;
   - better procedures (that really "reach out") for dissemination of information about the standards and for the standards themselves;
   - active effort to promote the implementation of the standards in industry and for the evaluation of standards.

Activities 1 and 4 could be started simultaneously and immediately. Activities 2 and 3 can be started simultaneously and after the completion of activity 1.

4. Scenario

4.1. Public environment

4.1.1. Introduction

The technological and price development in the computer field implies that computers and networks will become an integral part in the day-to-day life of future generations. By using the computer in schools, educational institutions and privately for learning, communication etc., future generations will become familiar with the computer and its potential to a much greater extent than our generation.

In the business sector, market forces will press enterprises to use current computer technology and simultaneously train employees to apply this technology optimally.

The public system comprising public administration at both central and local level and educational institutions is currently changing to similar technology thus preventing a technology gap arising between the business and public sectors.

Society need to initiate that citizens without daily access to computers in particular, get the opportunity to use public computers and receive training in computer and networking skills.

Such initiatives shall prevent social problems and imbalance and secure that the future society will not consist of an A group and a B group.

Social research studies have already, especially in industrial countries, forecast a risk of a division into 2 groups: the A group with the necessary education and ability to work with information and abstract concepts and the B group which makes up "the rest".

In private households the distribution of computers will increase rapidly, for example it is expected that 75 per cent of all Danish households will possess one or several computers by the year 2000, a figure which is representative for the industrial world.

Likewise it is to be expected that the private and working life of the newly educated generation will, to a large extent, be based on using computers and networks.

4.1.2. The public sector's application of IT

All institutions in public administration at both central and local level and the health sector will be connected to electronic service networks and have an electronic mail box.

The present correspondence by mail between the public sector and private enterprises/citizens will, to a large extent, take place electronically via networks in future.

The public sector will be responsible for structure, construction and maintenance of the public databases which are to be accessible (i.e. see and apply) and available for other users.

The key principle for the public databases will be that "it must be possible to find pre-recorded data and reuse the data in other connections" both by the public sector as well as the private sector (recycling and multi-use of data, data sharing).

4.1.3. Computer access and education

Employees within trade and industry, education and the public sector use computers in one form or another almost daily. There will be differences in the users' computer qualifications, but everybody will have the level of education enabling them to use computers and IT at an elementary level including accessing public networks.

Citizens without personal access to a computer may gain access to computers and networks for example in libraries, town halls and other public buildings. Instruction and guidance in using computers and networks will be provided for anybody who needs it.

4.1.4. The public educational system

The public educational system, which comprises primary schools, upper secondary schools, technical institutions, universities and polytechnics etc., engages in primary and higher education of children and young people, as well as the retraining of adults who have previously received professional training.

All educational institutions will be connected to an electronic network and have an electronic mail box. The institutions of higher education will have access to high-speed networks used in connection with research.

The educational institutions must apply IT on a level corresponding to the surrounding society at least. IT will thus become a natural part of the instruments which pupils and students use and have at their disposal.

Most of the pupils and students want a computer with network access at their personal disposal at home and this provides the basis for tele-teaching via networks as teacher and student can communicate electronically e.g. using multimedia. Assignments are distributed, answered and corrected/commented via an electronic media.

"Textbooks" will be replaced by "books/directories" on electronic media and with searching facilities making it easy to find specific subjects.

Lectures may be drawn from the networks (i.a. video-on-demand) or CD-ROM for example thus making it possible for the individual student to study when appropriate. Teaching may also be individualised via the electronic access to databases of lectures according to the personal needs.

4.1.5. Teleworking (Home work)

The increasing internationalisation, new organizational structures and IT application in enterprises provide the basis for much work being done at home or anywhere with mobile network connection. For enterprises working at international level there is a prospect that barriers may be broken down to which an enterprise working 24 hours a day is exposed.

The possibilities and degrees of freedom which the computer and the networks offer must be incorporated into the personnel policies of the enterprises, with a view to an optimal exploitation of human resources and to the benefit of the individual and his/her family and the society in general.

4.1.6. Controlling IT interests of society

Through national legislation, international standards etc., it is secured that networks are extended so that they will become accessible for all households/enterprises.

The networks must be open and easily accessible as it is presently known from the telephone system for example.

The public sector will secure:

- that tariffs for using the networks are in line with similar tariffs for telephones, television signals etc. Moreover, the public sector will intervene if monopolies are exploited.
- reasonable transitional periods when changing network technologies so that changing of hardware and software do not become a financial burden to the citizens.
- that scarcely populated areas have network access possibly by satellite.

4.1.7. Access to and protection of data

There will be many directories/databases with general information which can be accessible for all persons without problems but also data which needs some kind of protection, especially in public databases with "sensitive" data and in industries with e.g. development data.

Therefore extensive rules/legislation must be made for the data that needs protection ("sensitive data").

Based on current experience with examples on how easy it is for a "hacker" to get access to "safe" databases, it is necessary to develop access control system with a much higher degree of safety.

4.1.8 Information security and public networks

Organizations using services offered by public information networks will be subject to actions of malicious users or even competitors.

Although public service providers will build networks that have a high level of availability and reliability, they do not authenticate individual users as they maintain an open network policy. Therefore, they do not accept any responsibility for the security regimes of the networks which they interconnect.

Hence, some risks in relation to public network connections are:

- breaking into the organisation's internal competence systems;
- eavesdropping and/or disturbing communications with business partners;
- inappropriate use of the public network by internal users.

Investments to counteract these exposures must be made, e.g.:

- for universal access stronger authentication methods than simple passwords will be required;
- connections to public services should only be allowed via managed application gateways; connections bypassing these gateways should be impossible;
- although the introduction of encryption on an international scale is at present obstructed by regulations in several countries, proprietary encryption methods must be considered.

4.1.8. Private IT application

The consumer industry will have incentive to apply and use increasingly advanced computer technology. The multimedia will integrate television, video, telephone, computer etc. and occupy a central place in the individual household. There will probably be several computers of this type in the home and all members of the family will be familiar with using it. The daily purchasing (home shopping) will take place from this computer via the public network and most of the contacts to friends and family will take place through the "video phone".

4.1.9. International network access

The costs for the infrastructure like national and international networks is extremely high and highly qualified personnel is needed. This is not a problem for the industrial countries but for the third world. They won't be able to install the necessary infrastructure without help and so only some important regions in these countries will be connected to the world-wide network.

To avoid growing distance the part of international society, working with third world development, shall take initiatives, so all regions in these countries will have access to international networks.

4.2. Business environment

4.2.1. Disappearing borders

The disappearance between borders of disciplines and locations will be one of the main aspects in the work and handling of documentation in the future, which also includes the handling and processing of information.

4.2.2. Interoperability

The interoperability among different disciplines will become much easier by using standardized data formats and applications such as e-mail, Internet services and easily accessible knowledge databases.

The interaction with suppliers will change: The way of co-operation with a "profit centre" in the own company and "external" supplier will be the same. The co-operation with suppliers will increase, so the virtual company will be realised.

In the future, highly flexible process plans will be used, because of changing user requirements, optimisation of internal organisation, techniques as KAIZEN ("continuous improvement in small steps"), "virtual" companies, etc. Therefore, the data will be handled more and more independent of special applications and procedures. This reflects that applications will come and go, but the data produced have to be usable for a long period of time.

4.2.3. Resources and infrastructure

Internal (local) and external (global) networks will grow up simultaneously and bring fast information exchange inside and among companies. By using global networks the importance of distances and time for transporting information will decrease as well as prices for networking. The sinking prices result also from higher storage capacities (gigabyte-hard disks, optical disks) at lower costs. So storage on electronic media seems to be no problem today already.

Resources related to information processing will be available world-wide. A market for information processes will be established. An example is the software development of some European companies in India, which is happening already.

Much more sophisticated software tools will allow a new level of information exchange to be reached. An infrastructure like the World Wide Web (WWW) gives an outlook into the future concerning functionality and explosive growth. So multimedia and virtual reality will gradually become everyday tools for communication.

4.2.4. Work flow

Costs will be reduced by the reduction of time and the higher quality of data: The transport of information will practically need no time any more. In many cases suppliers and companies have access to the data in the computers of the other. So the time from a request for information to the answer will decrease extremely. The costs will decrease because of faster processes and reduction of personal. The access to all data, distributed on different computers in different companies is the vision of CALS[1].

The majority of information will be processed with the help of computers. So a part of the vision of the "paper less office" will become reality: The original is the electronic version and paper copies will be made only for personal use.

The distribution of documents will change completely: today many documents are distributed on paper, automatically, to people who need them as well to those who don't. By using networks only information that a document is existing is exchanged. Should someone require the document, he

sends a request and receives the information on his computer, which can be printed if necessary: "Distribution plus printing on demand!“

4.2.5. Quality

There will also be an effect on quality management. Quality will not, of course, increase automatically. By a sensible application of new technologies a higher quality level can be reached. As a result it will be possible to produce more complex products at acceptable cost in shorter time.

An effective and co-ordinated information flow may shorten time to market. The integration of logistic/commercial/technical data by computer-based applications is therefore an absolute must.

4.2.6. Traceability and responsibility

Due to the explosive increase in the exchange of technical information, the importance of traceability and responsibility for information will increase too. So procedures will be developed to handle information on the source for an information or a document. This will be an aspect of work flow management systems.

For the reasons of responsibility, information and documents will be signed with the name of the person and/or organization responsible. Responsibility also includes the responsibility for proper understanding of information and documents. This has to be ensured by the use of common standards.

4.3. Technological environment

4.3.1. Introduction

All data and information are produced , stored and distributed electronically.

Electronic Data Interchange of trade messages (known as EDIFACT resp. EDI) and *electronic interchange of technical product data* or *Product Data Interchange* (PDI), between multiple business partners are both tools to foster the collaboration of interdependent companies. Electronic Data Interchange and Product Data Interchange imply on the one hand a good co-ordination between the various processing systems and on the other hand, a good organization of the various businesses and technical relationships among the partners, which includes formalised and standardized procedures.

Product Data Interchange is the electronic interchange of technical product data for product development, engineering, production and service. In this context, product data is data that describes the functional, structural, and physical characteristics of a product throughout its life cycle, and is needed to develop, manufacture and service a product. Product Data Interchange may occur within an organizational unit (for example, between two subsequent disciplines in the development stage of a product, or between development and production), or between parties in different organizational units or companies (for example, in case of co-maker relationships).

4.3.2. Classification of product data

For the sake of clarity, a distinction must be made for example between the user's view and the manufacturer's view on product data, i.e. all product data needed for development, production and service. The user's view deals with *component* information required by an organization that assembles systems from "off the shelf" *products* (components). The user's view is restricted and does not deal with manufacturing and (re)design. The term manufacturer's view should be understood as opposed to the term user's view (see figure 2).

This report focuses on the manufacturer's view on product data.

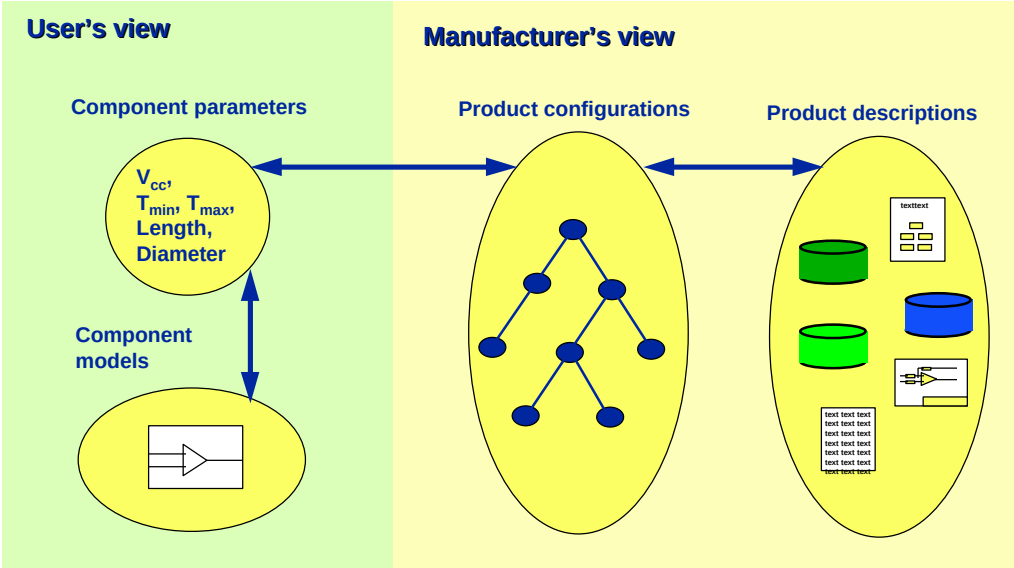

Fig. 2 - Views on product data

Within the manufacturer's view as discussed, two classes of product data are distinguished:

- *CAD data*, i.e. the data handled by computer aided design and engineering (CAD/CAE) systems. These data, in most cases graphically oriented, should be structured and documented in a standardized way.
- Other technical product data (technical product documents), which are not handled by CAD/CAE systems. This class includes a wide variety of data, ranging from the highly structured bill of materials registered in a database to technical documents in a pure textual form (e.g. specifications, manufacturing instructions, etc.).

Both classes comprise product-data-under-development (*product design data*), which are subject to frequent changes during the *product* development stage, and consolidated *product data (product definition data, manufacturing and testing data, etc.)*, which are released for production and subject to formal change procedures. It should be noted that Product Data Interchange concerns both product-data-under-development and released technical product data.

4.3.3. Main issues

4.3.3.1 Data passing versus data sharing

It is foreseen that the character of Product Data Interchange will change from the current data passing between individual users of the product data to data sharing by common access to the product data under the control of engineering data management systems (systems for the collection and control of *product data*), or even to *integrated product databases* shared by the various organizations using the *product data*.

4.3.3.2 Networking

In order for Product Data Interchange to be effective, it must be possible for the data to be exchanged to be automatically interpreted by technical information systems like Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) systems (i.e. without human intervention). Product data should be highly structured to make interchange effective. Another issue is that product data are voluminous, leading to specific *networking issues* [33].

The product data to be exchanged need to be precisely, semantically defined and standardised, if applying an automatic interpretation.

4.3.3.3. The evolution of Product Data Interchange

It is foreseen that Product Data Interchange will evolve from today's passing of product data to a future sharing of product data.

In today's practices Product Data Interchange is nothing more than the transfer of *CAD data* between related application modules belonging to different single-user or multi-user environments or the exchange of technical documents between the various disciplines within an organization. It concerns both work in progress (*Product Design Data*) and consolidated *product data (Product Definition Data)*. The focus is on solving a number of serious data exchange problems (e.g. because of the variety of tools). Hardly any attention is paid to the data management aspects. The information exchange between the individual parties is relatively uncontrolled. Figure 3 depicts this "as is" situation.


Product data
product data
storage and retrieval
Dicipline X
- CAx applications
- technical product
documents
Dicipline Y
- CAx applications
- technical product
documents

less suitable for *concurrent engineering*, or for collaborating parties having a co-designer or co-maker relationship.

Figure 5 shows a more advanced "to be" situation, where the partners involved have access to *shared product data* files, stored under the control of a common Engineering Data Management system. In this case, the exchange process is demand driven and integral data management permits optimal process support.

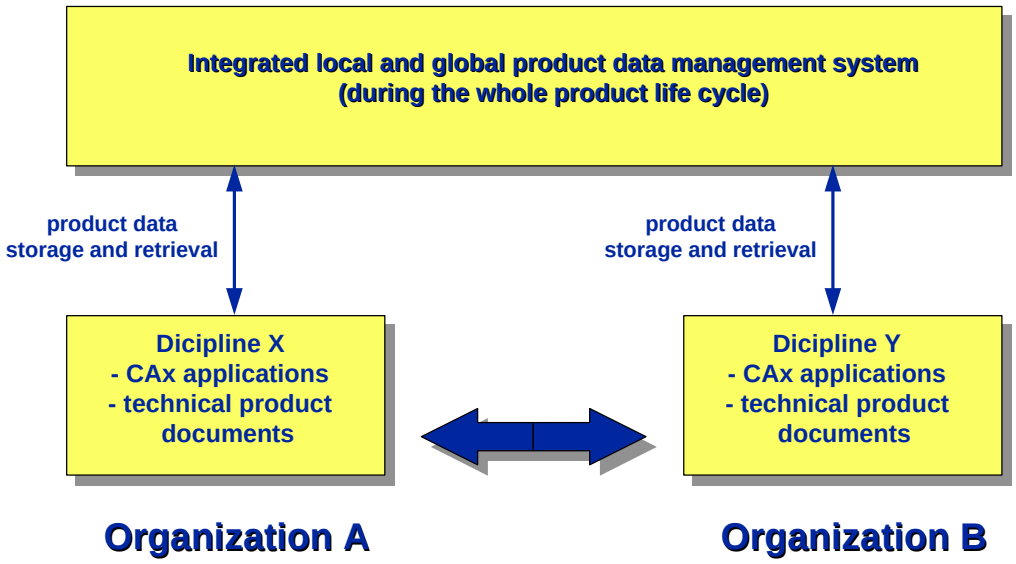

Fig. 5 - Situation C: sharing of product data

4.3.3.4. The evolution of supporting technologies

Networking and database technologies are enabling technologies for Product Data Interchange. The current "state-of-the-art" of these technologies is insufficient to support the evolution of Product Data Interchange. However, it is expected that these technologies will not be a limiting factor for Product Data Interchange beyond 2000.

4.3.3.5 Networking technology

It is expected that networking technology will no longer be an issue for Product Data Interchange in the year 2000: Broad-band Integrated Digital Services Network (B-ISDN) is believed to be the foundation for the high speed networks for the latter half of the 1990s and beyond, with an expected data rate of 1,5M to 600 M bits per second.

However, it is expected that the load on public networks will increase tremendously in the coming years, for example, because of multi-media applications, and that new technologies will be required. ATM is one of the most promising new technologies, as it will be possible to obtain transmission rates up to 2.5 Gbps [33].

4.3.3.6 Database technology

It is expected that industrial automation applications will be grouped around one distributed database and communicate product data only through that database.

It is also expected that engineering applications will still be very data intensive and are characterized by complex data structures. A complex data structure is one in which there may be thousands of different entity types or tables, with many relationships between them. Engineering information is not often simple enough to be represented in the form of flat "dumb" relations and the associated constraints in a RDBMS:

- the relationships between entities in engineering applications are often too complex or too subtle to be modelled by the relational model;
- a considerable amount of reasoning intelligence is associated with the design data in the form of feasibility, consistency, and other constraints imposed by the design process, which may be too cumbersome to implement using the constraints found in the relational systems;
- these systems are not optimised to store and handle large sized data elements, which are common in product data, leading to performance problems.

Although traditional CAD technologies in combination with traditional database technologies already have a good deal of potential, Object-oriented Database Management Systems (ODBMS) are considered as more suitable for modelling, co-ordinating, storing and manipulating engineering information because of the flexibility and power of object data representation combined with DBMS facilities.

ODBMS will facilitate the integration of CAD systems and knowledge based systems to support the product development process, as object data and process data will be clearly distinguished [34].

However, the present database technology is not developed to the extent that adequate STEP (standard for the exchange of product data: ISO 10303) database implementation may be carried out.

As a conclusion, the evolution of Product Data Interchange will be supported by object oriented database technology with distributed functionality.

5. Needs derived from the scenario

5.1. Requirements crossing different disciplines

5.1.1. General

Based on the previously described public, technical and business environment scenarios, this clause picks up on some of the major concepts derived as future standardization needs in the area of documentation.

The issues listed below are supplied with a short description. Some concepts are accompanied by definitions explaining the context. The concepts need common understanding which, for the complex ones, may sometimes require an information model expressed for example in EXPRESS-G (ISO 10303-11), even if such a model is not necessarily required for interpretation and processing by a machine. Only such models explain exactly what is meant.

The following sub-clauses specify some of the major concepts which transcend all activities throughout the life-cycle of a product, system or installation, independent of any discipline or industry branch.

For further explanation of the terminology used, please refer to **Annex B**.

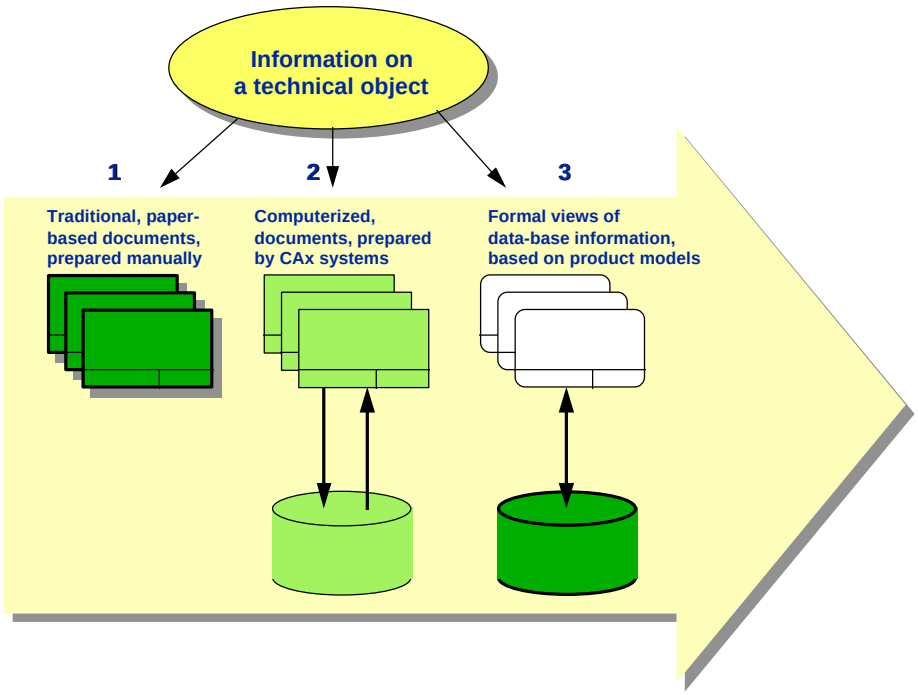

Fig. 6 Development of documentation techniques

5.1.2. The concept of a document: Document- versus Information-management.

Today, much of industry still works and manages projects using documents on paper or electronic documents as if they were prepared on paper, so-called document-driven information management. The electronic or paper based document can only be handled as a whole with no automatic cross-references between different presentations of objects, e.g. presented on different

document types. This document-driven information management will not provide the required cross-references between the contents of the document.

This corresponds to step 1 and 2 in figure 6.

According to the scenario, as a next step data-driven information management is required. In this case the information is stored in a database, from which defined documents are created according to specified algorithms or forms. This means, that the data required and their presentation are defined (preferably standardized) in advance.

This corresponds to step 3 in figure 6.

Since also data-driven management will continue to present data on documents, document handling facilities will still be needed and must be integrated.

Information can be entered or modified through:

- data entry screens;
- defined document types; and
- automated process.

This step indicates a very close relationship between documentation standards and information technology standards. This is further illustrated in figure 7, which is detailing step 3 of figure 6.

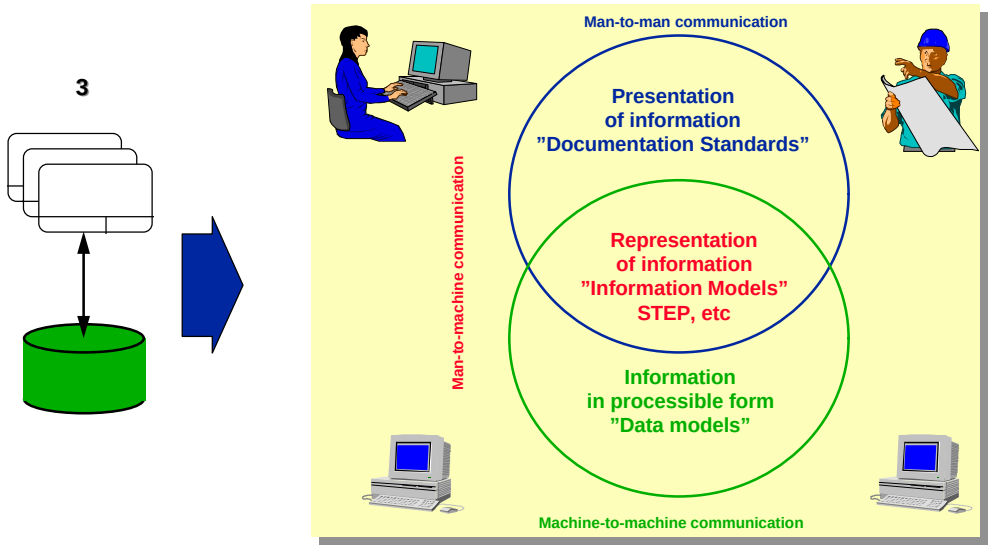

Fig. 7 Documentation versus information technology standards

While quite a lot of the necessary standards can be seen as belonging entirely to the information technology area, documentation standards will continue to be necessary not only for man-to-man communication, but also for the man-to-machine communication. They contain know-how with regard to the application of IT.

5.1.3. Document model to describe document types need to be developed

Document type definitions with minimum content are required.

In order to store information in a database, an information model and a description of the data base (a data model) is required. In order to present the stored data in a specific document a description of the document architecture (a generic document model from which document type models can be derived) is required. These two models allow a bi-directional connection between

the database and the document, allowing automatic generation of documents from the data base and manipulation of the database through the document.

While formal data models have been in existence for a long time, the existing document models are usually not formalised in order to be computer-sensible.

5.1.4. Separation of administrative data from the content of a document

Documents normally contain two types of information:

- the content, for example technical information, graphic symbols; and
- information about the document (administrative data) such as
    - document title;
    - document identification;
    - document classification.

5.1.9. Electronic signatures

Electronic signatures have to fulfil some functions to become equivalent to their manual model:

- Identity function: To give the identity of the signing person.
- Authenticity function: To ensure that the signature is correct.
- Closing function: To close or finish a document at a defined status.
- Warning and prove function: To ensure that the signing person knows what she/he is doing.

The techniques to fulfil these functions are already available, but not yet standardized. There are some different approaches for standards (especially in the USA) but no practical solution is realised.

It is agreed to use asymmetric coding algorithms. These algorithms apply one key for encoding and one key for decoding. Because no one can be derived from the other, one key can be public and the other is secret.

If a person codes a message with his/her secret key, everybody can decode the message by using the second public key and knows the author, who "signed" the message with his personal secret key.

What is needed is a common standard (not only for technical documentation) that standardises the use of the described techniques. For an efficient handling different levels of security and expenditure should be scheduled. For lower security level a "password" system may be enough.

The problem of electronic signatures is also strongly related to the different national authorities and related legal aspects.

5.1.10. Management of electronic originals

This item is closely related to the problem of electronic signatures. The problem of electronic documents is that copies are absolutely identical to the original. Therefore an electronic original must have an electronic signature and/or a defined location (generally it is not possible to store two files with the same name at the same location, i.e. directory). Additionally there should be lists or databases (based on the document meta-files) that give information about the electronic originals. For accessing these lists or the original areas, permissions have to be granted. This is especially necessary for operations that change the original or the list.

General procedures have to be developed and standardized for how to manage electronic originals. These procedures should include different levels of security for the different requirements of electronic originals. Considering that, company specific procedures for how to handle and protect electronic originals can be developed.

Note - See also ISO 11442-2:1993 Technical product documentation - Handling of computer based information - Part 2: Original documentation.

5.1.11. Tracing of data and documents

It needs to separate strictly between changes made on the document presentation and the information, as different procedures can be applied for presentation of the same information.

5.1.12. Reuse of data and documents; electronic libraries

Access to electronic libraries, in which the structure of the information is based on common International Standards, is of vital importance, as they can be used by many projects. Due to the fast access via Wide Area Networks or the Internet, such libraries are tools to foster quicker results.

The reuse of data and their presentation on documents is of high importance to industry. Any support needs to be given to those activities making the reuse of data more effective and productive; such reducing retyping, avoiding errors and allowing either data, data structures or documents of former projects for incorporation into new projects. This calls for hierarchical design methods.

In this context it is of vital importance to the industry that compatible sets of standards are defined since it is necessary to collect and to use information in different projects and among different disciplines working in the same project.

5.1.13. Basic rules for description and structuring of documents and documentation

With modern information technology, it is easy to prepare documents for each specific activity or task from a common information base, and to make purpose-oriented combinations from different information sources. This will, in addition to already standardized documents, require rules and standards for print-outs and composite documents.

Technical documentation is today still supposed to be pictorial, textual or data, such as process control data. Standards for the inclusion of other media for information provision, i.e. audio and video will be necessary.

Depending on the location of the plant and the labour force available, requirements for detailed documentation rise, needed e.g. for the installation and operation of the plant. For this purpose electronic pictures, video or audio sequences in the local language could replace traditional documentation to less cost.

Other parts of the documentation could be accessible files in a World Wide Web (WWW) environment, or not-computer-interpretable documents, e.g. a plaster model or a paper document at a specified physical location.

5.1.14. Multi-disciplinary standards

There is a fast growing demand for integrated processing of data; integration in this context refers to the collection of data belonging to the same object, independent of whether the data refers to electrical or non-electrical matters. For a sensor or actuator in a chemical process system there is mechanical, electrical and associated process information. Formerly these kinds information have been dealt with independently and documented separately.

The formerly traditional borders between the different industrial disciplines are not adequate today when dealing with information. Industry practice (developing new products, the project group includes participants of all involved parties from design, manufacturing, marketing, etc.) needs to be reflected in the development of standards like those for structuring principles and reference designations and the structure of standardization organizations. Therefore basic standards need to be developed by experts in a multi-discipline environment defining the common views and be supplemented by standards, if needed, specifying single discipline requirements.

5.1.15. Virtual products - virtual systems

The development of virtual products on computers allow to design the product-to-be without having implemented any physical prototype before. This technique requires the merging of the know-how from all involved parties and will set pace in the future for the development of all products, plants and systems.

Note - The layer technique used in drawings is a specific implementation of this issue.

5.1.16. Specifications for documentation for different types of products and installations

IEC 3/484/INF
ISO TC10 N652

Standards for product-, plant- and system-specific documentation-systems based on a generic set of standards are desirable.

5.1.17. Basic rules for documenting process plans.

Technical documentation includes the documentation of products and technical processes. To document technical processes standards should be developed. A very basic description of process-models is given in ISO 9000-1. For more advanced documentation additional methods as SADT (Structured Analysis Design Technique) and procedures for their use are considered as necessary.

5.1.18. Reliable standards for information interchange.

A limited set of standards for information interchange and standardized protection methods during transport is required. Related to this are standards for selective access to shared data and selection of data for exchange.

5.1.19. New forms of international tele-working

User-friendly and usable information and communication infrastructure would lead to completely new types of working, for example tele-engineering: this term introduces a new type of planning and design, which will change the type of working in technical offices. Computers are connected via high-speed Wide Area Networks(WAN) and global networks. The data network and connected computers are designed to transfer relevant data in the field of tele-working, -conferencing, -consultation, -diagnosis,
-teaching etc.

Global teleworking is far more than just a question of computer technology, the crucial issue is the one-to-one communication. This will require international standards and that these standards are available world-wide also in the relevant languages. Nevertheless, attention needs to be paid to cultural differences. Standards are therefore also required in the fields of:

- project management;
- co-operation; and
- technical product documentation.

5.1.20. Referencing mechanisms in networks

General rules need to be established allowing for references to electronic documents, independent of their location and physical format.

5.2. The standardization procedure and related problems.

5.2.1. General

Because of the expected rapid changes and development in the information handling and documentation area the future standards cannot not be developed unless we get better and quicker procedures for the standardization. This refers to:

- better sensitivity for the requirements from the users. More direct contacts have to be established between the users and the international standards bodies.
- better procedures for the definition of the standards projects and for ensuring that we have a reasonably complete, consistent and compatible set of standards for each defined area;
- better and quicker procedures for the development of a standard;
- better procedures (that really "reach out") for dissemination of information about the standards and for the standards themselves;
- active efforts to promote the implementation of the standards and for the evaluation of standards.

For the meeting of these requirements modern information technology offers a number of tools which can be very efficient provided that they are appropriately used and problems relating to funding of the work, payment, copyright etc., are solved.

5.2.2. World-wide availability and access. How to pay?

The speeded-up procedures in industry will require immediate access to the valid International and National Standards. The only way to meet this requirement is to make them available over data networks.

That focuses on how to pay for Standards. A separation between reading and **use** of a standard might be useful: you may read a standard for free, it is only when you in your product specification refer to it as fulfilled, you need to pay. (Compare distribution of *share ware*.)

Horizontal standards are especially important for making global communication on different level possible. Therefore the access to these standards ought to be especially easy for a potential user, and entirely free dissemination ought to be considered.

5.2.3. Funding for horizontal standards work

The funding of horizontal standards has been a problem for a long time: everybody needs them and wants to have them, but trusts that somebody else will do the development and pay.

Producers of products generally have a high interest in standards related to products because of the direct impact on their business.

The impact of horizontal standards on products is not so direct, and the willingness to sponsor is less. Therefore other types of funding than that for product standardization ought to be considered.

There may be the need to concentrate activities and get them sponsored by industry pools respectively by national or regional government organisations. This would give relief to those projects hampered by lack of resources. Known resources however are the basis for a effective project management.

5.2.4. Quicker procedures for standardization.

Any technical development needs to be driven under a strong project management and be run as an industry project.

International Organizations like IEC and ISO are not enough well prepared to run such projects. In order to manage such issues in proper time, at defined cost and at the quality needed, the actual organizational procedures offered in the actual version of the common ISO/IEC directives need to be adapted to modern requirements (and really common between IEC and ISO)..

This may lead to a restructuring of the standard bodies work, internationally as well as nationally. Teamwork is well-known in industry world-wide; this should also be applied among different standardization organizations to solve problems better, in order to obtain good quality and solutions in time to the market.

As an example of what may need to be done reference is made to document IEC 3/477/INF "Proposal for a re-engineered procedure for the development of International Standards".

5.2.5. Copyright on the meta-information on documents

Clause 5.1.4 above described the separation between information and meta-information.

In order to promote the creation of efficient "search and retrieval machinery's" for standards, meta information should be freely available. This will make it possible to include this information in private search data bases.

5.3. Revision of existing documentation standards

5.3.1. Investigation with regard to changes in other standards.

It is necessary to make an investigation of existing documentation standards, to see if they fulfil requirements with regard to other standards such as:

- quality management;
- legal requirements;
- certification requirements;
- environmental requirements.

In order to be able to create an International Standards systems with better consistency it would be useful to have the possibility to trace in which other standards a standard has been normatively referred to ("is-part-of" analysis).

5.3.2. Investigation with regard to the life cycle reference model

To find out gaps or overlaps among existing standards in relation to different disciplines, a reference model is helpful. Please refer to **Annex C**.

6. Standardization activities - competing or supporting?

If there is a real need for standards within the documentation area, they will be created by some institutions such as:

- Public institutions:
  Regional and national standards bodies (e.g. ISO, IEC, CENELEC, ETSI, ANSI, ...)
- Private institutions:
  Consortia of manufacturers (e.g. CFI, ECA, Pinnacles, ...)
- Globally acting corporations, consulting firms (e.g. ABB, Ahlstom, Siemens, Toshiba, Philips,.)

including

- Manufacturers' associations (E.g. EIA, ZVEI, VDA.....)

If the international standard bodies don't take up their job in time, other bodies will create the required standards de facto. Please refer to **Annex D.**

Annex A
Dissemination & feed back project

A.1. General

Important factors for standardization are quality and topicality of international standards, and dialogue with and support from end users.

This report contains information and recommendations on future needs, which should be discussed and clarified among "Standard producers and standard users" before strategies on the subject are determined.

The report, or the revised report, is proposed as basis for a global "Dissemination & feed back project" which besides dissemination of and feed back on the report also should benefit the standardization organizations regarding marketing, visibilization, public relation, etc.

The " Dissemination & feed back project" should be seen as part of the ongoing activities in ISO and IEC on future standardization, project management speed up, organization, industrial expert back up, etc.

The project should also be seen as a parallel activity to projects on national and international Information Technology (See references to report part: Scenarios) and Electronic Data Interchange. A co-ordination or contact to such activities/projects should be considered.

A.2. Possible example of project model and activities

Step 1 Preparation and introduction

- IEC and ISO agreement on the project
- Formation of project organization, pointing out of project key persons and project time schedule.
- Preparation of edition of the report for the project.
- Preparation of project manual
- Information of national comities

Step 2 Completion

- Formation of international/national project organisation and pointing out of project key persons and project time schedule.
- Project financing
- Publishing of articles in magazines.
- Publishing of invitation to project seminar
- Seminar(s)
- Preparation of Step 2 report

Step 3 Conclusion and decision

- Preparation of international report based on "Step 2 reports"
- IEC/ISO discussion and agreement on new strategy, procedures, etc.

Project responsibility

Step 1+3	IEC and IEC	
Step 2	International level:	ISO and IEC
	National level:	National standardization organizations.

Project time schedule

The project should be realised in 2 years, which requires extend use of electronic communication and distribution (Internet, E-mail, WWW etc.).

Project manual

To co-ordinate and support the project, especially step 2, a project manual is required.

The project manual shall contain information on:

- organizations
- communication
- time schedule
- planning of step 2 activities
- financing
- articles (drafts) for magazines
- seminar program
- reporting

Project participants

Besides the international and national standardization organizations the project participants should be those mentioned in the report "Competing standardization activities"

Project financing

Project step 2 should be financed by standardization funds, government funds, industrial sponsors etc.

Project publishing

Articles based on the report should be published in magazines distributed by ISO/IEC, national standardization organization, associations of industries, manufactures, engineers, etc.

The reports should be publicly available.

Project seminar

At the end of the publishing period, 1-day seminars should be arranged.

The seminar programmes should be structured as follows:

- Introduction
- lectures

- group work
- presentation of results of group work in plenum
- conclusions

Each seminar should be arranged with participants covering related fields e.g.

- International standardization organizations / international operating companies / world wide used national standardization organizations.
- National standardization organization / national manufactures associations / national companies

Project reports

The sequences, results, conclusions of each project should be documented in a report.

The individual project reports should be forwarded to the IEC/ISO project group for preparation of the final common report.

Project goals and feed back

- Marketing and visibilization of ISO, IEC and national standardization.
- Vertical and horizontal activities and dialogue on international/national level between "standard producers" and "standard users"
- "Standard users" expectations and requirements to "standard producers"
- Actual standardization needs
- Future standardization needs
- Visibilization of new needs for co-ordination and co-operation between IEC/ISO and other standards organisations.

Utilisation of project results

Besides as input for specific actual and future standardization activities , project effect and results should be utilised in succeeding activities on organization, procedures, directives, project management speed up, increase of the number of experts available for standardization works, etc.

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Annex B
Terminology, abbreviations and acronyms

Approval management: The function entrusted with the consistent identification, control and registration of approvals.

Archiving/retrieval management: Method and requirements to store and retrieve documents in databases.

CALS (= Continuos Acquisition and Life cycle Support) is an initiative started by the American ministry of defence and now supported by the government and the industry of most industry countries.

Certification requirements: Collection of processable information with respect to the certification of something

Change: A deletion, addition, modification or replacement of a part or parts of a product and/or its technical documentation of products .

Change authority: The function entitled to decide on change proposals.

Change decision: A decision taken by the change authority on a change proposal.

Change management: The function entrusted with the consistent identification, control and registration of changes.

Note - The task of change management include:

- recording and filing change proposals and related decisions;
- evaluating the consequences of proposed changes;
- giving practical advice on the introduction of the change;
- controlling the execution of change decisions;
- reporting to all the parties concerned;
- safeguarding configurations against unauthorised changes;
- ensuring adherence to the applicable coding and identification standards.

Change note : A formal statement, based on a change decision, which gives details, implementation instructions and measures taken by the relevant change management.

Change proposal: A formal statement to change a product and/or its technical documentation of products .

Note - A change proposal contains at least a detailed description of the proposed change, purpose, scope and objectives of the proposal, name and organization of the originator and date of the proposal.

Classification : Systematic arrangement of objects in groups or categories according to well-defined characteristics, in order to serve a given purpose.

Note - This definition is valid for both documents and other objects.

Clerical change (CLC): A change in the technical documentation of a product without changing the product.

Compound document management: Different information views classified as different document types presented on a single document.

Document and data dissemination: The distribution flow of documents to a listed persons/organisations during a project taking into account self-service or controlled distribution.

Document revision versus information revision: Method of managing occurring information changes not necessarily affecting the presentation on documents and vice-versa to avoid inconsistency.

Electronic signature : Electronic method to assign responsibility and authorisation to a person.

Environmental requirements: Collection of information with respect to the environment and a method to map it onto products when realising, based e.g. on IEC 721 series.

High-level change (HLC): A product change visible to the user, causing modification of or a new product identifier. The changed product is to replace its predecessor.

History management of documents: Method and requirements to treat documents within the life cycle of the object being subject for the documents

Identifier: String of characters/or symbols used for the identification of an object or person.

Identification: Systematic determination and registration of identifiers concerning objects or persons, in order to uniquely distinguish them from each other to the degree of detail required for a given purpose.

Note - This definition is valid for both document and person identification as well as the identification of organizations.

Interchangeable product: Products are considered to be interchangeable, if the new changed version can be used in the relevant assemblies without deterioration in performance and reliability. Depending on the nature of the change, the upwards compatibility may be limited.

Interoperability: Method of handling data from different sources within a project.

Legal requirements: Collection of processable information with respect to common and national laws.

Low-level change (LLC): A change of the product or its manufacturing which is not visible to the user of the product, causing an update of the technical documentation of the product, but leaving the product identifier concerned unchanged.

Maintenance: The combination of all technical and corresponding administrative actions intended to retain a product in or restore it to a state in which it can perform its specified function.

Note - Within the scope of this standard this means that change proposals regarding both the unchanged and changed products are accepted and dealt with by change management. It also covers control over both versions of the product with respect to subsequent changes.

Multi-discipline interaction: General guide supporting the interaction among different disciplines in a project when starting a project.

Multi-lingual documents: Method of managing different language versions of a document with identical content.

Quality management system requirements: Collection of processable information in conformance with quality management systems with regard e.g. to ISO 9000 series, IEC 400, .

Reference designations: Identifier of a specific object with respect to the system of which the object is a constituent, based on one or more aspects of that (IEC 1346-1)

Reference file technique: Organisation of the presentation of data in a multi-discipline project.

Reference to external documents: Methods of identifying, classifying and describing references to other objects of interest, needed in the context without inclusion by copying into the actual document. Such references may refer to data, text, photo, video- and audio-sequences (multi-media).

Revision: Minor modification/update of the definition of a resource. A revision is identified.

A typical definition of how revision is used is that different revision are interchangeable in terms of providing unchanged functionality. Therefore, revisioning implies that the latest revision is the valid one, although earlier revisions shall be stored for quality and retrieval purposes (e.g. compare the EU machine directive, and other directives)

Revision management: The function entrusted with the consistent identification, control and registration of versions.

Release management: The function entrusted to a person (owner) with the consistent identification, control and registration of releases of objects of interest intended for a defined purpose.

Several (document) identities: Associating additive identifications to objects with identical content, each identification based on different context.

Structuring of documentation; composite document handling: Method of how to compose documents in order to build up a documentation of an object.

Temporary print outs: Method of managing print-outs of a database which serves a momentaneous action applying e.g. SQL (Structured Query Language) formulas or macros for retrieving data for its presentation in human-readable form on screen or paper without planning to identify, store and maintain it.

Variant management: Method of managing data belonging to complete product families

Version: Major modification to the definition of an information object, as regards values and/or substructure.

A version may be a major or minor (maintenance) version, the latter reflecting error corrections to e.g. a software product. A version is identified.

A typical definition of how version is used is that different versions of an information object ARE NOT interchangeable in terms of providing unchanged functionality. Moreover, versions unusually have to “live side by side“.

Version management: Method of how to manage versions of a function and/or product.

Virtual product: Information concept of a product covering all later features, not yet actually implemented.

Annex C
The Reference Model

C.1. Introduction

The purpose of the proposed reference model is, within the framework of the product life cycle, to show the gaps in or overlaps between existing standards. Only then is it possible to lay down the detailed standardization needs for documentation.

Although the phases were chosen consciously, any other grouping can be introduced into the structure, for example:

- documentation processing,
- product documentation, process documentation,
- product development documentation, production and quality assurance,
- organization of documentation,
- fulfilment of ISO 9000 items
- document administration

In order to lay down the future points of emphasis for tasks, it is suggested that the matrices be created through the standardization institutes using the relevant information. For reasons of capacity, the task force does not consider itself in a position to make this analysis.

To get the standardization needs on future documentation, the following tasks should be carried out:

- Definition of the phases of the reference model
- Completion of the disciplines
- First recording, i.e.. the individual `little boxes` in the cube have purpose.
- Contents of the positions of the reference model should include:
    - Standards
    - Descriptions of information to be presented (procedures etc.)
    - Document types
    - Processes which convert documents/information

An overview of the area of the technical documentation of products follows on and from this can be analysed for gaps, overlaps and priorities for action. After establishing the necessary action, the individual themes may then be divided up between ISO/IEC and worked on in a compatible` way.

For examples of the reference model, see the following figure C.1.

	Electrical Engineering	***Measuring Control***	***Process Engineering***	***Hydraulic Engineering***	***Mechanical Engineering***
Information ...					
• *creation*	x	x	x	x	x
• *storage*	x	x	x	x	x
• *retrieval*	x	x	x	x	x
• *distribution*	x	x	x	x	x
• *protection*	x	x	x	x	x
• *qualification*	x	x	x	x	x
Life cycle phases of a product type	x	x	x	x	x
Organization of documentation	x	x	x	x	x
Process documentation ...					
• *development*	x	x	x	x	x
• *manufacturing*	x	x	x	x	x
• *maintenance*	x	x	x	x	x
General rules for document administration	x	x	x	x	x

Fig. C.1 Example of life cycle model

As a basis for the description of the product life cycle the draft of IEC/TC3-ISO/TC184/SC4 JWG9 might be useful (see SJWG13/25) and ISO/TC 10/SG-D N 143 rev.1.

Annex D
Standardization activities - competing or supporting ?

D.1. General

If there is a real need for standards within the documentation area, they will be created by somebody.

If not the international standards bodies are doing the work satisfactory other bodies may create standards *de jure* or *de facto*. Some possibilities are discussed in the following.

D.2. Regional and national standards bodies

(E.g. CEN, CENELEC, ETSI, ANSI, ...)

Such bodies should normally canalise their efforts through the international bodies and not start any activities unless the international bodies have actively neglected to adopt new work item proposals.

D.3. Manufacturers' associations

(E.g. EIA, ZVEI, VDA.....)

Manufacturers' associations usually work on a national level, although there are also examples of such that have members from several nations (it would anyway not be correct to see them as international). They normally work with a long time perspective.

These associations are often very active, and the result of their work has impact at least on national level and for specific branches.

Associations of this type can be seen as "feeders" of results for international standardization formally canalised through national or regional standards bodies, or informally through global acting enterprises.

D.4. Consortia of manufacturers

(E.g. CFI, ECA, Pinnacles, ...)

Consortia are set up by a restricted number of companies, normally competing in products, but not in concepts. A consortium is set up to solve a specific problem, common to those involved. This problem is normally so urgent that the participants are willing to provide substantial resources in manpower as well as in funding. Through this concentration of resources results can be achieved comparatively quickly. If the involved companies are enough dominating within their branch, *de facto* standards can be established. The produced standards are often product type dependent.

This type of standardization activities are growing rapidly, and are sometimes linked to traditional international standardization activities.

D.5. Globally acting corporations, consulting firms

(E.g. ABB, Ahlstom, Siemens, Toshiba, Philips,...)

Globally acting corporations and consulting firms have a need for at least a minimum set of standards in the documentation area in order to make co-operation possible and efficient. IT makes this need successively increasing.

Corporation of this type usually relay on international standards to the maximum extent possible, but also creates own standards where international or suitable regional or national standards are missing.

The need for standards is most emphasised for corporations dealing with large installation projects, since these usually involve a large number of "uncontrollable", and different, external partners, consulting firms, suppliers and also the customer in each project development process.

A comprehensive set of standards has to be decided upon for each such project. Therefore, internal standards can become *de facto* standards, regionally, or for specific branches.

Corporations supplying consumer products also need standards, but primarily for their internal work, and is therefore less dependent on common solutions. However, use of sub-contractors can also in these cases make internal standardization necessary.

As a lot of industrial companies supply services to the whole variety of industry branches, these companies would be highly effected by a possible variety of different and probably not co-operatively usable standards. They would be highly negatively affected by such incompatible variety of vertical(= specific branch) standards instead of having so-called horizontal (= applicable for a variety of different industry branches and disciplines) standards. If investments have once been taken previously for branch specific efforts, it would be probably impossible to harmonise later on the results as experience has shown already.

D.6. Professional associations

(E.g. IEEE, VDI, VDE, ...)

Engineering associations usually work on a national level, although there are also examples of such that are international (IEEE). They normally work with a long time perspective.

The associations are often very active, and the result of their work has impact at least on national level and for specific branches.

Associations of this type can be seen as "feeders" of results for international standardization formally canalised through national or regional standards bodies, or informally through globally acting enterprises.

D.7. Suppliers of engineering and documentation tools

If there are no standards available that can be used as part of the requirement specification at the development of software tools of different types, than the suppliers have to formulate the requirement specification themselves or in co-operation with some dominating customers.

The result can be more or less satisfactory. Normally, the result will to a high degree be governed by the available technology.

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Germany

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Japan

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