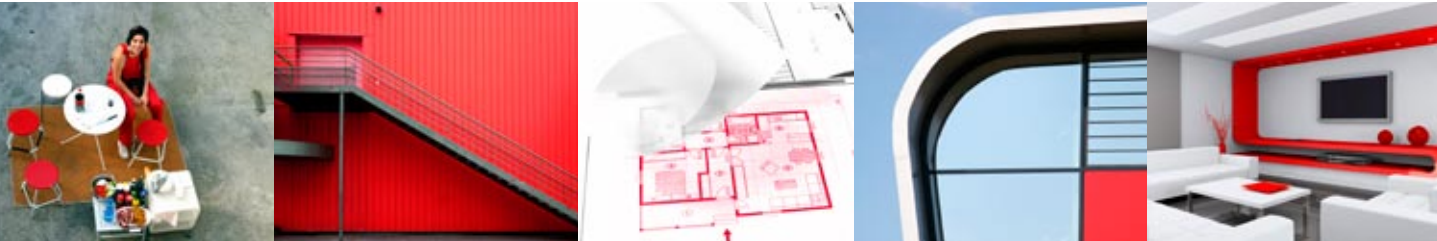




FURNITURE INDUSTRY IN RESTRUCTURING : SYSTEMS & TOOLS

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Guidelines

THE ISO 10303 STANDARDS
HOW TO ADOPT & IMPLEMENT



Co-funded by the EUROPEAN UNION
European Social Fund
Article 6 Innovative measures

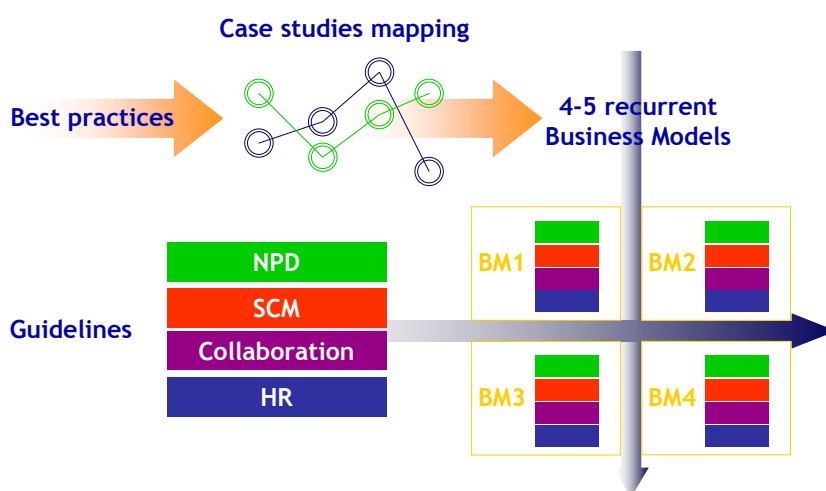
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The globalization is changing the structure of labor intensive industries such as the furniture industry. Increased imports at lower prices force the European manufacturers to look for competitive edges and if necessary to restructure their operations. Some looked at their business model, other at the product, the production, productivity or the relation with the final consumer or a combination of some or all of these different aspects. The solutions, some more successful than others they come up with are multiple.

The FIRST project has the ambition to look into this subject with the aim to formulate recommendations to serve as inspiration to manufacturers. The methodology used was to analyze 30 companies that either went to a restructuring or that had particular characteristics in one or more aspects of their business that allows them to (better) cope with the problems arising from the globalization. This analysis should lead to business models from which guidelines on specific strategies could be distilled.



During the work it rapidly became clear that there are almost as many business models as there are companies, and on suggestion of the advisory board of the project, it was decided to concentrate on guidelines for practical strategies in specific fields rather than develop entire business models. The advisory board also suggested to formulate these guidelines in short separate formats easily usable by interested manufacturers.

This way the work resulted in the formulation of six guidelines around specific activities: product development and innovation, supply chain management, industrial co-operation, outsourcing, human resource management and electronic communications. In parallel the partners developed a sub contracting database for manufactures interested in co-operation as an instrument of increasing such co-operation between manufacturers in the EU and especially with manufacturers in the most recent EU Member States. Information on the project and on the database can be found on the UEA web site www.ueanet.com.

The analytical work has been done by the partners under the leadership and guidance of the MIP, the Polytechnic University of Milan and of AIDIMA, the Spanish technical furniture center. BFM, MEDIFA and the UEA and some of its other members contributed in the best practices and the redaction of the guidelines. Ifabrick, the information department of MEDIFA was responsible for the Web site and database.

The current booklet formulates guidelines on how to use product innovation in the furniture industry. It is not meant to suggest that European furniture manufacturers should follow the strategies described, but the booklet wants to contribute to the reflection on this subject by those manufacturers who feel that it might fit into their business model. We hope it serves them well.

Bart De Turck
UEA secretary general
FIRST project manager

I DEFINITIONS

The ISO 10303, – the STandard for the Exchange of Product model data – is a comprehensive series of documents which provides industry with a major capability to exchange and share the information used to define a product, throughout the supply chain to the end customer and throughout the entire life cycle of the product. It is already in use to share simple CAD (Computer Aided Design) information, product models, complete product structures and technical drawings, as well as the underlying analysis information in industries such as aerospace, automotive, shipbuilding and construction. The ISO-10303-236 standard or AP236 standard can help European furniture SME's to improve competitiveness through the adoption of open standards in their business relations processes.

1.1. The ISO 10303 Standard

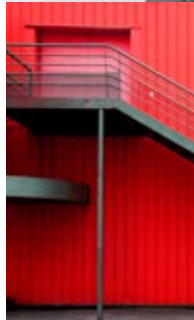
Two standards are under ISO 10303: one that is the AP236 (ISO 10303-236) for product data catalogue and another that is a de-facto standard for the furniture sector for commercial documents as orders, quotations, ..., and that are related to the ISO standard.

1.1.1. The AP236: Furniture catalogue and interior design

Providing a neutral mechanism capable of describing products throughout their life cycle, STEP (ISO 10303), is an International Standard for representation of product information and exchange of product data. This standard is composed of several application protocols (AP), including an AP for representation of furniture catalogues and placement of pieces of furniture into an interior decoration project, named AP236 (ISO 10303-236) or "Furniture catalogue and interior design". AP236, defines the context and scope for representation of furniture catalogues and placement of pieces of furniture into a decoration project, and references the AP information module (ISO/TS 10303-436) that specifies a formal structure and associated semantics for the representation of data.

This AP contains six levels of implementation, which are designated implementation modules or Conformance Classes (CC) and are standards by themselves:

1. ISO/TS 10303-1351 "Catalogue Data Information", provides the definition for the main information product data of a catalogue, such as the definition of a product, its different versions, and specifications. A furniture catalogue contains a list of pieces of furniture to be offered to customers or distributors. A catalogue provides a commercial view of the products of a furniture supplier but it does not represent the design information of the pieces of furniture;
2. ISO/TS 10303-1352 "Catalogue Data Information and Shape Representation", adds to the catalogue data information about the geometry of the products. It enables the representation of geometric models, surface conditions, geometric tolerances, and dimensions that characterize the shape of product components. Thus, AP236 has the capability of managing CAD files and representations including the aspectual model characteristics without information loss.
3. ISO/TS 10303-1353 "Parameterized Catalogue Data Information", adds to the catalogue data information the capability of including expressions. All the information related to the geometry could be defined in base of variable properties of associated parts. As an example: It is possible to define a relationship between the height, length and width in such way that when you modify one value, the others will be modified proportionally as a result of the defined relationship rule;
4. ISO/TS 10303-1354 "Furniture Interior Decoration", adds the capability to create interior decoration projects, i.e. of placing the CAD modelled



I.3. Shape product data representation

Geometry

The standard has the capability of managing CAD files and representations including the aspectual model characteristics without information lose.

Parameterized Data Information

Any information related to the geometry could be defined in base of variable properties of associated parts. As an example: It is possible to define a relationship between the height, length and width in such way that when you modify one value, the others will be modified proportionally as a result of the defined relationship rule.

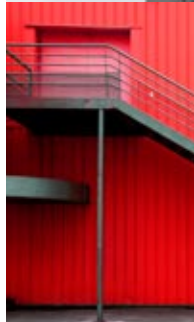
Interior Design Projects

The standard comprises the capability of placing the CAD modelled pieces of furniture in a room space.

I.4. Commercial information

For the improvement of the enterprise interoperability related to the commercial documentation interchange the business process model can be developed as a specific application activity model for the commercial data interchange of the enterprises that are inside the furniture sector. This specific 'business process model' includes more than fifteen documents. The most relevant are:

1. Despatch Advise
Specifies the details for the goods despatched under conditions agreed between the buyer and the seller.
2. Invoice
Sent by the supplier to the customer claims the payment for goods or services supplied under conditions agreed between them.
3. Order
Sent by the customer to his supplier in order to order goods or services and to specify the relevant quantities, dates and locations of delivery.
4. Order Change Request
Information sent by the customer to the supplier in order to specify the details concerning modifications to a previously sent purchase Order.
5. Order Response
Sent by the supplier to the buyer in relation to one or more goods items or services in order to acknowledge the receipt of the purchase Order, to confirm its acceptance, to propose any amendments, or to notify non-acceptance of all or part of the purchase Order items.
6. Order Status Enquiry
Sent from a buyer to a supplier based on a request information on the current status of a previously sent Order(s).
7. Order Status Report
Used by a supplier to report the status of an Order.
8. Quotation
Transmitted by the Supplier to the Buyer in response to a previously received Request for Quotation for the supply of goods or services. It may directly lead to a purchase Order.
9. Receiving Advise
Specifies details for the goods received under conditions agreed between the buyer and the seller with the function of advising the consignor of the received contents of a consignment.
- 10 Request for Quotation
Transmitted by the customer to his supplier based on a request for the quotation for the supply of goods or services. It may be used to ask for information on the supplier's payment terms and conditions, and to specify the required quantities, dates and locations of delivery.





2. USING ISO 10303-236

Starting to describe the different stakeholders involved in the furniture value chain, its relationships and the solutions are possible when using ISO-10303-236 standard; this set of guidelines intends to propose a set of use-cases for the adoption of the ISO-10303-236 standard by furniture-related companies. These use-cases do not intend to represent business situations or system behaviours, but the real situations the furniture industry is facing.

The use-cases propose a set of best practices and guidelines which can be used by the industry in their way to adopt ISO-10303-236 standard in their business.

The use-cases develop, in a summarized way, the situations the different stakeholders of the furniture sector will face when implementing the ISO-10303-236 standard and solutions, how long it will take, and what might be the return of investment.

The different stakeholders in the furniture value chain considered in these guidelines go from manufacturers to retailers, considering also providers, e-Marketplaces and interior designers, considering the manufacturer always as the central point.

2.1. Stakeholders Profiles

2.1.1. Manufacturer

The manufacturer is the principal actor in the furniture industry as it is in contact with the other agents of the value chain. Therefore, it is easy to understand the manufacturer is in the centre of all the relationships which occur in the furniture industry. Depending on the side of the relationships the manufacturer is placed, it can play two different roles: as a seller or as a buyer. The first of the roles is played when it is in contact with the retailer and with the e-Marketplace. On the other hand, the second role is played when he/she buys some raw material from the supplier or services from the interior designers.

2.1.2. Supplier

The supplier serves raw-material or half-finished products to the manufacturer. It can also provide some services like sanding. The supplier is the first step in the furniture supply-chain as it is in charge of transforming the wood from its source to selling the boards to the manufacturers. Usually, suppliers are categorized depending on their business objectives and a sole manufacturer can establish relationships with many suppliers due to the atomization of suppliers in terms of activities.

The supplier, as the manufacturer does, can also play the same two different roles: as a seller or as a buyer. The most known role of the suppliers is when it plays as seller, as this role puts itself inside the supply-chain when dealing with the manufacturer. The second role, buyer, is played when the supplier deals with its own suppliers making this role less visible; nevertheless it is important for the supply-chain.

2.1.3. Retailer

The retailer is the most visible stakeholder along the furniture industry, at least under the customer's perspective. Nevertheless, the retailer is the last link in the furniture supply chain as connects both the manufacturers and the customers. The retailer keeps the privacy of the products as the customer never knows to which manufacturer he/she is buying except for the high decoration retailers.

Contrary to manufacturers and suppliers, the role of the retailer is the “buyer” one. As buyer, he/she just buys the products from the manufacturer and sells them to the end customer/consumer. Although this statement may pop the thoughts they would also play as sellers up, this is not valid. The retailers sell the products (that the bought from manufacturers) to the end customer.

2.1.4. e-Marketplace

The e-Marketplace is a recently created stakeholder when the Information and Communication Technologies (ICT) appeared and started to be profitable. Nevertheless, this kind of stakeholders suffered from the explosion of the technology bubble and tries to recover from those years.

The e-Marketplaces can be divided into two different categories: B2B and B2C. The B2B e-Marketplaces act as mediators between manufacturers and retailers. B2C act as mediators between the sellers (retailers, distributors and manufacturers) and the final customer.

Having in mind this distinction between both types of e-Marketplaces, their roles will also be slightly different. While the B2C e-Marketplaces, like the retailers, can only play the buyer’s role, the B2B e-Marketplaces can play both roles –buyer and seller–, as they are in the middle between manufacturers and retailers.

2.1.5. Interior designer

Finally, the Interior designer is a kind of supplier. This may conduct to think why they have not been included into the suppliers section. This is due to the level of specialization the designers have achieved. Nevertheless, although the designers are not suppliers, they both play the same role: sellers. The designers are stand-alone people who work following the CAD rules and with the restrictions that means. Therefore, they are usually subcontracted by manufacturers to bring their ideas to reality. The manufacturers contact the designers for exclusively product development. The interior designer (or architect) is a prescriber, prescribing or recommending to the client (the manufacturer in this case) an assortment of interior design products in addition to the interior design project itself. This relation to the end customer makes the interior designers an important target group for the manufacturers and retailers of interior design products. In some markets the interior designers even get provisions from manufacturers and retailers for recommending products.



3. USE-CASES

This section includes the detailed set of 12 use-cases (UC). A short description regarding its scope, a graphical formalization using the UML (see www.uml.org) nomenclature and a textual plan actions expected to be carried by each actor involved is provided for each use-case.

3.1. Use-Case 01 – "Uptake basic ICT"

The use-case 01 intends to represent a scenario to describe how a company that has no ICT equipment whatsoever, uptakes a basic ICT. It is based on the assumption that normally before acquiring any kind of material, companies analyse the market to find the best deal possible. The use-case predicts the enrolment of three actors: the "Software Engineer" who manages the ICT systems, the "Business Administrator" who is generally the manager and the "ICT Technician" with technical knowledge.

3.1.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Business Administrator" starts by defining the available budget for investment;
2. Then, the "Software Engineer" makes an analysis of the market regarding hardware and software components to find a set of components that better match the requirements and the available budget;
3. The "Business Administrator" analyses the prospective made and acquires both hardware and software. As far as the hardware is concerned, at least a printer, one computer with a modem and hire an Internet Service Provider (ISP) is required. Regarding the software, the minimum is required, i.e. operating system, text processor and e-mail software;
4. Afterwards, the "ICT Technician" installs the acquired software and connects external hardware components to the computer;
5. Finally, the "ICT Technician" also creates e-mail accounts for all employees, and provides them internet access.

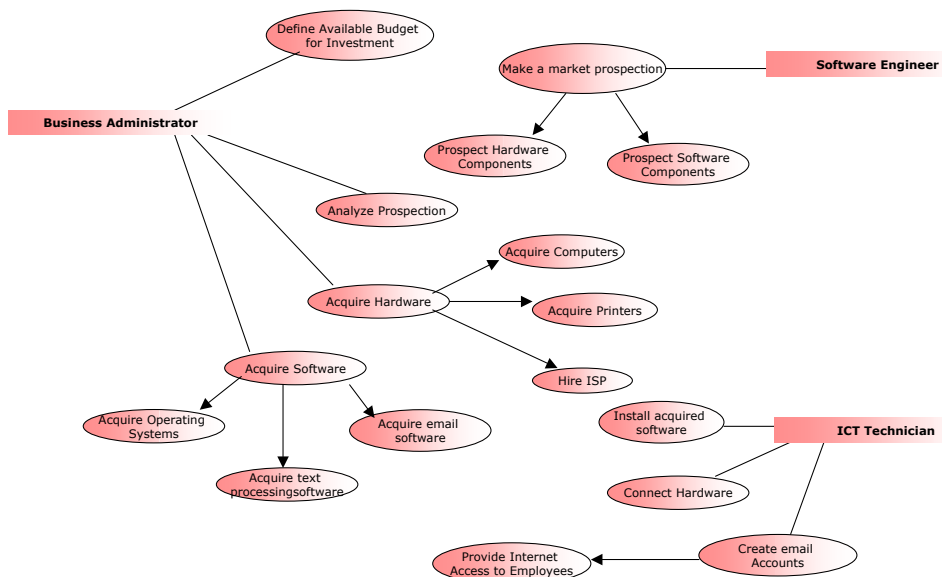


Diagram UCI - "Uptake basic ICT"

3.2. Use-Case 02 – "Build data system based on ISO

IO303 standards”

The use-case 02 represents a scenario that describes how to build a data system based on ISO 10303 standards. It is based on the belief that the company has no ICT infrastructure to deal with the product data catalogue or commercial documents except the basic use of PCs with an office automation software suite, like Microsoft Office. This situation is common to the majority of European furniture manufacturers; most of them use simple spreadsheets or documents to support the management of product catalogue data. This use-case estimates the enrolment of three actors: the “Software Engineer” (person responsible for managing the ICT systems and for coordinating the implementation teams), the “Business Administrator” and the “ICT Technician” who plays a dominant role being in charge of most of the actions.

3.2.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The “Software Engineer” starts by selecting the adequate database system for the company;
2. Then, the “Business Administrator” acquires the database proposed by the “Software Engineer” (in the case it is not a free one);
3. Afterwards, the “ICT Technician” installs the database acquired and builds the data repository based on the full extent of the ISO 10303 standards based on the description of ISO 10303 standard data model (in XSD or SQL or XMI or OWL). The use of the full extent of ISO 10303 standard is recommended because in this situation, the amount of work to install just a subset is equivalent to implement the complete ISO 10303 standard data model;
4. Finally, the “ICT Technician” implements data import/export functionalities from the database system, so that it can interchange data with others.

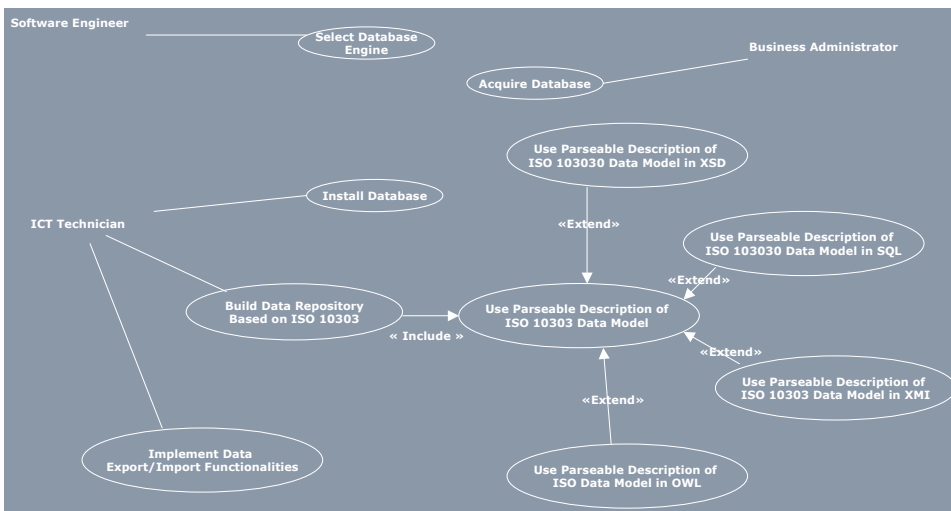


Diagram UC2 - “Build data system based on ISO IO303 standards”

3.3. Use-Case 03 – “Implement system interfaces”

The use-case 03 aims to represent a scenario that illustrates how a company could implement system interfaces based on ISO 10303 standards. The interfaces are meant to cover the full extent of ISO 10303 standard standards since this use-case only applies in situations where the company is making that kind of implementation. This use-case involves two actors: the “Software Engineer” and the “ICT Technician” who play the main role being responsible for the implementation actions.

3.3.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Software Engineer" starts by defining the functional and visual requirements for the system interfaces;
2. Then, the "ICT Technician" using the ISO 10303 standard tutorials and the description of ISO 10303 standard data model (in XSD or SQL or XMI or OWL or EXPRESS), can hardcode the interfaces directly company's software system, implement them using database forms, or using automatically generated web forms.

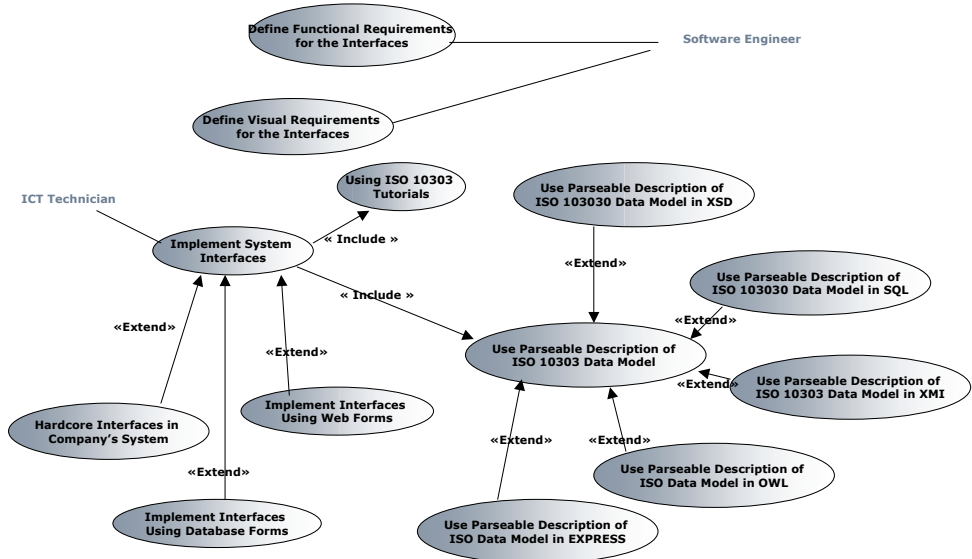


Diagram UC3 - "Implement system interfaces"

3.4. Use-Case 04 - "Populate data system"

The use-case 04 represents a scenario that illustrates the actions a company does when populating data in the internal system. This scenario only occurs after building a new system compliant with the ISO 10303 standard standards (described in UC-02).

This use-case involves three actors with equal importance: the "Business Administrator", the "System User" and the "Company's ISO 10303 standard-based System".

3.4.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Business Administrator" defines which data to migrate to the new data system;
2. Then, the "System User" populates the new ISO 10303 standard-based data system, looking at the company records and using the system interfaces to manually insert internal data into the new ISO 10303 standard system;
3. Finally, the "Company's ISO 10303 standard-based system" stores the data.

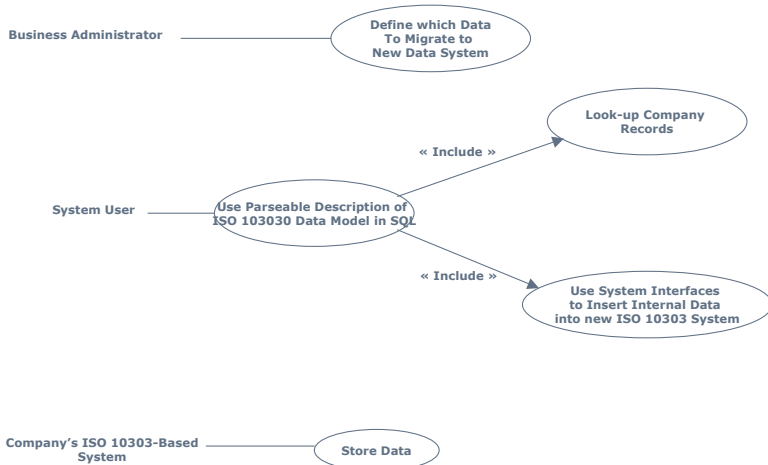


Diagram UC4 - "Populate data system"

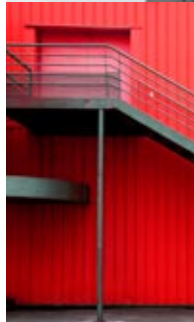
3.5. Use-Case 05 - "Test the level of ISO 10303 standard compliance"

The use-case 05 represents a scenario describing how a company tests the level of ISO 10303 standard compliance of its own software system. This test will help the company to know if its system is in conformance, both syntactically and semantically, with the ISO 10303 standard standards and if it is interoperable with other systems also using the same standards. This use-case is rather complex in terms of the diversity of actors involved. Six actors have actions assigned; however the "Software Engineer" and the "ISO 10303 standard Consultant" have preponderance regarding the others: the former, because he/she is in charge of leading the testing process on the company side, and the latter because he/she is the one responsible for making the final certification. The other actors involved are: the "ICT technician", the "Company's ISO 10303 standard based System", the "Conformance Testing Mechanism" and the "ISO 10303 standard central System".

3.5.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Software Engineer" starts analysing the available ISO 10303 standard methodologies in order to test company's system level of compliance;
2. Then, the "Software Engineer" chooses the conformance testing mechanism, i.e. which mechanism to use for doing the task. He/she can choose the testing mechanism among the following: remote ISO 10303 standard web-services, online testing application, or local downloadable application;
3. After that, the "ICT Technician" is in charged of preparing the Company's System for the conformance testing and interoperability checking procedures. He/she has to install Java Virtual Machine³ and depending on the mechanism chosen, either implement a client for web-services, or download the local ISO 10303 standard Conformance Application;
4. The next step, consists on the generation of a sample data sets covering the full extent of data that the system can handle, by the "Company's ISO 10303 standard-based System";
5. With the data set generated, the "Conformance Testing Mechanism" can execute the validation of the data set, detecting the level of compliance and reporting the errors found in the implementation of the "Company's ISO 10303 standard-based System" if that is the case;
6. After these tests, the "Software Engineer" can start with the inter-



operability checking procedures, downloading the pre-prepared ISO 10303 standard battery of tests and feeding them to the "Company's ISO 10303 standard-based System";

7. Afterwards, the "Software Engineer" visualizes the imported information and modifies it using system interfaces;
8. Before ordering the system to store and export modified information in ISO 10303 standard format, the "Software Engineer" takes snapshots of the displayed information. This procedure provides a printable document to make proof of the information inserted in the "Company's System";
9. Finally, the "ISO 10303 standard Central System" imports the information from the company and then displays it to a "ISO 10303 standard Consultant" that will compare the snapshots with displayed information. If everything matches, he/she will certify the software system as ISO 10303 standard compliant.

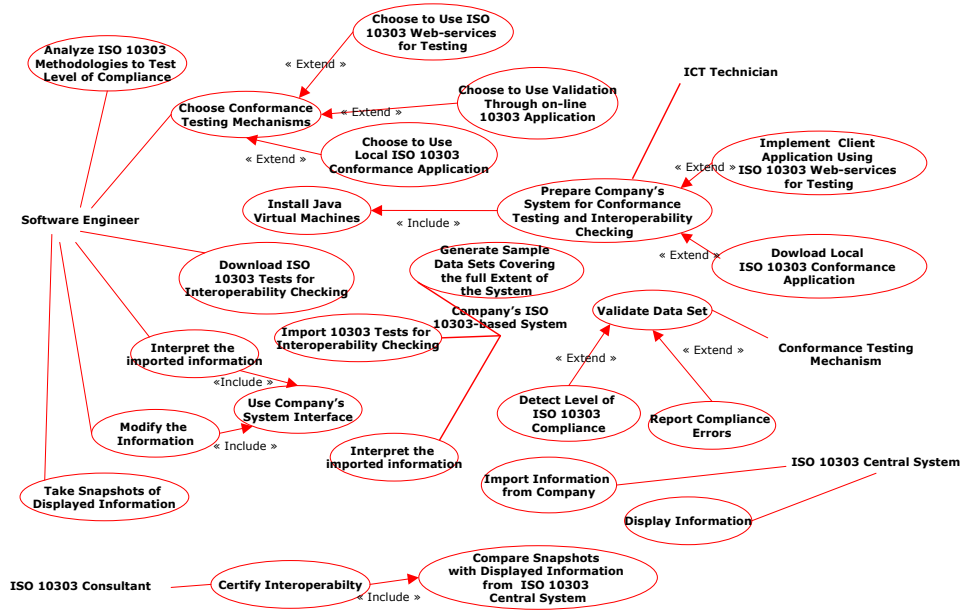


Diagram UC5 - "Test the level of ISO 10303 standard compliance"

3.6. Use-Case 06 – "Migrate internal data to ISO 10303 standard system"

The use-case 06 represents the situation in which a company has to migrate its own data into the ISO 10303 standard system. It is based on the assumption that, for adopting ISO 10303 standard, some data has to be imported into the system. The key of the scenario is that not all the data has to be shifted from one system to the ISO 10303 standard, only the data the "Business Administrator" consider.

The use-case involves three actors, one of them, the "Software Engineer" playing a key role in the discovery and matching of data from the system against ISO 10303 standard.

3.6.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Business Administrator" starts by defining which data has to be migrated into the ISO 10303 standard system;
2. Then, the "Software Engineer" based on the list of data provided by the Business Administrator starts the mapping by discovering the ISO 10303 standard concepts which match certain internal data;
3. To do so, the "Software Engineer" proceeds with two analysis: one corresponding to the structure of the internal data and another one corresponding to the structure of the ISO 10303 standards;

4. To analyse the structure of the ISO 10303 standard, the "Software Engineer" uses the ISO 10303 standard tutorials to assist in the task; He/she only needs to analyse the ISO 10303 standards his/her company is implementing. It can be either the AP236 standard (for exchanging product data), the efbSOA (for exchanging commercial e-documents), or both. The same applies to the different parts of AP236;
5. Once the "Software Engineer" has performed this analysis, he/she has to formalize the mapping in order to help the following actor in the development of his task;
6. The "ICT Technician" based on the mapping provided by the "Software Engineer", implements a routine which will perform the migration of the data between the two systems;
7. The old "Company System" exports the data selected into a ISO 10303 standard based format.
8. The new "Company System", which is based in ISO 10303 standard, imports the data provided by the old "Company System" and finally stores it inside its databases.

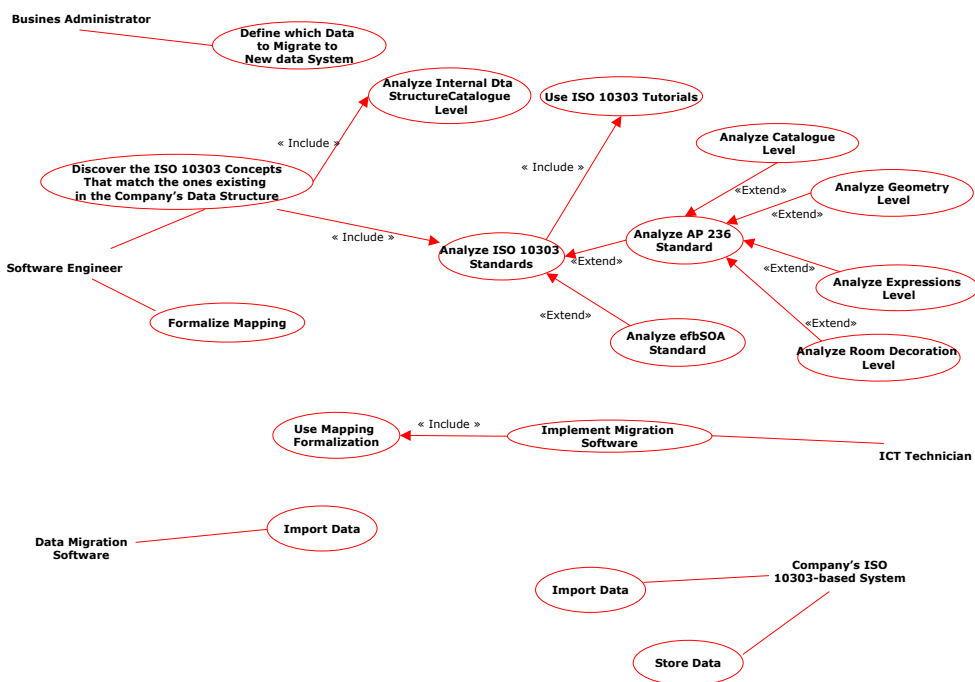


Diagram UC6 - "Migrate internal data to ISO 10303 standard"

3.7. Use-Case 07 – "Find requirements that the current system does not answer"

The use-case 07 targets to represent a scenario to describe how a company gets new technical requirements that would demand some changes in the company software. It is based on the belief that a company will not simply start looking for requirements that their system cannot handle, just because someone feels it is important. This requirements list is produced, most likely, after an analysis of the company business activity over the past, and outlook for new business opportunities.

This use-case predicts the enrolment of three actors, two of them playing a dominant role in the achievement of the new requirements, i.e. the "Business Administrator" and the "Software Engineer".



3.7.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Business Administrator" starts by requesting a summary of the business activity to the "Company System";
2. Then, the "Company System" provides the history of past businesses, i.e. all information stored regarding the company business activity in a predetermined period of time;
3. To do so, the "Company System" needs to search the internal records and compile the report in a printable format;
4. With that report, the "Business Administrator" can look for new business growth opportunities, either by analysing the report searching for the reasons of lost businesses, or by identifying new market trends;
5. Afterwards, the "Business Administrator" will produce new business requirements that he/she wants to cover;
6. Finally, the "Software Engineer" will conduct an analysis on the systems capabilities, to produce a report whether the system can respond with the new business requirements or not;
7. If the system cannot respond the new business requirements without internal changes, a list of new technical requirements will be produced.

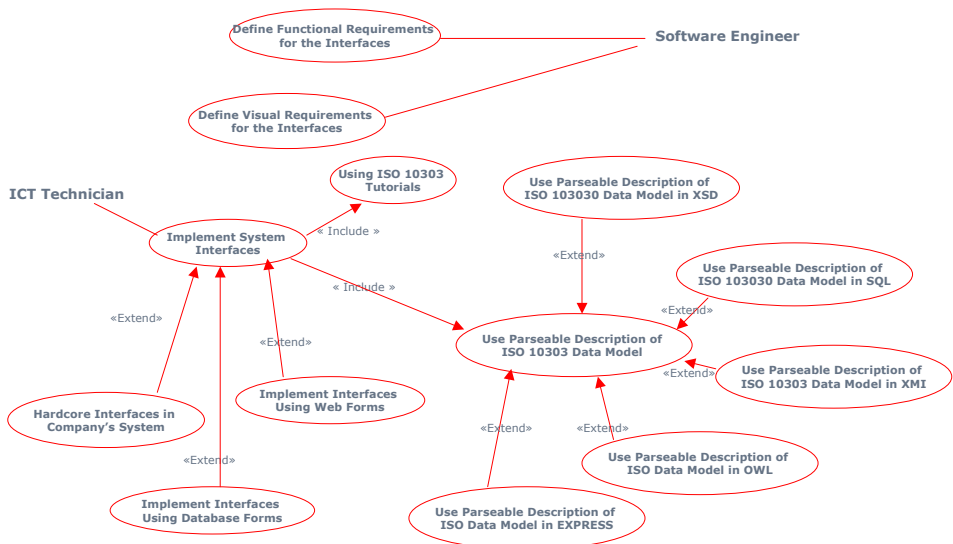


Diagram UC7 - "Find requirements that the current system does not answer"

3.8. Use-Case 08 - "Analyse how ISO 10303 standard could answer the requirements"

The use-case 08 represents the situation in which a company has to analyse if, and how, ISO 10303 standards can answer to its requirements. It is based on the hypothesis that, for adopting ISO 10303 standard, some engineering work, in terms of requirements satisfaction, has to be performed for a better exploitation of the ISO 10303 standard data. The use-case involves only one actor, the "Software Engineer" who performs all the tasks.

3.8.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Software Engineer" has to ascertain if the technical requirements of the company are satisfied by the ISO 10303 standards. To do so, he/she has to analyse its own technical requirements;
2. Then, the "Software Engineer" has to analyse the scope of the different ISO 10303 parts of standard with the use of the ISO 10303 standard tutorials;
3. Once these two tasks have been performed, the "Software Engineer"

has to select the ISO 10303 standards and parts which satisfy his/her own technical requirements;

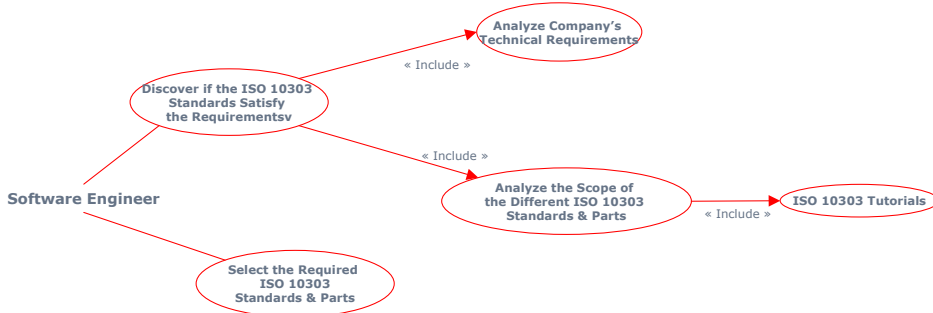


Diagram UC8 - "Analyze how ISO IO303 standard could answer the requirements"

3.9. Use-Case 09 - "Discover mapping from internal system to ISO IO303 standard or (selected parts of ISO IO303 standard)"

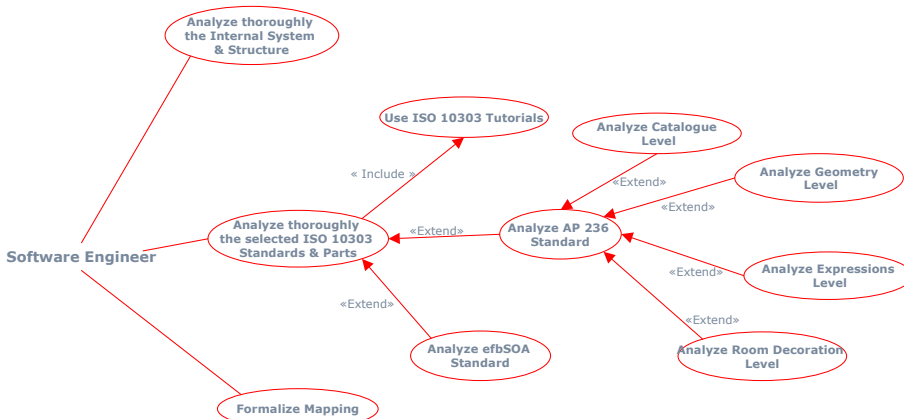
The use-case 09 represents the situation in which a company has to map its own data into the ISO 10303 standard based system. It is based on the belief that, for adopting ISO 10303 standard, some mapping between the structure of the internal data and the structure of the ISO 10303 standard data has to be performed.

The use-case involves only one actor, the "Software Engineer" who performs all the tasks previously listed.

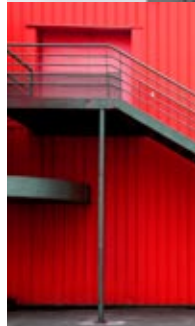
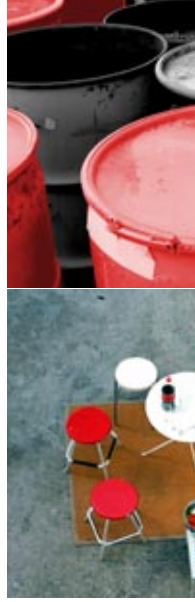
3.9.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Software Engineer" starts by analysing the complete the data structure of the internal system;
2. Once the "Software Engineer" has analysed the internal data structure, he/she moves towards the analysis of the structure of the ISO 10303 standards. To do so, the "Software Engineer" uses the ISO 10303 standard tutorials. He/she only needs to analyse the ISO 10303 standard his/her company is implementing. It can be either the AP236 standard (for exchanging product data), the efbSOA (for exchanging commercial e-documents), or both. The same applies to the different parts of AP236;
3. Once the "Software Engineer" has performed this analysis, he/she has to formalize the mapping by stating the correspondences between both systems;



UC9 - "Discover mapping from internal system to ISO IO303 standard "



3.IO. Use-Case IO – "Implement functionalities/services to transform internal data in ISO IO303 standard data and vice-versa (selected parts of ISO IO303 standard)"

The use-case 10 represents the situation in which a company has to implement some functionality to automatically transform internal data into ISO 10303 standard data. It is based on the belief that, for adopting ISO 10303 standard as the base structure supporting new company's functionalities/services, some transformation between internal data and ISO 10303 standard data has to be performed.

The use-case involves two actors, but one of them, the "ICT Technician" is in charge of more than the 80% of the tasks of the use-case.

3.10.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. Prior to implementing any functionality/service, the "Software Engineer" has to precisely define how those new functionalities/services will behave, and how they will be integrated in the company's system;
2. Once the "Software Engineer" has finished with this task, the "ICT Technician" starts by identifying the data sets that will be exchanged. The ICT Technician needs to identify in those data sets which parts are already automatically transformed to ISO 10303 standard (if that is the case) by the company's system and which are not; In this moment, the "ICT Technician" knows exactly which concepts he/she needs to transform to ISO 10303 standard. By using the formal mapping performed by the "Software Engineer" in the previous use-case, he/she is also able to find the equivalent ISO 10303 standard concepts;
3. At this point, the "ICT Technician" moves to describe the services interfaces which would perform the data exportation. To perform such description, he/she might additionally describe the Web-Services and the Tool/Software interfaces;
4. The last step comprises the implementation of the services once they have been described. To perform such implementation the "ICT Technician" is recommended to use the parseable description of the ISO 10303 standard data model. This description is developed in different programmatic languages such as XSD, SQL, XMI, OWL and EXPRESS;

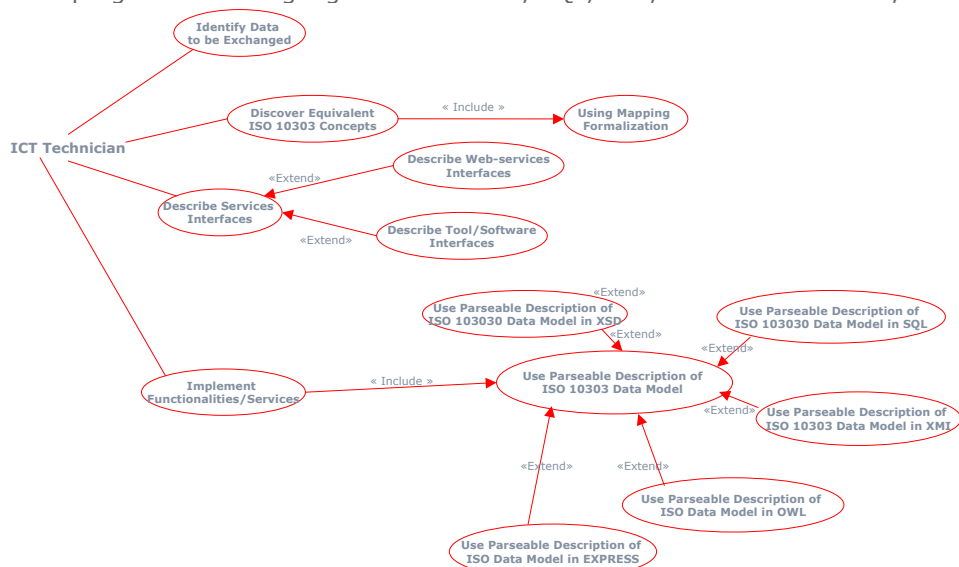


Diagram UCIO - "Implement functionalities/services to transform internal data in ISO IO303 standard data and vice-versa "

3.II. Use-Case II - "Implement new parts of ISO 10303 standard"

The use-case 11 represents the situation in which a company is implementing the new parts of ISO 10303 standard into their internal system. The use-case involves two actors: the "Software Engineer", and the "ICT Technician" who split the work depending on their roles inside the company.

3.11.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Software Engineer" defines the new functionalities for the internal system based on the analysis of the technical requirements produced in UC-07;
2. Once the functionalities have been defined, he/she has to specify how to do the integration of ISO 10303 standard with the internal system;
3. On the other hand, the "ICT Technician" has to perform three different tasks: he/she has to build a repository for the new data sets, implement the integration of the repository in the system and implement the new services. In the first task, the data repository must be based on the selected parts of ISO 10303 standard. To ease this task he/she is recommended to use parseable descriptions of the ISO 10303 standard data model, expressed in XSD, SQL, XMI, OWL or EXPRESS. The repository will be used for storing the different data the company uses. Once the repository has been built, the "ICT Technician" has to integrate it into the internal system of the company. Finally, in the last task, the "ICT Technician" will have to implement the new system functionalities and/or services based on the ISO 10303 standard Data Model to access the repository, and store/retrieve data to/from it.



Diagram UCII - "Implement new parts of ISO 10303 standard"

3.I2. Use-Case I2 - "Implement system interfaces for the new parts"

The use-case 12 represents the situation in which a company is implementing the interfaces for new parts of ISO 10303 standard. It is a use-case very similar to UC-03, with the main difference that here the interfaces do not need to cover the full extent of ISO 10303 standard and have to be integrated in the old system. The use-case involves two actors, the "Software Engineer" and the "ICT Technician" who split the work depending on their roles inside the company,



although the "ICT Technician" has a slight more workload.

3.12.1. Plan of Actions Expected

The sequence of actions represented in the use case is the following:

1. The "Software Engineer" starts by defining the functional and visual requirements for the new interfaces to be developed for the ISO 10303 standard parts;
2. Once both set of requirements have been defined, the "Software Engineer" specifies the integration with the company's system by analysing the system itself;
3. As soon as the requirements have been set and the integration has been specified, the "ICT Technician" using the ISO 10303 standard tutorials and parseable description of ISO 10303 standard data model (in XSD or SQL or XMI or OWL or EXPRESS), can hardcode the interfaces directly company's software system, implement them using database forms, or using automatically generated web forms;
4. Finally, the "ICT Technician" will implement the integration of the new interfaces with the company's system.



Diagram UC12 - "Implement system interfaces for the new parts"

4. ACTION PLAN FOR STANDARD ADOPTION AND IMPLEMENTATION

In order a company could start to implement the ISO 10303 standard, the first thing to do is to classify it according to the ICT adoption status (i.e. situation).

The most common situations of the furniture SMEs have been identified and five typical situations have been defined:

- 1 Does not have an ICT Infrastructure;
- 2 Has an ICT Infrastructure, but is not focused for information exchange;
- 3 Has an ICT Infrastructure for information exchange but has not adopted any ISO 10303 standard;
- 4 Has an ICT Infrastructure for information exchange but only has adopted ISO 10303 standard (fully or partially);
- 5 Has an ICT Infrastructure for information exchange but only has adopted ebSOA.

The following table represents the requirements a company has to fulfil to be classified in a given situation:

Requirements to be fulfilled

Next step after that classification should be follow the sequential implementation of the recommended use-cases. The document defines the twelve use-cases described in previous chapters which can be applied in the different situations. The table below represents the different use-cases applicable depending on the different situations and the order they represent in the sequence of steps. As far as the different colours from use-case UC-09 to use-case UC-12 is concerned, it is necessary to say that some of the internal steps are valid for that particular situation and some others are not.

Use cases by situation

Each typical situation has associated a sequence of use-cases that have to be implemented by the organizations that are adopting the standard. Hence, a company that is classified under situation #2 (has an ICT Infrastructure, but is not focused for information exchange) has to go through the use-cases UC-02, UC-03, UC-06, UC-05 respectively.

The actions each actor needs to carry on in order the company may have a successful implementation of the use-case, are described in section 3 under

the sub-section named "Plan of Actions Expected" (there is one for each use-case or UC). In order to assure that all implementations are done correctly and that the information is being processed completely according ISO 10303 standard recommendations in the end of each cycle tests have to be performed to certify the quality of that implementation. The way to perform these testing procedures is described in use-case UC-05 (see section 3.5), and for this very reason, it has been moved to the end of the table.





Estimated efforts needed

The previous table identifies the estimated effort (temporal, in number of days) that a committed organization needs to successfully complete and the sequence of actions recommended to each use case. This estimation can be useful for the stakeholders, helping them to know how much time they would need to adopt ISO 10303 standard.

On some use-cases the estimation of time may vary a lot depending on the number of parts of the standard that one decides to implement (see section 3.1). It is important to emphasize that the adoption of a standard is not a trivial task and needs full commitment by the organization and its employees so that these time estimations can be fulfilled.

An action plan is introduced below with all this information in the form of gantt chart. It illustrates the sequence of use-cases that each stakeholder needs to implement and how long it will take according to its initial situation.

4.1. Manufacturers action plan

The furniture manufacturer is the most important stakeholder of the furniture supply chain, he/she is involved in all use-cases, and depending of the situation the time to adopt ISO 10303 standard may vary. Since a manufacturer can be in any of the already described situations, next figure illustrates an action plan for manufacturers with the times and use cases applicable to each of the five situations.

Action plan for furniture manufacturers

4.2. Retailers action plan

As the manufacturer, the retailer also plays a very important role in the furniture sector. All use cases are of particular importance to a retailer. However, those related to the situation #1 can be considered out of the retailer scope because he/she at least uses an ICT infrastructure for issuing orders and quotations. This way, the next figure illustrates only the action plans for the other four situations.

4.3. Suppliers action plan

Supplier organizations might fit in any of the situations so they could be potentially interested in all use cases. Next figure depicts the corresponding action plan. It is possible to observe some differences regarding the manufacturers and retailers expected times. These are related to the fact that suppliers are not interested in the room decoration part of AP236 because its business they only transform raw material in parts that manufacturers can use.

This fact is reflected in the times spent in the implementation of some use cases reducing the time for each situation.

4.4. e-Marketplaces action plan

As described in section three, it is clearly understandable that the first two sub-sets of use cases - those related to the situation #1 and situation #2-

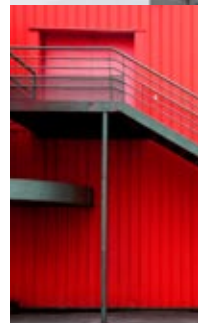
can be considered out of the e-Marketplaces scope. So, in the next figure is only represented the action plan to situations #3, #4 and #5.

As retailers, the e-Marketplaces are interested in all implementation levels of both AP236 and commercial documents. However the exchange of room decoration projects is less important.

4.5. Interior Designers action plan

In the Interior designers case the first two sub-sets of use-cases -those related to the situation #1 and situation #2- can be also considered out of the designer scope as in his/her tasks he/she has to deal with room decoration projects. And he/she must be able to exchange information electronically in that task. This type of stakeholder organization is typically very advanced regarding ICT usage.

Interior Designers are more interested in the exchange of product catalogue and room decoration projects, but also all the other levels of AP236 are important.



5. EXPECTED BENEFITS

The implementation of the proposed use-cases implies a considerable effort both, in time and money for the companies that follow the action plan. This way, in order to seduce more companies to engage an industrial implementation of the ISO 10303 standards, the expected benefits must be stated clearly.

Based on the actual business model of the furniture industry, this section presents a list of expected benefits that furniture stakeholders would have after implementing ISO 10303 standard.

5.1. Actual business model

The furniture sector is a very complex industry regarding data sharing, process methodologies and business processes between organisations across the supply chain. The EU furniture industry accounts for about half the world furniture production, being one of the largest manufacturing industries. Moreover, the furniture industry in the EU accounts for 8,800 enterprises with over 20 employees, employing 600,000 people, and more than 80,000 enterprises with under 20 employees (employing almost 300,000 persons). SMEs which are mostly family owned as a labour-intensive industry provide employment for

around one million people. Those companies are using a wide range of information systems, many of them developed by small software houses, usually in a very strong competition in the market. Design, production and services available are the major aspects that SMEs have to deal in order to achieve the success.

The current usage of the ICT infrastructure within the furniture industry is devoted to store the product data and the documentation exchanged with the other partners along the value chain. Other uses of the ICT are controlling and scheduling the manufacturing processes including stock management. Nevertheless, the usage of the ICT is reduced to a certain percentage of the whole industrial map due to the different levels of needs existing. This is reflected in that for a wide range of SMEs, only some office tools, like Microsoft Excel or Microsoft Word, are enough to cover their needs.

It is necessary to take into account that for many companies it is much more important and convenient manufacturing and selling products than improving ICT as no return of investment is foreseen in the immediate time. Therefore, the penetration of the ICT infrastructure is low although it is increasing in during the last years.

5.2. Benefits of ISO 10303 standard adoption in the furniture supply chain

If SMEs adopt the open ISO 10303 standards and integrate the resulting business efficiencies and resulting innovation in their normal business through the use of different tools and services, the benefit would be considerable.

The adoption of the ISO 10303 standard will help furniture SMEs to become more competitive and times and budgets saved will allow them to invest in different products or open new markets.

ISO 10303 standard products and services enable businesses in the furniture industry to work faster using standards and not proprietary solutions and in fact this is one of its main benefits.

Thus, it provides to SMEs with the possibility to move more efficiently and cost-effectively.

ISO 10303 standard is focused in interoperability issues trying to solve the gap for a clear communication within the furniture value chain through ICT, which helps to facilitate new ways of working enabling better integration of business process within SMEs organisations and with external business



partners.

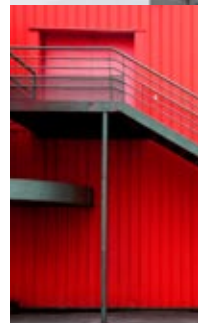
There are a number of business benefits that companies engaging in ISO 10303 standards can get, and these include:

- Developing a greater understanding of the needs of furniture manufacturers and the business issues affecting them.
- Extending the service offered, thus developing new business streams and opening possibilities of extending the customer base across Europe.
- Save time and money in internal communication; catalogue creation and distribution; product design and administrative tasks.
- Improve products and services reducing turn-around time; quickening the exchange of commercial information with clients regarding orders, invoices and quotes, etc.; enabling the immediate availability of information and reducing the errors in the management of catalogues and orders.
- Apply innovative methods with minimum disruption to existing work practises.

Nevertheless, all these generic business benefits are keen on being separated according to the profile of the stakeholder, i.e. technology providers, which include e-Marketplaces and software houses and interior designers; manufacturers and providers; and retailers.

Benefits of applying the ISO 10303 standards for retailers:

- Increased efficiency and quality in business critical processes
- Easy importation, input and update of product catalogues & price lists and images into ERP systems, web catalogues and e-Commerce websites;
- Sending and receiving of commercial documents in a standard format;
- Reuse information from furniture manufacturers;
- Avoid maintaining duplicate information in different internal systems;
- Export design and graphical information from interior design/visualization software to use it with ERP software and allow the furniture manufacturer to import them into their systems.
- Share information
- Import information/link from ERP to a web-based E-commerce system;
- Access to new markets: publish your catalogue in foreign marketplaces;
- Just-in-time update data catalogue information into any in-house applications;
- "Type once, publish everywhere" paradigm.
- Avoid getting locked with proprietary tools and formats that may disappear in the near future. Future-proof solution;
- Easy maintenance of product information across the company;
- Allow real-time browsing of product information, including stocks, prices, pictures, ...









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