ABSTRACT

A building process optimization needs a systemic approach in order to correctly manage its complexity. Despite many important contributions have been provided in the last few years, both from a procedural point of view and from a normative one, building process management is often fragmented. This may cause repercussions on building quality and inefficiency in cost and time management. That is why, the research project INNOVance has developed an unambiguous classification system for every object and informative attribute for construction, creating a unique database to smartly store and share information. This through a proper definition of the content of data sheets which can be collected and easily shared together with their complementary attributes by different stakeholders. Unambiguous language and standardized information, in and of themselves, increase building process efficiency.

If we then consider that data exchange is possible through the exploitation of a user friendly web portal and some interoperable web services, efficiency and economic savings in the entire construction chain could be extremely relevant. The present paper describes the results achieved during the last year of the research project, in terms of information standardization and data collection.

1. INTRODUCTION

The building process involves, at its various stages, a plurality of actors, among whom an inefficient information management may often occur. This represents a considerable waste of time and of economic resources. The INNOVance research program aims at generating an efficient data exchange thanks the implementation of ICT tools for the construction industry and the definition of criteria to identify and describe unambiguously every subjects and objects involved in construction works life cycle. The interaction among different stakeholders of the building process become easier thanks to the presence of a unique collector for information (the INNOVance database).
Everyone can access the database, uploading or downloading data, through a user-friendly portal or through some interoperable web services which allow other software to read data.

For this reason, INNOVance database has been developed on one side to structure efficiently every data about products (for constructions, building systems, vehicles or facilities), in order to facilitate selection and give a higher transparency in terms of completeness of manufacturer provided information.

On the other side, this database also allows everyone to store every construction process data and it lets different actors read and download updated information they are interested in or upload documents and data.

For construction products, a technical committee was established at UNI. Among its participants, there are different Association and Federation of products manufacturers.

The working group, according to existing national technical standards and to ongoing activities, has developed a methodology to name unambiguously construction products and to standardize the collection of their life cycle data.

Through data sheets prepared by different manufacturers, INNOVance allows everyone to know and compare technical and performance characteristics of different products; it also permits to read design suggestions for their installation, maintenance and management. This aims at facilitating building materials and products individualization and choice, but also at making immediately available every information about them. Therefore, INNOVance database has been developed to become the first national database for construction able to store, update and share information in a clear, standardized and interoperable way.

With this aim, starting from the use of an unambiguous language (given by the standard designation), the working group defined parameters for information standardization (through proper data sheets), making collected data, together to further informative attributes, accessible thanks to an easy-to-use central system. That is why, the research project INNOVance has developed an unambiguous classification system for every object and informative attribute for construction, creating a unique database to smartly store and share information. This through a proper definition of the content of data sheets which can be collected and easily shared together with their complementary attributes by different stakeholders.

Unambiguous language and standardized information, in and of themselves, increase building process efficiency. If we then consider that data exchange is possible through the exploitation of a user friendly web portal and some interoperable web services, efficiency and economic savings in the entire construction chain could be extremely relevant.

The present paper describes the results achieved during the last year of the research project, in terms of information standardization and data collection.

2. THE UNAMBIGUOUS CLASSIFICATION

To overcome difficulties in communicating, collecting data and sharing information among many subjects, it is necessary to focus more and more on the concept of interoperability.

Thanks to the analysis of the state of the art of available classification systems, the research project INNOVance has defined a new naming system based on seven characteristics. The name of every objects in the database is articulated in this way.

For construction products the seven characteristics are the following:

1. category, to identify construction products families with homogeneous performance and function (masonry element, window, door, parquet elements for internal wood flooring, concrete with guaranteed performance, prefabricated structural element);
2. typology, to diversify the construction product class by providing information about its typological characteristic (collaborating block floor system, mullion-transom facade, casement and burglary resistant doors);
3. normative reference, to specify the harmonized technical standard for CE marking (UNI EN 1304 roofing tiles, UNI EN 1351-1 windows, UNI EN 13162 thermal insulation); otherwise, a different reference standard or guideline can be given;
4. performance characteristics, to indicate the main performance of each construction product (masonry element with equivalent thermal conductivity =… W/(mK), mortar masonry with guaranteed performance M5);
5. geometrical features, to provide information about shape, geometry, packaging, etc. (thermal insulation panels, double and rectangular window);
6. dimensional features, to specify dimensions (slab block with height =… mm, length =… mm and width =… mm, rectangular block, double and rectangular window);
7. properties, to name unambiguously construction products; it also permits to read design suggestions for their installation, maintenance and management.

In this way, the INNOVance database offers a methodology to name unambiguously construction products and to standardize the collection of their life cycle data.

On the other side, this database also allows everyone to store every construction process data and it lets different actors read and download updated information they are interested in or upload documents and data.

For construction products, a technical committee was established at UNI. Among its participants, there are different Association and Federation of products manufacturers.

The working group, according to existing national technical standards and to ongoing activities, has developed a methodology to name unambiguously construction products and to standardize the collection of their life cycle data.
To describe construction objects (products, on-site elements, assembled systems or entire works) the unique name has to be integrated with further informative attributes (from the on-site element (the construction product after its installation) to the entire work itself). For these levels, function (its intended use) was given instead of the reference standard.

Similarly to the denomination approach adopted for construction products, Politecnico di Milano used seven features to name also higher levels of object complexity: from the on-site element (the construction product after its installation) to the entire work itself. For these levels, function (its intended use) was given instead of the reference standard.

3. THE STANDARDIZATION OF INFORMATION

To describe construction objects (products, on-site elements, assembled systems or entire works) the unique name has to be integrated with further informative attributes. Therefore, a system for collecting complete information has been developed to describe technological, design, physical-chemical properties, to indicate its material composition (glazed door with wood frame, aluminum profile for windows and doors).

Regarding terminology and semantics, ITC-CNR verified the consistency between INNOVance terms and national and community standards ones; preparing a reference lexicon for the construction industry, to be used as an ambiguous language by all operators. Eventually, to facilitate communication and information exchange within the supply chain, this lexicon also contains a collection of synonyms which are commonly used in construction sector.

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life cycle. The standardization has been carried out for information management finalized to integrated design. Eventually, by generating QR codes on INNOVance web portal, everyone can check and see given details, for example when that product is stored inside the construction yard. It is also possible to visualize other useful data, such as drawings and BIM objects, video installation or declaration of performance.

3.1. THE STANDARDIZED DATA SHEET FOR CONSTRUCTION PRODUCTS

The standardized data sheet for construction products has been developed with the working group UNI GL 9 “Coding of products and processes in construction”. The information blocks for CE marked construction products are:

1. Identifying manufacturer information
   1.1. Name
   1.2. Company
   1.3. Website
   1.4. Registered office
   1.5. Factory/ies
   1.6. Contact
   1.7. Company certifications

2. Identifying product information
   2.1. Name (UNI 11337:TS1)
   2.2. Identification code (UNI 11337:TS1)
   2.3. Trade name
   2.4. CPV code
   2.5. Other internal codes assigned by manufacturer
   2.6. Intended use (derived from the harmonized technical specification)
   2.7. Harmonized technical specification (hENs - EAD): description, classification, definition, code, number and year
   2.8. Description for contract specification
   2.9. Description for price list
   2.10. Synonyms
   2.11. Keywords

3. Technical information
   3.1. Morphological and descriptive features
     3.1.1. Geometry and shape
     3.1.2. Appearance and constructive features
     3.1.3. Dimensions
     3.1.4. Physical-chemical properties: qualitative and quantitative ones
     3.1.5. Main components of the product
     3.2. Performance characteristics
     3.2.1. Essential properties
     3.2.2. Voluntary properties
     3.3. Information about sustainability
     3.4. Safety information

4. Information about packaging, handling, storage and transport
   4.1. Packaging
   4.2. Type of movement

La standardizzazione è stata effettuata per la gestione delle informazioni nell’ottica di una progettazione integrata. Con la generazione del codice QR da portale, è possibile verificare e consultare la scheda del prodotto consegnato in cantiere, ma anche i dati in allegato, quali disegni e oggetti BIM, video di posa, dichiarazione di prestazione o altro.

3.1. LA SCHEDA TECNICA STANDARDIZZATA PER I PRODOTTI DA COSTRUZIONE

La scheda tecnica per i prodotti da costruzione è stata sviluppata in ambito UNI (UNI GL 9 “Codificazione dei prodotti e dei processi in edilizia”) e, per i prodotti da costruzione soggetti a marcatura CE, prevede i seguenti blocchi informativi:

1. Informazioni identificative del fabbricante
   1.1. Denominazione
   1.2. Ragione sociale
   1.3. Sito WEB
   1.4. Sede legale
   1.5. Stabilimento/i di produzione
   1.6. Contatto
   1.7. Certificazioni aziendali

2. Informazioni identificative del prodotto
   2.1. Denominazione (UNI 11337:TS1)
   2.2. Codice identificativo (UNI 11337:TS1)
   2.3. Denominazione commerciale
   2.4. Codice CPV
   2.5. Altri codici interni attribuiti dal fabbricante
   2.6. Impiego previsto (ricavato dalla specifica tecnica armonizzata)
   2.7. Specifica tecnica armonizzata (hEN-EAD): denominazione, classificazione, definizione, codice, numero e anno norma
   2.8. Descrizione da capitolato
   2.9. Descrizione da elenco prezzi
   2.10. Sinonimi
   2.11. Parole chiave

3. Informazioni tecniche
   3.1. Caratteristiche morfologico-descrittive
   3.1.1. Geometria e forma
   3.1.2. Aspetto visivo e costruttivo
   3.1.3. Dimensioni
   3.1.4. Fisico- chimiche: qualitative, quantitative ones
   3.1.5. Principali componenti del prodotto
   3.2. Caratteristiche prestazionali dichiarate
   3.2.1. Caratteristiche essenziali
   3.2.2. Caratteristiche volontarie
   3.3. Informazioni sulla sostenibilità
   3.4. Informazioni sulla sicurezza

4. Informazioni su imballaggio, movimentazione, immagazzinamento in stabilimento e trasporto
   4.1. Imballaggio
   4.2. Tipologia di movimentazione
   4.3. Modalità di immagazzinamento

Fig. 3 – Codifica “Sistema tecnologico costruzioni”.

GRUPPI PER VUOTO A CIRCUITO CHIUSO PER L’INDUSTRIA DEI LATERIZI

AUTONOMI, MODULARI, DI RAPIDA E FACILE INSTALLAZIONE, PER LA CENTRALIZZAZIONE DEL VUOTO O SU SINGOLE MATTONIERE E/O PRESSE

- Grade di vuoto elevato e costante
- Eliminazione dell’acqua
- Drastica riduzione della manutenzione
- Sicurezza di funzionamento

LA SOLUZIONE OTTIMALE AI PROBLEMI DEL VUOTO

www.gleffesystems.it
2. Informazioni su trasporto, movimentazione e stoccaggio
2.1. Modalità di trasporto
2.2. Tipologia di movimentazione
2.3. Modalità di stoccaggio
2.4. Prescrizioni sullo smaltimento dell’imballaggio
3. Informazioni commerciali
3.1. Rete di vendita

3.2. IL DOSSIER-GUIDA
È stato poi predisposto un dossier-guida contenente informazioni sulla posa, sull’installazione, sul corretto uso, sulla manutenzione e sulle modalità di disposizione, secondo i seguenti blocchi informativi:
1. Informazioni identificative del prodotto
1.1. Denominazione del fabbricante
1.2. Denominazione (UNI 11337:TS1)
1.3. Codice identificativo (UNI 11337:TS1)
1.4. Impiego effettivo
2. Informazioni su trasporto, movimentazione e stoccaggio
2.1. Modalità di trasporto
2.2. Tipologia di movimentazione
2.3. Modalità di stoccaggio
2.4. Prescrizioni sullo smaltimento dell’imballaggio
3. Informazioni commerciali
3.1. Rete di vendita

3.3. FURTHER INFORMATIVE ATTRIBUTES
The database can also contain further information such as:
- economic attributes, such as sale price, actual price, average discount, price for installation;
- security-related attributes, such as H-phrases (hazard),
3.4 ANDIL CONTRIBUTION FOR THE DEFINITION OF DATA SHEETS MODELS AND THE LOADING ACTIVITY

After the definition of structure and main contents for data sheets, a special layout has been developed and some examples have been drawn up in collaboration with the associations of manufacturers of building materials belonging to INNOVance research group.

ANDIL is the Italian association of clay bricks and roof tiles producers since 1945. It belongs to TBE Federation and, today, its members companies make up 80% of overall national production of clay elements and they are placed in every region of our Country.

In Italy 125 companies, with 147 factories and more than 5000 workers, produce different types of clay construction products in particular for residential building in its various forms (masonry, roofing, partition walls, veneers, flooring and horizontal structures).

In 2012, the Italian brick/tiles industry produced over 7.5 million tons, with a value of approx. 700 million euro. ANDIL is committed as a representative, on a national and international scale, of the whole sector by means of an active participation in federative bodies carrying out programmes of general interest relative to “building products”, in defining and revising rules and agreements for production processes; moreover, ANDIL carries out initiatives specifically aimed at promoting higher knowledge about products with regard to performance and correct use.

Furthermore, ANDIL is constantly involved in many Research & Development activities, as it is demonstrated by the strong and fruitful cooperation with scientific researchers and manufacturers, established over the years through several collaborations for the advance and innovation of clay products and construction systems.

In this regard, the experience of the INNOVance project is a good example of effective exchange of information and knowledge between industry and research world. Actually, the main goal of this project is the creation of the first unified database for construction building. As a consequence, it has required a sharing and an examination of all the potentiailities and weaknesses of the entire construction process.
The first key outcomes of the project are data sheets for construction products. All the characteristics defining and identifying a product are contained in these data sheets. With the involvement of several member companies, AN-DIL has prepared and compiled data sheets of different product categories in which it operates. They develop data sheets for brick products subject to CE marking (governed by harmonized technical specification, such as: masonry elements, UNI EN 771-1; clay blocks for floor systems, UNI EN 15037-3; tiles and related accessories, UNI EN 15034; clay pavers, UNI EN 1344) and for those without CE mark (tabi blocks, DM 14/01/08; large hollow flat tiles, UNI 11128).

1. FROM PRODUCT INFORMATION TO FUNCTIONAL LAYERS AND ENTIRE BUILDING COMPONENTS INFORMATION

Construction products constitute the first level of object complexity of the whole building. From a technological point of view, there are also in site elements (the single functional layer of a technical element) and assembled systems (the resulting technical element). Therefore, similarly to the work conducted for construction products, standardized data sheets are developed for these levels: the individual layers (result of the installation of construction products) and the entire building components are described by appropriate data sheets associated with a series of informational attributes attached.

1.1. THE STANDARDIZED DATA SHEETS FOR IN SITE ELEMENTS

Similarly to the work conducted for construction products, information of functional layers have been grouped into categories, in order to allow a more rapid detection of the data inside of the data sheet.

1.1.1. Identification information of the compiler
1.1.2. Registered office
1.1.3. WEB site
1.1.4. Contact
1.2. Identifying information of the in site element
1.2.1. Trade name
1.2.2. Name (UNI 11337/TS1)
1.2.3. Identification code (UNI 11337/TS1)
1.2.4. CPV code
1.2.5. Intended use
1.2.6. Number of construction products used for the realization of the in site element

1.2.7. Description of the in site element
1.2.8. Description from list prices
1.2.9. Test reports
1.2.10. Synonyms
1.2.11. Keywords

2. FROM PRODUCT INFORMATION TO FUNCTIONAL LAYERS AND ENTIRE BUILDING COMPONENTS INFORMATION

Considering the entire technical package, it was structured within 7 basic requirements of the CPR:

1) resistance against fire
2) safety and accessibility in use
3) protection against noise
4) energy economy and heat retention
5) protection against corrosion
6) sustainable use of natural resources
7) sustainable use of natural resources

2.1.1. Geometrical characteristic
2.1.2. Dimensional characteristic
2.1.3. Physical-chemical properties: qualitative properties, quantitative properties
2.1.4. Tolerances
2.1.5. Composition
2.1.6. Performance characteristics
2.1.7. Safety information
2.1.8. Economic planning
2.1.9. Operational planning
2.1.10. Graphical representation in section
2.1.11. Keywords

3. ADDITIONAL INFORMATION

Although the setting is derived from the construction products defined with a dedicated working group in UNI, it is necessary to adapt the different sections, remove some and add others for the in site elements.

The part of the performance characteristics is, for example, structured by grouping the possible performance within 7 basic requirements of the works of CPR:

1) mechanical resistance and stability
2) safety in case of fire
3) hygiene, health and environment
4) safety and accessibility in use
5) protection against noise
6) energy economy and heat retention
7) sustainable use of natural resources

4. RAPPRESENTAZIONE GRAFICA IN SEZIONE

Nonostante l'impostazione derivi da quella del prodotto da costruzione definita sul tavolo UNI, per gli elementi in opera è stato necessario adattare diverse sezioni, togliere alcune e aggiungere altre.

La parte relativa alle caratteristiche prestazionali è stata, ad esempio strutturata raggruppando le possibili prestazioni nei 7 requisiti di base delle opere della CPR:

1) resistenza meccanica e stabilità
5. DATA USE

Data are collected in the SAP ERP system (SAP NetWeaver). For a better consultation and compilation of the data, a portal of free access has been developed. Through this website:
- manufacturers can create and modify the technical specifications of their construction products; they can attach the object BIM too;
- designers can describe the technical solutions designed;
- companies can consult data sheets established by designers and manufacturers, checking the correspondence between ordering and arrival of the goods in the pipeline.

Depending on the authentication of different users, the portal will contain a section of private or public data. Indeed, it is expected that sensitive data is accessible only to the user owner. The private part of the database is an advantage because it allows everyone having statistics on their products, being more competitive on the market and having a higher visibility in the industry. The portal applies to manufacturers but also to suppliers, designers, developers and managers of real estate assets.

References:

2) sicurezza in caso di incendio
3) igiene, salute e ambiente
4) sicurezza e accessibilità nell’uso
5) protezione contro il rumore
6) risparmio energetico e ritenzione del calore
7) uso sostenibile delle risorse naturali

4.2 LA SCHEDA TECNICA STANDARDIZZATA PER I SISTEMI ASSEMBLATI

A livello di intero pacchetto tecnico, si è strutturata una scheda tecnica che permette una facile visualizzazione della composizione stratigrafica dello stesso e, analogamente, a quanto impostato per l’edilizia scolastica, permetta di indicare le caratteristiche prestazionali raggruppandole per requisiti di base delle opere.

5. FRUIZIONE DEL DATO

I dati sono raccolti nel sistema gestionale SAP (SAP NetWeaver). Per una migliore compilazione e consultazione del dato, è stato sviluppato un portale di libero accesso tramite il quale:
- i produttori possono creare e modificare le schede tecniche dei prodotti da costruzione, con la possibilità di allegare l’oggetto BIM;
- i progettisti possono descrivere completamente le soluzioni tecniche progettate;
- le imprese possono consultare in ogni momento le schede redatte dai progettisti e dai produttori, controllando la corrispondenza delle merci tra ordinis e arrivo in cantiere.

A seconda dei dati di autenticazione dei diversi utenti, il portale presenterà una sezione di dati privata e pubblica. È, infatti, previsto che i dati sensibili siano accessibili solo all’utente proprietario e non pubblico (ma condivisibili con altri dall’utente proprietario). La parte privata del database costituisce un vantaggio per l’utenze proprietario che decide di utilizzare il database INNOVance in quanto gli permette, in maniera veloce e poco onerosa, di disporre di statistiche sui propri prodotti, di essere più competitivo sul mercato e di avere una maggiore visibilità, in quanto il portale INNOVance non si rivolge solo a produttori ma anche a fornitori, progettisti, imprese, committenti e gestori di patrimoni immobiliari.