A Building Material Information System: BMIS–In the Context of CONNET–Turkey Project

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ABSTRACT: Building material information supply is discussed. The problems which are encountered by users on web-based building material information sources in Turkish construction sector and worldwide are evaluated. A Building Material Information System – BMIS which is being revised for CONNET–Turkey project is introduced in brief.

1 INTRODUCTION

It is a well-known fact that building material sector grows parallel to the technological developments in the construction sector since 1970s. There are many imported building materials and components available in the market besides those are being manufactured in Turkey. All of these products have an effect on construction sector as a whole complex manner. On the other hand, it is a very significant enrichment for the users who accomplish to select an appropriate building material among alternatives. The very process of getting access to choose and specify building materials is persistently changing by virtue of the emerging information technology tools. By the help of these tools, it is also easy to access up-to-date, accurate and sufficient information about building materials on time.

At the moment there are numerous information sources that have a very intense and up-to-date content related to building materials in the countries where construction sector is well-developed. In the last decade in particular web-based information tools have been dramatically developed. Emerging web-based technologies offer opportunities to create a straight link among manufacturers, suppliers and customers. On-line supply chains and electronic business considerably change the way products are specified, ordered, customized, marketed and sold. It reduces the time and effort spent in the assessment and choice of appropriate building materials and components. Hence, more efforts can be spent to decrease the total building cost. Simultaneously, these tools provide opportunities,

- to the users to make comparisons among the alternative building materials and components available in the market faster than conventional methods,
- to the manufacturers and suppliers to introduce and present comprehensively their products and to make less investment in marketing operations.

Material and labor inputs used up through the construction process create quality control dilemma. That is the reason why the performance of the building materials pointed out in the catalogues cannot be accomplished after the construction has been completed. Manufacturers spend a great effort to solve the problem in the scope of total quality management.

Besides, in the building materials sector numerous new products introduced to the market continuously. It is becoming unattainable to check their performance by tests, thus most of the new products are to be used without being sure if they have satisfactory performance or not. In this case, making the users to be in conscious is quite important. Users should consider following factors throughout the assessment and selection process of building materials:

- the properties of the materials that are pointed out in the catalogues,
- the physical, chemical or aesthetic compatibility with other materials,
- cost of the material,
- availability of the material particularly for long-lead items,
- familiarity or experience (that is to say knowledge about the material by craftsmen and suppliers),
- labor cost,
- labor skill,

- guarantee conditions,
- standards, codes, regulations, and specifications that should be satisfied,
- ease of maintenance and repairs (Keyser et al. 1978).

2 BUILDING MATERIAL INFORMATION ACCESS PROBLEMS

At the moment various information sources are used to choose building materials and components at different stages of a construction project. Some trade associations, institutions, public and private organizations deliver information about regulations and standards that should be satisfied in the use of building materials and components. So called information can be obtained from paper-based sources, e.g. books, journals, catalogues and brochures. On the other hand, there are on-line web-based sources or off-line CD-ROMs making use of emerging information technology opportunities.

However, users come across many difficulties to access building material information depending on technological development level they are in. Some of them are being encountered in Turkey as follows (Yaman et al. 2000):

1 The users who write technical specifications particularly in the design phase have to spend a lot of effort in finding accurate and up-to-date information about building materials available in the market,
2 Information found from different sources is not uniform. It makes hard for users to assess, compare, decide, and choose the appropriate building material among alternatives,
3 Manufacturers mostly concern in marketing, therefore their presentation includes only the best characteristics of their products,
- for marketing purposes, manufacturers sometimes need to emphasize or conceal certain physical characteristics,
- the reported data they quote are obsolete or inappropriate or do not match the reporting requirements of the standardized tests,
- the reported measurement units they give for the properties of the materials do not match each other. This happens especially when imported products are introduced to the market. These imported products can have either inch–pound units or inch–pound to SI unit conversions is frequently in error.
- consequently, it is almost impossible to compare the alternative materials produced by different manufacturers.

4 When the performance of a building material indicated in various information sources is found acceptable, this doesn't mean that the material is fully compatible with the other building materials or the construction methods applied,
5 The building materials found in the catalogues may not be available easily and with reasonable price within all-geographical regions of the country.
6 It is also observed that there is no effective official authority that checks up building materials both in manufacturing and using processes. This is generally the user who has to control the technical information given by the suppliers or manufacturers in order to find out if a building material is compatible to the standards and regulations or sustains its performance when applied.

3 WEB-BASED BUILDING MATERIAL INFORMATION SOURCES

The subject of supplying building material information to the users has been tremendously developed by the help of the opportunities of emerging information technologies particularly within the last decade. The building material information exists mainly in paper form, e.g. brochures, catalogues etc., lost its actuality because of the development of innovative manufacturing technologies and introduction of new building materials to the market. The paper-based information rapidly is being replaced by the information, which serves the users by taking the advantage of digital media like offline CD–ROMs or online web-based databases. Such as CONNET, ROSETTA NET, SWEETS ONLINE etc. Latest developments in the communication and computer technology make available all the information or experiences in any place in the world for the users. Those can be systematically gathered, processed and used to modify the rationality of the decisions taken by the human brains.

AEC communities who are the major participants of the construction sector also take advantage of web-based tools and the developments of information technology frequently. They also keep up searching methods to solve their communication problems among each other such as using wireless communication. Since the quality and reliability of the information are as important as its accessibility, which has the key factor for the construction sector, it should be accessed easily and on time. Construction sector has some problems because of its nature and this has an affect on the information access issue. Some information systems serve in different domains can be a solution to the information access issue to such an extent.

Building material information sources serve on the web:

- provide the users making comparisons, evaluating and choosing among alternative building materials in the market in a quick and rational manner,
- provide the manufacturers or suppliers publishing reliable, up-to-date and detailed technical information and introducing their new products economically,
- provide suppliers developing e-commerce facilities between manufacturers and users,
- provide building material manufacturers developing supply chains among each other.

3.1 *Web-based Building Material Information Sources in the World*

At the moment there are numerous global web-based sources that supply building material information to the users. The structure of those web-based sources varies according to the (Tas et al. 1999):

- financial capacity of the sponsor institutions or the organizations,
- the user profile which it serves,
- it's capacity,
- geographical range that it serves.

On the other hand, the content of the web-based sources can be grouped under four main topics:

- General information (contact info, mailing and e-mail address of the institution or organization that supports and maintains the source),
- Product profile (the content contains technical and the other information about products the users look for),
- Other services (catalogs, CD-ROMs and floppy diskettes, electronic magazines and manuals sent via mail or e-mail mostly on registration basis, web page design and electronic mail services),
- Communication and web links (interactivity between the user and the web-based source, discussion forums, message centers, live chat, e-business etc.).

Factors that influence the users' preference of the web-based sources are:

- ease of use, in other words user-friendliness and enabling accurate and fast access to information,
- whether or not a well-known classification system is used in the organization of the content, e.g. CSI Master Format, CI/SfB,
- having a fast search engine and a comprehensive database,
- having services like technical specification data, etc.,
- having not only technical information but also problem solving alternatives related to the application of building materials, e.g. CAD files,
- having not only online services but also using traditional tools such as mailing paper-based sources,

It can be said that those services and content is progressively developed parallel to the increase of numbers of users. It is a well-organized source if the content is in order, reliable and up-to-date.

3.2 *Web-based Building Material Information Sources in the Turkish Construction Sector*

According to the results of a survey carried out over different manufacturers and suppliers in different size actively work in Turkish construction sector, it is seen that manufacturers make a great deal of investment in marketing operations (Tas 2001).

Most of the companies find it attractive to supply or to introduce building material information on the web because it is:

- easier and faster,
- integrated
- more economical than other traditional marketing methods and,
- information is up-to-date, reliable.

Almost all of the companies (91%) want to be involved in such a system. However, they also think that the web-based building material information supply cannot be done effectively because of the following reasons:

- applications attempted on this area are still in developing phase,
- there are bandwidth problems on the Internet infrastructure and,
- computerization level of the users is quite low.

On the other hand, the manufacturers expect that the supply of building material information via Internet will become prevailing and useful over paper-based sources within the next few years.

There are limited well-organized sources in Turkey. "Building Industry Center web-based source and the building catalog off-line CD–ROM", "Turkish Chambers of Architects' web site", "Turkish Chambers of Civil Engineers' web site", Constructera" and "Building Guide web site" are used most frequently.

When the web-based building information sources in Turkey are examined, it is seen that the efforts are not beyond collecting various brochures and scanned information files in a digital medium without using any classification system. Apart from that, some other communication facilities like e-mail bulletin and online forum are put forward by personal enforcements. Web-based contents and links are quite poor. Updating frequency of the content is quite poor as well. Hence, it can be said that web-based sources in Turkey are not user friendly or practical in use.

3.3 *Problems in Designing of a Web-based Building Information Tool in Turkey*

Problems that should be taken into consideration in the planning phase of a web-based building material information tool are (Yaman et al. 2000):

- changing inflation rate,
- economical instability and diminishing of the construction sector,
- complexity of classification systems,
- quality and standardization problems of building materials and components.

Economical instability and changing inflation rate in Turkey are the most important factors that prevent the development of Turkish construction sector for years.

It is well-known fact that the Turkish construction sector as the driving force of the economy has not only been extensively affected by the reformist economical movements but also has seen as a solution to unemployment problem. The companies, which have an active role in construction sector, are adversely affected by the cost variations during the construction process, which cannot be foreseen in the design phase. The share of the building material cost is very high in total building cost. Since it is necessary to access up-to-date market prices besides technical information of building materials.

There is no widespread use of well-known international classification systems in Turkey except CI/SfB to some extent. Selection of a classification system is a very important step in the design of a building material information tool. Moreover, it is hard to exchange data among accessible information sources.

The audit to check the conformity of the standards, manufacturing, storage and application of building materials and components is not enough. On the other hand, there is no well-developed quality assurance system for the imported products to control the suitability of them for the Turkish conditions. Users are not supplied with any further knowledge that can guide them through building material assessment and selection process. Most of the users are not aware enough about standards and regulations. So, building materials are mostly selected in an empirical way, such as along with personal experiences, knowledge and preferences. There are low quality mostly imported products available in market cheaper than the others.

A web-based building material information tool should have a role to orient the building material sector by encouraging the manufacturers to produce high quality products and by helping users to aware in assessing and choosing building materials in Turkey.

4 A BUILDING MATERIAL INFORMATION SYSTEM MODEL (BMIS) FOR TURKEY

This section mentions about a research project carried out in 'The Center of Building Cost and Construction Management Center" in the Faculty of Architecture at Istanbul Technical University (ITU). The main theme of the project was developing a "Building Materials Information System (BMIS)" based on relational database structure in the context of Turkish construction sector. The main objectives were to examine Turkish market and to develop an information system. It would be possible to estimate the approximate total building cost of a project even in the design development phase by means of developed information system. The information system would be used both in schematic design and design development phases of the construction process.

There were two main objectives of the studies carried out within the scope of the BMIS research. First group of the objectives were as follows:

- gathering all the information on the subject of building materials used in market at present,
- having access to detailed technical information about available building materials in the market,
- having access to detailed information about manufacturers and suppliers,
- obtaining information about the current unit prices of building materials, including labor and equipment,
- choosing among alternative building materials by the taking advantage of the comparative building material data sheets,
- linking the BMIS building product classification system to Turkish Ministry of Public Works and Resettlement classification system,
- linking the BMIS building product classification system to well-known international classification systems e.g. CI/SfB and CSI Master Format.
- developing and maintaining an up-to-date building materials and components database,
- making BMIS a web-based information source for Turkish construction sector operating on registration basis.

The second and ultimate objective of the research project was to estimate total building cost based on functional building elements. The cost estimation module based on functional elements is a computer-based model that estimates the building cost in schematic design and design development phases by making use of the data retrieved from similar projects.

The major steps of the research project were:

- studying state-of-the-art of building material information sources accessible in Turkey and worldwide,

- gathering information concerning building materials and components available in Turkish market,
- developing BMIS product classification system and linking it to international and domestic ones,
- developing relational database,
- developing building cost estimation module,
- making BMIS as a web-based information source.

4.1 *Gathering the Building Material Information*

From the studies of the previous research it is seen that most of the available worldwide building material information sources utilize technical specifications e.g. Spec-Data and Manu-Spec created by the manufacturers (in USA under the licensure of CSI) in order to supply the users.

Conversely, the users and researchers do not have any occasion to get such well-organized and comprehensive product literature information from the manufacturers. However, since the building materials available in the market have to hold Turkish Standard approval given by Turkish Institution of Standards (TSE), these standards were taken into consideration all through the research project. Building material standards that are currently approved by TSE were studied and material data sheets that summarize the performance characteristics like physical, mechanical, and environmental properties of the material were generated.

Standardization is based on a technical and scientific institution. It determines the qualities of a material, a product, a method or a service by the rules it put forward. In the developed countries there is no obligation in the applications of standardization except the subjects directly related with the human life, health and safety. On the other hand, in developing countries, since the economical and social conditions are not at the sufficient enough, national standards have a compulsory character by the laws. The standards approved by the TSE are called as "Turkish Standard". According to the National Notification #82/1-13 related to "Public Procurement" of Turkish Ministry of Industry and Technology it is pointed out that (Esen 1984):

- Turkish standards should be referred in technical specifications prepared for public procurement and tenders,
- If a Turkish Standard is available in an issue, "Turkish Standard Conformity Certification" given by TSE should be looked for,
- If a Turkish Standard is not available in an issue, once more and only "TSEK Certification" given by TSE should be looked for,
- The authority given to the other boards by regulation, law and decrees is reserved.

Therefore when the users know that the building material complies with the TSE standards, they can easily assess and select it. It also helps them to be protected from deceiving advertisements or announcements.

The building material data sheets that are engaged in different generic categories are developed as follows:

For instance, in developing a building material data sheet in the category of "paint", TS 7847 (Wall-Coating Emulsions for Exteriors-Polymer Based), TS 39 (Paints-Organic Solvent Based-Top) and TS 5808 (Water-Based -Emulsion Type- Architectural Paints) are analyzed. The structure of the data sheets mainly consists of following titles:

- material category name,
- structure of the material,
- TSE number,
- physical, chemical, mechanical performance characteristics and environmental properties of the material,
- manufacturer,
- the Turkish Ministry of Public Works and Resettlement classification number and unit price of material.

Hence, the user has an opportunity to check the performance characteristics of the building material he/she selects from the data in the sheets, which are generated from its corresponding standards.

Developing standard building material data sheet formats for Turkish construction sector and using them extensively are considered to be the next step for the research.

4.2 *BMIS Coding System Development*

The system can also be used as a computer-based model that estimates the building cost in schematic design and design development phases. In that context, a BMIS coding system based on "classification system based on functional building elements" was developed. So called BMIS classification system was linked to Turkish Ministry of Public Works and Resettlement and CI/SfB classification system.

4.3 *Building Material Information System (BMIS) Development*

Microsoft Access relational database management system software was used to generate data entry and query forms using data structures on building material data sheets.

Building material alternatives in the database were classified in the context of first group of objectives of the research project. Therefore, users could easily take advantage of cost estimation module for the current market prices of the building

material alternatives as well as technical information forms.

5 CONNET PROJECT

The CONNET initiative provides an open arena through which appropriate information resources can be identified within a nation and across Europe. CONNET has been developed through EC funding to become an open portal to connect industry practitioners to relevant information. CONNET establishes a technology transfer network for those involved with the built environment with active notification services (CONNET 2004).

CONNET–Turkey project is aimed to develop a virtual technological park. However, as a candidate country, such a virtual technological park could not be designed separately projects being carried out EU 5th and 6th frame programs. Thus, CONNET–Turkey project will be linked to the backbone of the European Construction Network.

Objective of the CONNET–Turkey project are:

- developing a web-based virtual technology park,
- preparing an infrastructure in order to integrate and to standardize Turkish construction sector consistent with EU norms,
- starting up vital services for the sector,

The European CONNET entry point provides a range of technology park services as well as industry-specific services such as:

- management of security services,
- help desk for potential service providers and for problem resolution,
- information broker role,
- technology observatory service,
- Provision of user profiles,
- Multi-classification support,
- Inter-service communication services,
- Multi-language supports (Bloomfield et al. 2001).

Outputs of above mentioned BMIS research will be a part of the CONNET–Turkey project. BMIS will serve as an online building material and component information source.

Currently BMIS is being revised for CONNET–Turkey project as a whole.

6 CONCLUSION

Construction sector is called as the driving force of the national economy and cannot be separated from the development process of a country. In addition, construction sector uses the products or services of the other sectors, and the products it produces also are used by the others. Construction sector is not only affected by the activities occur in the other sectors, but also affects other sectors concerning to the decisions taken and the industrial improvements. Besides, it creates employment opportunities.

Alternatively, as a candidate country for the EU, Turkey knows his duties and responsibilities very well. International contractors and building material manufacturers perceive Turkey as an important potential market. Turkish contractors, building material manufacturers and designers are also getting projects abroad together with their partners.

As BMIS is started being used practically, the characteristics and properties of the building materials manufactured in Turkey will be introduced to the world and it will be an important step to a web-based source which has a link with the international classification systems.

Availability of the building material information on the web will give the users the opportunity of easy access to up-to-date and accurate technical information. It will have encouraging contributions to the building material assessment and selection process regarding time and cost issues. By the help of the BMIS, users can select the appropriate products bearing in mind detailed technical information and unit cost, and through user's experiences or feedbacks. It will encourage manufacturers to search more economical production and marketing operations. The users will be aware of quality and standard issues. In addition, during the schematic design or design development phases of the project, building cost estimation can be made to check whether the building material selected is a rational choice or not.

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