Cut Back of Non-technological Barriers to Double Skin Facades

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ABSTRACT

This paper is part of the "Best Practice for Double Skin Facades" – 'BESTFACADE' project (supported by the Intelligent Energy Europe Programme of the European Community) and aims to describe the cut back of non-technological barriers to the application of Double Skin Facades (DSF) in a number of European countries (Austria, Belgium, Germany, Greece, Portugal, France, and Sweden) that participated in this action. In the first part of the research, the study aims to identify and analyse the non technological barriers and in the second part to suggest a strategy in order to overcome these barriers. The analysis of the barriers and the suggested strategy are based on a questionnaire, which was completed by all participant countries and round table discussions that took place between the partners.
The results showed that the lack of specific legislation and standardised schemes on DSF, the lack of knowledge on DSF regarding the system's advantages, disadvantages and cost, the inefficient documentation of reliable DSF best practice and the lack of funding constitute the main barriers for not using and promoting the product in the national markets. Therefore a policy is suggested to follow in order to overcome these barriers and encourage the application of DSF systems in the EU market.

KEYWORDS

Double facades, advanced glazing

INTRODUCTION

The aim of this paper is to describe the cut back of non-technological barriers to the application of Double Skin Facades (DSF). These non-technological barriers are more difficult to overcome than technological barriers due to the fact that the factors which govern them are not objective and differ from country to country.
The present work comprises two parts: In the first part the non technological barriers are identified and analysed. These barriers concern aspects as legislation, financial aspects, institutional aspects, sociological-behavioral aspects, educational aspects and institutional aspects. As part of this action a questionnaire was completed by each partner describing the above factors that hinder or, in some cases, promote the development of double skin facades in their countries respectively. In the second part of the research, strategies to overcome these barriers are suggested. The proposed strategies are based on the answers of the questionnaires.

METHODOLOGY

A questionnaire was developed within the first part of the study, aiming to identify the non-technological barriers for the application of DSF. The questionnaire was distributed to all the BESTFACADE participants and forms the basis for a 'SWOT' analysis. 'SWOT' analysis is a methodology that analyses the barriers and limitations of a product in the market. It is a means to identify the advantages and disadvantages of the product. 'SWOT' is an abbreviation of 'Strengths', 'Weaknesses', 'Opportunities' and 'Threats'.
The issues 'Strengths' and 'Weaknesses' study *internal* resources of the product (in this case double skin façade systems) by comparing it with other products of the same type (in this case with conventional façade systems)
The issues 'Opportunities' and 'Threats' analyse *external* resources that have an impact on the applicability and use of the product such as sociological and behavioral aspects, legislation etc.
The questionnaire studies whether the investigated issues constitute an opportunity/strength or a threat/problem for double skin facades in the BESTFACADE participating countries. The questions are split into the following five categories: legislation, knowledge, financial aspects, sociological and behavioral aspects and institutional aspects.

NON TECHNOLOGICAL BARRIERS – RESULTS

The first factor to be studied is whether legislation issues constitute a threat or an opportunity in the application of double skin facades in each country. The legislation issues that were investigated concern the existence of a basic legislation on DSF, the legislation on sound and fire protection, legislation on energy and environmental issues, on ventilation requirements, legislation on thermal insulation and requirements on thermal and energy modeling of the building and DSF. The analysis shows that in the participating countries there is no awareness of any specific legislation for double skin facades. Additionally, all existing legislation applicable to conventional facades is also applied to double skin facades, since there are no specific ones for this type of facades.
More specifically, legislation on fire protection may be a threat to DSF since the fire transfer between the rooms and levels have to be reduced. Additionally sound legislation can be a threat when considering sound transfer between adjacent spaces through the DSF cavity. On the other hand, sound legislation can also be an opportunity to DSF as this type of façade provides better sound insulation than single skin systems. Legislation on lighting issues could pose a threat to DSF since the inner layer of glazing in conjunction with the internal blinds can lower significantly daylight factors in occupied spaces; however a proper design can result in adequate visual comfort; in this case the legislation is considered an opportunity to the use of DSF.
All countries have legislation on thermal insulation and achieved U-values; most countries consider this as an opportunity for double skin facades since the U-value is usually lower than for other glazed façade types.
Currently in all countries there are no requirements on thermal and energy modeling of double skin facade performance. This might change with the EPBD requirements and might pose a threat to DSF if the requirements

cannot be met by this system. In the case of ventilation requirements, these exist in all countries but do not pose any threat to the application of DSF.

The second aspect to be studied from this questionnaire is the level of knowledge that each country has on double skin facades on issues like typology and design, performance and construction of DSF, advantages and disadvantages of DSF and dissemination of this system. The questions are addressed at 4 target groups: scientific institutions, the building industry, architects and others (such as building owners and investors). Concerning the typology, performance, design and construction of DSF, research institutions and big constructions companies usually working at an international level have good knowledge of the DSF systems. On the other hand, low level of knowledge is noted in the group of architects, building owners and investors. In the case of the advantages and disadvantages of the double skin facades compared to the conventional systems, it seems that the knowledge is low in all target groups apart from several educational/research institutions that are working in relevant projects. The analysis showed that in all countries there are built DSF examples; the majority of them have been constructed recently; however there is no documentation of their energy and environmental performance.

The third aspect to be studied concerns the sociological and behavioral aspects of double skin facades in each country. This section investigates whether local climatic conditions and local architecture may pose a problem to the application of DSF, if DSF are appropriate for all type of buildings, the importance of occupant control ventilation in the use of DSF and the system's reputation.

Climatic conditions do not seem to pose any obstacle in the application of DSF. Full transparency also does not seem to pose any threat to the application of DSF; it seems that architects desire full transparency while users might not like it. Although DSF can be applied in all type of buildings, until now they have been used mainly for office buildings and not so much for residential and other type of buildings because of their increased construction and capital cost. Moreover, the occupant control for ventilation may be a threat to DSF if their design does not allow user control. Regarding the reputation of DSF in all participating countries, it seems there is skepticism in the scientific field concerning the energy efficiency, the indoor air quality and thermal comfort levels that this type of façade can provide. The reputation is good in the building industry that tries to promote this type of façade but there is also concern because of the high investment cost. Among the majority of the architects the reputation is good mainly because of aesthetics reasons. However, there is a rather low level of knowledge on the energy performance of DSF among all target groups.

Regarding the questions on the financial section, the research investigated the level of knowledge on the cost of DSF compared to conventional constructions and the availability of funding grants. The analysis showed that, in all countries taking part in this questionnaire, the cost of double skin façade buildings compared to buildings with traditional facades is considered higher although the available data on cost is limited. In the majority of the countries the level of knowledge on the cost of double skin facades concerning the investment, operational and maintenance cost is low in scientific and

educational institutions, as well as in architects. In all countries there are no available grants for DSF.
The study on institutional aspects of double skin facades concerns the possible support that this kind of technology could have, as well as institutional drawbacks, such as bureaucracy. The results showed lack of regional support and support from the government. Additionally, the levels of bureaucracy are rather high in all partners and at least as high as for conventional facades.

STRATEGY TO OVERCOME THE NON-TECHNOLOGICAL BARRIERS

In order to overcome the non-technological barriers to DSF a policy with a pre-assessment and post-assessment stage is suggested to cover all issues that were defined in the first part of the analysis.

Pre-assessment stage

The pre-assessment phase aims to provide the target group with all necessary information on DSF to be able to check the performance of the suggested technology. This part covers the need for the existence and compliance with standard schemes and homogenous calculation methods on DSF among the EU countries as well as adequate dissemination of the system.
Currently there is legal regulation for DSF in use covered by the EN-standards, EN 13830 'Product Standard - Curtain Walling'. According to EN 13830: 2003-11 a curtain walling is defined as: 'external building façade produced with framing made mainly of metal, timber or PVC-U, usually consisting of vertical and horizontal structural members, connected together and anchored to the supporting structure of the building, which provides by itself or in conjunction with the building construction all the normal functions of an external wall but does not contribute to the load bearing characteristics of the building structure'.
According to prEN 13119:2004, a double skin façade is defined as: 'a curtain wall construction comprising an outer skin of glass and an inner wall constructed as a curtain wall that together with the outer skin provide the full function of a wall'. The EN standards list the façade specifications according to the requirements of the Construction Products Directive (CPD) leading to the CE marking for curtain walling, that is in enforcement since the year 2005.
The standards cover the thermal and acoustic resistance, air tightness, water permeability and wind protection issues for DSF systems. It is suggested that all countries should comply with the specific schemes; thus dissemination of the EN standards should take place.
A homogenous procedure for the U-value calculation and performance of DSF is necessary as a means to compare projects in different countries; this could be covered by the procedure suggested by prEN 13947:2005 in conjunction with a simple calculation method that will be developed within the BEST FAÇADE project in accordance with the CEN standards.

Harmonization of the EN standards and calculation methods to meet all national legislations is important to meet the different climatic conditions and market needs.
Dissemination of DSF is also important in conjunction with reliable documentation of good built examples. A broad dissemination of projects relevant to DSF through seminars on national level and workshops to a large target group is necessary to overcome the lack of information. Additionally, training of architects and engineers at university level on the DSF system would increase the consciousness of the students and future professionals.
Within the dissemination procedure, a best practice guideline including good DSF examples already built in the participating countries could be prepared and distributed to engineers, architects, building owners and construction industry.
The analysis of the questionnaire showed that the majority of the built DSF examples concern office buildings. For financial and commercial reasons, it is essential to show the applicability and expansion of DSF use also in other type of buildings such as schools, malls and other public buildings.

Post assessment

The post assessment stage includes all actions that have to be taken into consideration after the DSF dissemination in order to support and promote the product in the market. This part highlights the need for aggressive marketing of the product form relevant companies, the need for reliable documentation of best practice and the provision of funding.
The advertisement of the DSF is dependent on the company level policy: the national markets and involved associations should follow an aggressive policy for the promotion of the product. They could demonstrate the advantages of the system as well as the fact that funding is important to spread the use of it. Additionally, companies could play an active role on legislation issues, for example by promoting DSF products as 'green' products that are adequate to comply with the EPBD, thus to reduce emissions (especially CO_2) and the building energy consumption.
Additionally, a board-institution is necessary to be the link between the designers and the construction industry and to set specific targets and standards for the façade industry. A society of façade engineering on national and EU level in conjunction with the façade industry could play a driving force for the development of the glazing systems.
The publication of the good examples along with the documentation of their energy and environmental performance including operational and investment costs in scientific journals is important to increase reliability of the product. The provision of real data (i.e. monitoring data on energy and indoor comfort combined with the users' opinion) and advertisement of the results would encourage the use of DSF and the public confidence in the product. The monitoring policy and the documentation of the results are effective in showing of how the DSF construction is meeting or not the various thermal and energy requirements.
'Demonstration' projects could also be used to demonstrate the best technology, such as DSF, document the whole procedure from the pre-design

building until the occupancy of the building to indicate the performance of the technology.
The main competitor to the DSF is the conventional glazed system due to its simpler technology and reduced investment and lower construction costs. However, the driving force for the application of DSF should not be the cost but the advantages of the technology and the system selected. The reduction of the cost of the façade would promote the use of the product in the market. However, because of the high initial construction cost of the DSF the DSF buildings could be assessed as cost-effective through the life-cycle cost method, assessing the total building cost over time.
The analysis showed the lack of financial incentive schemes for DSF. On national and EU level, short and long term funding methods should be established to support both research and construction along with public support and support from the Government.

CONCLUSIONS

From the answers obtained in this research the aspects that could be identified as the main non-technological barriers to the use and further development of the DSF in the EU market are: the lack of knowledge on legislation and standardized schemes of DSF, the lack of knowledge on the advantages and disadvantages of the system, the increased cost of the system, the inefficient dissemination of real best practice examples and the lack of funding.
In order to overcome these non-technological barriers it is suggested to follow a policy that would be distinguished into two stages: the pre-assessment and the post-assessment stage in order to cover all issues defined in the research.
The pre-assessment stage deals with the information that can be provided on legislation and standardized schemes on DSF, harmonisation of the standardized schemes to the national market industry, introduction of a homogenous calculation method as a means to compare projects in different countries and increased dissemination of DSF to the target group and beyond it.
The post-assessment stage includes actions that deal with the adequate and reliable documentation of good examples, the better definition of targets by the façade industry, the aggressive marketing policy from the relevant associations and the provision of funding schemes.

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