

Practice and knowledge of Flemish architects on sustainable material use

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ABSTRACT: The focus of sustainability in the building sector is gradually shifting towards the environmental impact of building design. A substantial amount of research has already been performed on the assessment of the environmental impact and numerous impact assessment tools have been developed. However, as the architect is usually the key actor in the design process, the assessment of the environmental impact should be adapted to his work method. Up to now, few research concerning the architect's practice and knowledge regarding sustainable material use and the environmental impact of building design has been performed. Therefore, a survey on sustainable material use was conducted in February 2014 among 364 Flemish architects. From this survey it appeared that sustainable material use is not frequently applied in practice and architect's knowledge is rather limited. So there is a clear need to sensitize the architects regarding the importance of the environmental impact of building materials.

Keywords: survey, sustainable materials, environmental impact assessment

1 INTRODUCTION

The last decades the energy performance of building design has been the focus within the field of sustainable building. However, the attention is gradually shifting towards the environmental impact of building design as the construction industry is responsible for over 50% of the raw materials use and for the generation of about 30-40% of the solid wastes (OVAM 2013, European Commission 2014, Buendia & Cuevas s.d.). In building design, the building materials are responsible for a large share of the environmental impact of building design. As the matter is gaining importance in the construction sector, the eventual implementation of the environmental impact in building design is inevitable. However, the assessment of the environmental impact should be embedded in the architect's work method. Therefore, insights in the architect's current knowledge level and awareness are indispensable for future developments in this domain.

2 RESEARCH AIM AND METHODS

The aim of this research, which is part of an ongoing doctorate, is to gain insights in the architect's attitude, awareness and knowledge level regarding sustainable material use and environmental impact assessment (methods). This need for insights was already expressed by Haapio & Viitaniemi (2008). However, few research up till now provides these indispensable insights. Therefore, a large-scale survey into the sustainable material use in design practice and LCA-based environmental impact assessment (tools) was conducted among 364 architects in Flanders, Belgium in February 2014.

Prior to conducting the survey, a literature review into existing survey material regarding sustainability in the construction sector, and more specifically environmental impact in building design, was performed. As none of the existing surveys fit the scope of this research, a new self-administered survey was drafted. However, some questions are (partially) based on Arup & World Business Council for Sustainable Development (2012), Klingele et al. (2007), Tritthart et al. (2010) and Weytjens (2013).

The survey was structured in five parts, being general background knowledge of the architects questioned, sustainability in building design, material choice in building design, life cycle assessment in building design and tool development. It was conducted during four information sessions on new legislation for sustainable energy, more specifically on how to implement the obligation to integrate renewable energy in building design, organized by the Flemish Architects Organization (nav).

The survey was originally developed to gather a handwritten response. However, an online identical version was also provided from the second session on, as numerous participants asked for it.

The data-analysis is performed in Microsoft Excel and SPSS Statistics 22.

3 RESULTS

3.1 Representativeness of the sample

At the end of the information sessions, 354 surveys were returned. The almost completely empty ones (8) and the copies filled in by non-architects (4) were omitted, leaving a response of 342 surveys. In an attempt to extend the sample, five bachelor students in architecture were assigned to collect additional surveys. This took place in the context of an assignment for a bachelor course on research methodologies. This way, an additional 25 surveys were collected (13 handwritten and 9 online), 22 of them were usable in the context of the further research, 2 were left out due to non-reliability and 1 was left out because the person questioned was no architect.

So, in total 732 surveys were distributed and 364 usable surveys were collected, which corresponds to a response rate of about 50%. The sample size covers approx. 5% of the total population of Flemish architects, being 7714 according to the Flemish Council of Architects. Both the age (Table 1) and gender (Table 2) distribution of the sample resemble the population distribution according to the data of the Flemish Council of Architects (Orde Van Architecten - Vlaamse Raad 2014).

Table 1. Age distribution of the sample and the total population.

	Sample	Total population
	%	%
20-29	26	22
30-39	29	29
40-49	17	20
50-59	21	19
60-69	7	8
70-79	0	1
80-89	0	0

Table 2. Gender distribution of the sample and the total population.

	Sample	Total population
	%	%
Male	64	68
Female	36	32

3.2 Sustainability in building design

First, architects were asked about their general concern with sustainability in building design. As Figure 1 shows, about 67% of the architects questioned indicated to be concerned with sustainability in their architectural design practice, whereas 30% claimed not to be concerned with sustainability and 3% could not decide between yes and no and chose to answer with both options, which was converted to the “sometimes” option. However, the term “sustainability” was in this question not further specified, so the interpretation was left to the architect’s opinion.

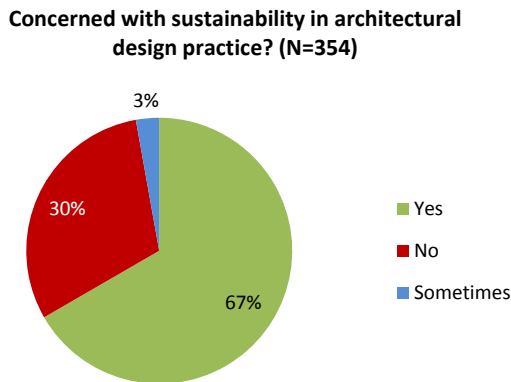


Figure 1. The percentage of participants concerned (or not) with sustainability in their design practice

By analyzing these data, it appears that two third of the architects consider themselves concerned with the level of sustainability of the buildings. To further investigate to what extent they are concerned with sustainability, a list of options was presented and architects could select all options that were applicable to their situation (Fig. 2). Most architects claim to be actively occupied with it. The second most common answer is that they do it on clients demand, which means that apparently a number of clients are asking for this kind of service. This tendency was also found in the article “The growing willingness in Europe to invest in sustainable materials” (Ruseva 2011) for some neighboring countries. In third position is the fact that they discuss it within the architectural office. The “others” option consists mainly of sustainable concepts, attending courses and information sessions, consider sustainable materials, pay attention to the choice of insulation material,

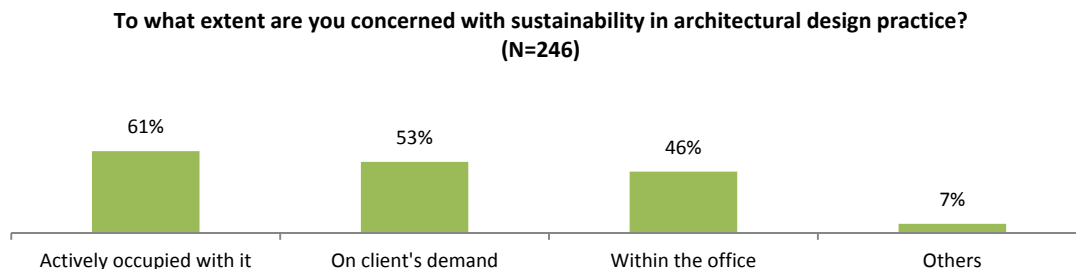


Figure 2. Indication to what extent the architects are concerned with sustainability in design practice

The architects who claimed not to be concerned with sustainability in design practice were asked to specify why not. They were allowed to select more than one reason. The results of this subquestion are shown in Figure 3.

If you are not concerned with sustainability in architectural design practice, why not?
(N=116)

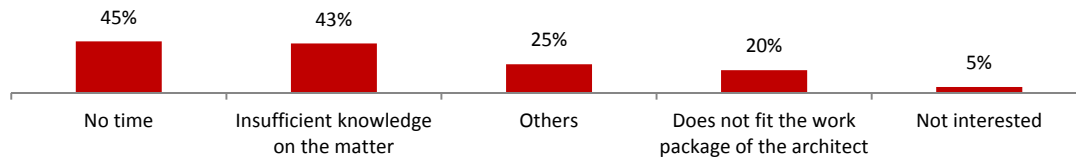


Figure 3. Indication why the architects are not concerned with sustainability in design practice

Main reasons for architects not to be concerned with sustainability in their design projects are the fact that they do not have the time (45%) or the right knowledge on the matter (43%). Next reason, being the “others” option (25%), mainly relates to the fact that there is no interest or demand coming from the client regarding the matter and the fact that the client’s budget is often insufficient. Next in line is the option “does not fit the work package of the architect” (20%). The option “not interested” was only selected by a limited number of architects (5%), meaning that most architects themselves appear to be interested in the matter of sustainability. The suggestions under the “other” option do indicate that there is still room for improvement on the work load that comes with it (which relates to the time aspect). Also architects should be better informed on sustainability, as they indicate their knowledge on the matter is insufficient. An important conclusion is that clients should be made aware of the importance of sustainable building for future generations, as they are in control of the budget of the building project and decisions often relay on the accompanying cost. Furthermore, they can be the driving force for architects to pay attention to this aspect (Fig. 2).

In the next question, architects were asked how they stay informed on sustainable developments (Figure 4). A distinction is made between the architects who indicated to be concerned with sustainability, those who indicated not to be concerned with it and those who selected both options (converted into “sometimes”). Most Flemish architects (approx. 90%) try to stay informed on sustainable developments by means of practical sessions such as courses, education, About 68% of the Flemish architects (mostly those concerned with sustainability) stay informed by reading books, journals, Only 6% of the architects (mostly architects concerned with sustainability) try to stay informed in other ways such as discussions with the EPB reporter and technical engineer, the internet, About 4% of the Flemish architects (mostly architects who are not concerned with sustainability) are not specifically concerned with staying informed on sustainable developments. This shows again that most architects are interested in the matter regarding sustainability, as most of them try to stay informed on sustainable developments.

How do you stay informed on sustainable developments?

(N=354)

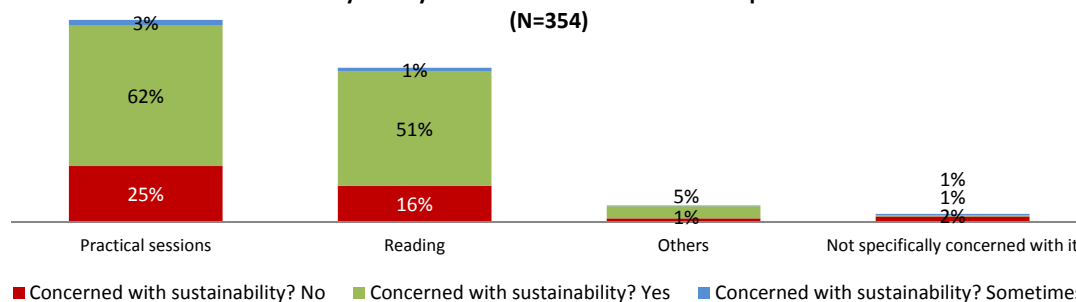


Figure 4. Relation between the question “concerned with sustainability” and “How do you stay informed on sustainable developments?”

In the next question, some additional insights in the architects interpretation of the term “sustainability” are gained, by asking participants to mark the sustainability aspects they consider in their architectural design practice. The results are shown in Figure 5.

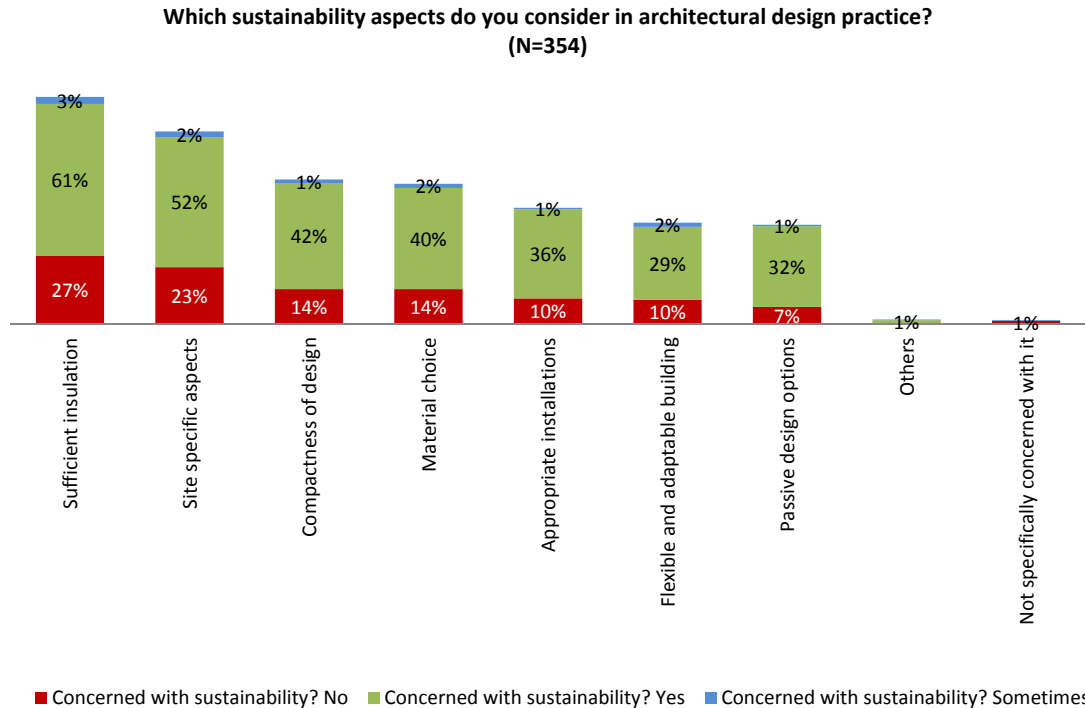


Figure 5. Relation between the question “concerned with sustainability” and “which sustainability aspects do you concern in your architectural design practice?”

As can be derived from this figure, the first two options are considered by the major part of the architects questioned, both by those who are and those who are not concerned with sustainability in their architectural design practice. Therefore, these two aspects show no significant link between their “concern with sustainability” and the “sustainable aspects considered”. For the remaining aspects, there appears to be a significant link between both questions: from the participants who indicated to be concerned with sustainability, the majority selected a number of these sustainability aspects, whereas the share of people who indicated not to be concerned with sustainability in their architectural design practice did not select these answers as often (less than half of them). The architects who are sometimes concerned with sustainability all selected the “sufficient insulation” option, for the other options their share differs. If we look at the participants who suggested other aspects, it stands out that all of them are participants who indicated to be concerned with sustainability, whereas the participants who marked the option “not specifically concerned with it” are all participants who are also not concerned with sustainability in their architectural design practice.

If we look at the deeper meaning of these aspects, it appears that most sustainable aspects which are considered relate to the energy performance of the building design (such as insulation, site-specific aspects, compactness, ...). The material choice is considered by 56% of these participants and is on the fourth place in the list. As the focus of the survey was on the environmental impact of building design and as a high proportion of this impact comes from the building materials used, the architect’s awareness and knowledge level regarding the importance of these aspects is discussed in the following paragraphs.

3.3 Sustainability of material choices in building design

First of all, the basis for material choice in building design is investigated. The participants were asked to select all relevant options which they use as a basis for decision making regarding the building materials used in building design. The results are shown in Figure 6.

**On what basis are decisions concerning material choice usually made?
(N=355)**

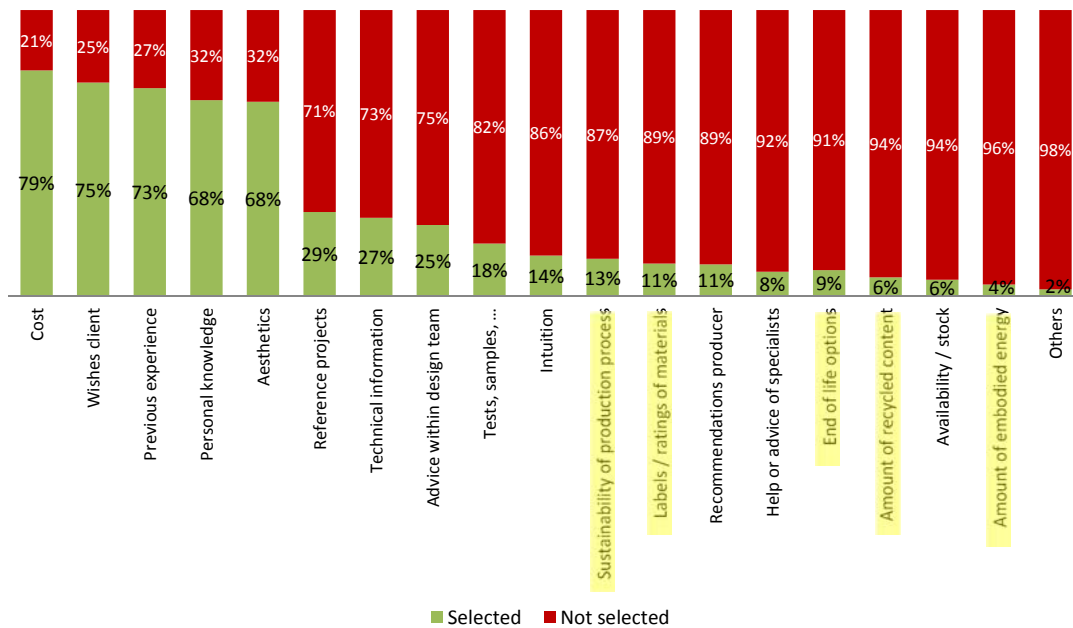


Figure 6. Basis for decision making regarding the material use in building design.

Figure 6 shows that cost, client’s wishes, previous experience, personal knowledge and aesthetics are most frequently used as a basis for decisions concerning material use (in approx. 70-80% of the cases). Then there is a large gap between these five aspects and the following three aspects, being reference projects, technical information and advice within the design team (all between 25 and 30%). The remaining 11 criteria are only considered by 2-18% of the participants. Only one participant selected all options at the same time. For the “others” option, labels such as the cradle-to-cradle principle, ATG/BENOR label and the use of the NIBE classification were mentioned.

The criteria marked in yellow relate to the environmental impact of building materials and as can be concluded from this graph, these aspects are only rarely considered by architects as a basis for decision making.

In addition, the participants were asked to indicate the three most important actors regarding the material choice in building design. The outcome was 94% for the architect, 90% for the client and percentages between 2 and 19% for the local government, the contractor, the structural engineer, the project manager, etc. So it becomes clear that the (sustainable) material choice is mostly a shared responsibility between the architect and the client.

As some architects added labels as a basis for material choice in the design process, the value of these labels is explored in the next question “does a label help in sustainable material choice?”. The results are shown in Figure 7.

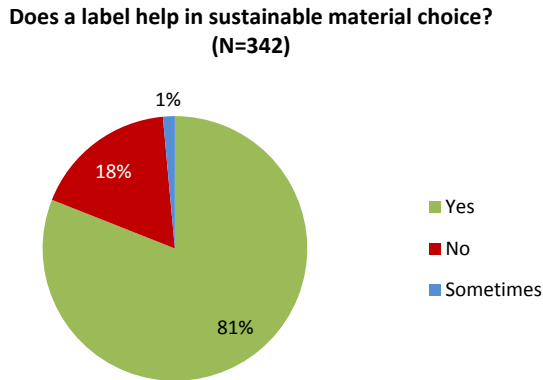


Figure 7. Does a label help in sustainable material choice?

According to 81% of the participants, a label can help in choosing sustainable materials. Only 18% claims that a label does not help and about 1% could not choose between yes and no and checked both boxes, meaning that it helps in certain situations or that they have doubts.

Those who selected that a label helps in making sustainable material choice (N=278) were asked to specify their choice. From this group, 83% indicated that a label could help for structural or carcass materials (except the stone and granulate materials). Then there is a large gap to 61% who indicated that a sustainability label could help for stone and granulate materials. Next in line are the building elements such as windows and doors, selected by 57% of the participants. 56% could use the help of a sustainability label for building-related technical installation and systems, whereas 54% indicated that a label could help to choose more sustainable finishing materials. For the subsequent aspects, a gradual decrease occurs: the next type of materials for which a label on sustainability could help are the additives, with 41%, and maintenance and cleaning products with 24%. Only 3% of the participants selected the others-option. When they specified their choice, most of them indicated that they want a label for all types of materials, or they claimed that they preferred a label for wood-materials (such as the PEFC label).

For the explanation why a sustainability label does not help (N=61), no argument really stands out. However, three reasons do score better than the others. The main reason not to use labels in sustainable material choice is lack of knowledge on the matter (39%). Next reason is the fact that they do not have faith in the quality of such an assessment, which is indicated by 33% of the participants, followed by the fact that clients are not interested (31%). Then there is a drop in the results: 16% of this group indicated that they do not see an added value in the use of a label and the option that the office is not interested as long as there is no obligation was selected by 15% of the participants. Requires too much effort and time was indicated as a reason by 10% of the architects. The “others” option was also checked by 10% of the participants. Different explanations were given, varying from too commercial, already too many labels on the market, lack of transparency,

As the Environmental Product Declaration (EPD) will become the communication format on the environmental performance of (building) materials (Wagner 2013), the knowledge of the participants regarding this “label” was also investigated using the question “Have you ever heard of an Environmental Product Declaration?”. As the Environmental Product Declaration is calculated by means of the Life Cycle Assessment (LCA) methodology, a similar question on Life Cycle Assessment was surveyed. In order to analyze whether the architects who have heard of LCA also know EPD and vice versa. The combined results to both questions are shown in Figure 8.

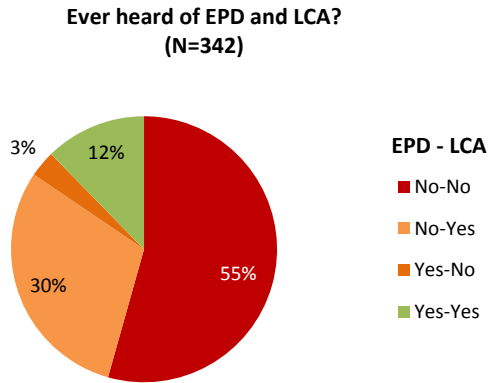


Figure 8. The combined results to the questions “Have you ever heard of an Environmental Product Declaration?” and “Have you ever heard of Life Cycle Assessment?”

As it turns out, most architects questioned (85%) have never heard of an Environmental Product Declaration. Only 15% has ever heard of an EPD, most of them in an additional training (65%), the remaining options were only rarely selected: only 15% has ever heard of it in their architectural education, 11% heard of it in a journal or via other sources (co-worker, lecture, ...) and 9% came across the term on a website. In the architecture office it is only rarely used by the architect himself (2%). Usually it is used by others in the office (7%) or outsourced to specialists (7%).

For the Life Cycle Assessment, 58% of the architects questioned has never heard of LCA, meaning that 42% of them has already heard of it, most of them in a further training course. LCA is not often used in the architectural office, and if it is used, it is usually in a passive way, meaning for consultation of data on a material or a product level or for evaluation of materials. It is only rarely used for the calculation of the environmental impact. This could be due to a lack of appropriate evaluation and calculation instruments on a material, product, element or building level, which would allow the architect himself to perform an environmental impact assessment of a building design.

So 55% of the participants has never heard of EPD nor LCA and only 12% has heard of both. About 30% of the architects has heard of LCA, but has never heard of an EPD. Approximately 3% of the participants has heard of an EPD, but has never heard of the background calculation methodology used in an EPD (being LCA). Since LCA and EPDs are also often used in assessment methods and tools to calculate the environmental impact of building design, it was questioned whether architects are familiar with these type of environmental impact assessment tools and to what extent. This is investigated in the next paragraph.

3.4 Environmental impact assessment tools

In this paragraph, the architects familiarity with some existing environmental impact assessment methods and tools (mostly from Western-European countries and 1 from Australia, being LCADesign) is elaborated. A distinction is made between databases, methods and tools on a material or product level, a building element level and a whole building level. As Figure 9 indicates, the Flemish architects questioned are not that familiar with most of the proposed databases, methods and tools to determine the environmental impact of building materials, building elements or buildings as a whole. The NIBE classification is the most frequently used method on a material or product level (almost half of the participants has heard of it and about one in five has ever used it in their architectural design practice). For the other databases, methods and tools, the usage percentage remains very low (varying from 1 to 3%). No other valuable databases, methods or tools to calculate the environmental impact of materials,

building elements or buildings as a whole were suggested by the participants. The architect's unfamiliarity with these databases, methods and tools indicates that their active concern with the environmental impact of building design is still rather limited.

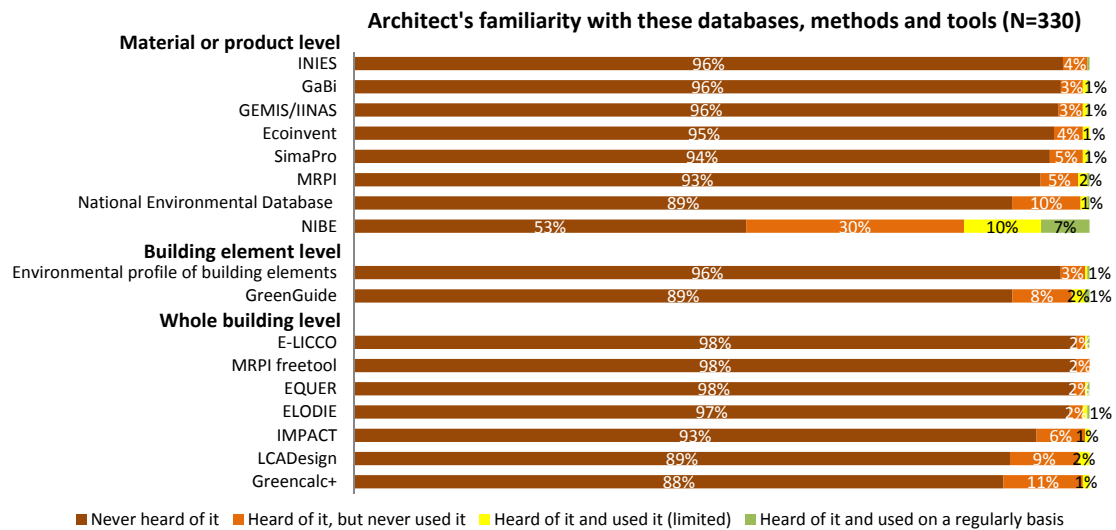


Figure 9. The architect's familiarity with the proposed databases, methods and tools

4 CONCLUSIONS

As the focus of sustainability in the construction industry is gradually shifting towards the environmental impact of building design, this survey tried to get an overview of the architect's awareness and knowledge regarding the growing importance of the environmental impact in building design. As it turned out, most architects consider themselves to be concerned with sustainability in their architectural design practice. However, the aspects which correspond to sustainability are still mostly related to the energy performance of building design. The material choice only comes on fourth place in the ranking of sustainable aspects.

After closer investigation of the drivers behind the material choice, the importance of the role of the client (budget, wishes and aesthetics) and the knowledge of the architect (personal experience and knowledge) came forward. Less than 10% of the architects considers aspects that relate to the environmental impact of building materials. They do claim that a label regarding the sustainability of building materials could help them, even though some of the participants are rather reluctant towards such a label due to insufficient knowledge, no faith in a label or the missing interest of the client regarding sustainable material labels.

In addition, it became clear that the majority of the architects questioned (85%) has never heard of an Environmental Product Declaration (soon to be the most important label to communicate the environmental impact of (building) materials) and that more than half of these participants (58%) has never heard of Life Cycle Assessment, the most frequently used background methodology to calculate the environmental impact. For the databases, methods and tools that use these Environmental Product Declarations or a Life Cycle Assessment Approach, the knowledge level of the Flemish architects is even more limited.

From these results it can be concluded that there is a clear need to sensitize the architects regarding the importance of the matter. In addition, more appropriate calculation methods should be made available for the architects, in order to enable them to perform an environmental impact assessment of their building design themselves.

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