Detecting trends and further development potential of contemporary façade design for workspaces

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ABSTRACT

Façade design is claimed to fulfil a number of requirements in workplaces, ranging from privacy to safety and from comfort to aesthetics. For future R&D efforts in façade design, identifying the key drivers that should shape contemporary facades in office buildings is not always an easy task because of the discrepancies that can emerge between the diverse expectations from professionals and the possible conflicts that can exist in conciliating global design trends with local climate constraints. This research aims to enrich the debate on façade design developments for office buildings, by discussing the outcomes of an on-line survey distributed worldwide among professionals working in the building design sector. Outcomes of 245 responses are summarized in an interactive chart that enables to visualize the potential of some main aspects and technologies characterizing today's office building skins. The potential is shown based on the observed level of relevance among different professional profiles or climates. While energy and comfort emerged as the aspects attaining global and interdisciplinary consensus, the features that entailed psychological or emotional reactions attracted the most diverse evaluations. Despite not being fully exhaustive, the observations arising from this study can help with identifying possible research and developments gaps in the field.

ARTICLE HISTORY

Received 31 July 2018
Accepted 16 December 2018

KEYWORDS

Building envelope; façade design; interactive chart; office buildings; perception of built environment professionals

Introduction

The building envelope is a crucial element in architecture. It is the component that helps define the unique aesthetics of a building and its architectural identity. At the same time the envelope plays a critical role in the functional performance of the interior space from the point of view of thermal comfort, quantity and quality of daylight, and energy demand (Jin & Overend, 2014). This results in important challenges that have to be tackled by the façade industry today: meeting more stringent energy-performance goals and indoor environmental quality requirements, developing increasing complex and often customized components, and offering cost-effective solutions (Piroozfar & Farr, 2015).

Transparent parts of the envelope are usually the most challenging from the point of view of design and construction. Manufacturers have to deal with the development of energy efficient glass, coating products and shading devices that provide the desired appearance, while architects have to work between integrating technical requirements and the achievement of enhanced aesthetic quality (Ochoa & Capeluto, 2009). Glazed parts of the façade are the ones also receiving greater scientific attention compared to other elements of the building. Research in this field is
mainly conducted according to three performance indicators: functionality, environmental sustainability and financial sustainability (Jin & Overend, 2014).

In workspaces in particular these three indicators have increasing gained importance in recent decades because of their potential impact on people’s comfort and productivity (Feige, Wallbaum, Janser, & Windlinger, 2013; Heschong, 2002; Leaman & Bordass, 2005) and on the overall economic and energy management of buildings (Guerra Santin, 2011; Roulet et al., 2006). Research has been for the most part oriented towards the consideration of ‘conventional’ façade components, e.g. regular-shaped windows or double skin façades with common shading systems like venetian blinds or roller shadings (Alibaba & Ozdeniz, 2011; Alzoubi & Al-Zoubi, 2010; Anđelković, Gvozdenac-Urošević, Kljajić, & Ignjatović, 2015; Galasiu & Veitch, 2006; Ghisi & Tinker, 2005; Parra, Guardo, Egusquiza, & Alavedra, 2015; Shameri et al., 2013; Tzempelikos, 2008). Contrarily, only a small number of studies have explored the technical performance of innovative façades (Abdelsalam, 2013; Attia, 2016; Bianco, Lo Verso, Serra, & Perino, 2015; Favoino, Goia, Perino, & Serra, 2014; Grynning, Lolli, Wågø, & Risholt, 2017; Morini, Corrao, & Pastore, 2015), and their direct impact on the building users have been reported by even fewer observations (Bakker, Hoes-van Offelen, Loonen, & Hensen, 2014; Juaristi & Monge-Barrio, 2016; Lee, Claybaugh, & LaFrance, 2012).

Among existing studies the façade appearance, despite playing a key role in the architectural decision-making process, has been rarely seen as a scientific matter. However, a deeper and more comprehensive understanding of how the aesthetic qualities of the façade can contribute to occupants’ overall perception of a space has started to slowly attract the attention of the design research community in recent years (Chamilothori, Wienold, & Andersen, 2016; Omidfar, Niermann, & Groat, 2015; Wymelenberg, Inanici, & Johnson, 2010).

Generally, the available literature shows that there is ample scope for further research and development of façade systems (Loonen, Trčka, Cóstola, & Hensen, 2013). At the same time, it also highlights a certain difficulty in real-world uptake of building envelope solutions created in the laboratory, partly due to a lack of thorough understanding of their benefits by designers and end users (Loonen, Favoino, Hensen, & Overend, 2017). For researchers working in the academic field or in the building industry it may, therefore, be difficult to align the scientific directions and or intuitions with the actual design intentions or other binding technical requirements. With this, we mean that a possible mismatch may occur between scientific evidence, architectural vision and real-word engineering implementation.

Another element of uncertainty for façade development relies on the fact that it constantly faces the dichotomy of a worldwide design homogenization phenomenon on the one hand, and a high sensitivity to the local climate and cultural context on the other. This may result in an increasingly complex global scenario, where revealing the key drivers shaping the majority of contemporary façades for office buildings becomes a difficult task. Based on this, the research aims at deepening the understanding of the decision-making process of façade design for office buildings by discussing the outcomes of an extensive on-line survey distributed worldwide among building professionals. In particular, the study attempts to gather new insights to answer the following questions:

1. To what extent is façade design driven by an integrated approach and a shared vision established among the professionals involved in its application and development?
2. To what extent are there recognizable global trends and/or local preferences in façade design?

The survey is mainly built around those aspects of the building skin that contributes to the indoor comfort and overall building perception, i.e. the light-transmitting part and the related façade systems for daylight control. The ultimate goal of the research is not only to detect the main factors that today drive the research and professional practice in this field, but also to identify those façade features that may deserve greater attention for research and future development.
Method

The research methods used for this study have been chosen and developed on the basis of two requirements. First, to capture a broad range of opinions, allowing us to observe and evaluate current design preferences according to different climatic regions and professional profiles. Second, making the results of this investigation easy to read, understand and re-use by both a scientific and a non-scientific audience.

Data acquisition

Data for the study was collected through an on-line survey administered over a five-month period. The adopted sampling method consisted of both purposive and snowball sampling. Representative potential respondents were reached via personal contacts, professional networks, and social media networks of architects, engineers and façade manufacturers. They were also asked to distribute, through their networks, the survey to other participants who could potentially contribute to this specific study. The target group for the survey were professionals working in the field of building design and construction across multiple world regions with varied degrees of work experience. The respondents were asked to provide their opinion about some aspects of façade design based on their professional experience and/or intuition. The questionnaire included 19 questions grouped in 4 main parts:

1) Background: This segment was used to collect general information regarding the participant such as gender, age, educational background, place and nature of current employment. Participants were asked to indicate the geographical area and climate where most of their projects have been located and to refer to this climate when answering the successive questions. To specify the climate targeted by the respondent’s work, an updated Köppen-Geiger climate classification map (Peel, Finlayson, & McMahon, 2007) was used and shown in the survey.

2) Design practice: In this segment respondents were asked about their work experience, phases of involvement in the design process and the importance of some key design elements, including façade design, in their work practice.

3) Role of the façade: This segment included questions that attempted to gauge the relative importance of various roles of the façade as a building element from the designers’ personal perspective, based both on their professional expertise and on potential conflicts with the client’s priorities.

4) Façade design options: Lastly, the respondents were asked to rate their degree of approval for various design solutions for the façade.

The content of second, third and fourth sections were evaluated and selected based on a review of some main recent contributions in the field of façade design and constructions (Herzog, Krippner, & Lang, 2017; Klein, 2013; Knaack, Klein, Bilow, & Auer, 2014; Schittich, 2006), consultations with experts, and a review of research studies focusing on potential innovative façade components. All rating-based questions were based on 5-points Likert scale. At the end of the survey, the participants were also given the opportunity to make comments or clarify responses in a comment box. Responses were filtered and disqualified if one or more of the following three cases occurred:

- Partial completion of the survey
- Non-differentiation in rating different items in more than 4 questions (straight-lining)
- Answers given in less than 4 min, i.e. less than half of the response time estimated by the diagnostics tool of the survey one-line platform.
Data analysis

Results were first analysed globally and then filtered according to two main categories: the profession of the respondent and the targeted climate. For the statistical analysis, Kruskal–Wallis tests and Mann–Whitney with Bonferroni correction tests were used to assess the statistical significance of the difference in the recorded answers (NHST, Null Hypothesis Significance Testing) based on respondents’ profession and the climate targeted by their work. Results were declared statistically significant when the probability that a difference could have arisen by chance was below 5% ($p \leq 0.05$). Statistical tests were performed with the R software.

Data visualisation

Graphs produced during the data analysis were manipulated in Adobe Illustrator and merged in one PDF that was successively enhanced by executing Javascript in Adobe Acrobat Pro to create an interactive chart.

Results from the on-line survey

Demographics and general figures

A total of 465 surveys were administered, 220 of which were disqualified (47% validity rate). This resulted in a total of 245 valid answers collected from 5 continents and 38 countries. Approximately half of respondents were aged between 25 and 34 years, almost a quarter between 35 and 44, and one fifth between 45 and 64; 149 were male and 94 female; 104 of answers came from people working as professionals in architecture, 49 work in engineering companies, 32 were energy consultants and 43 were academics.

The distribution of responses based on climate was the following: 56 from continental climate, 126 from temperate climate, 30 from dry climate, 31 from tropical climate. A homogeneity Chi-Square test confirmed that employment profile subgroups were homogenous with respect to the climate and vice versa ($p$-value > 0.05). Both employment profile and climate subgroups were also found homogenous with respect to age.

Design practice

Phases of engagement during the design process

Figure 1 shows how often people claimed to be involved in different phases of the design process. As it can be observed, interviewees are more engaged during the actual architectural design development (early, mid-term, final stage) and less with intermediation with the building owner or industries.

The mid-term stage, corresponding to the design development, was the phase with the highest participation of professionals, where more than 80% of architects, engineers and energy consultants claimed to be always or often engaged. This is reasonable if we think that this is the stage where collaborative work and integrated design mainly occurs. What might appear less obvious, however, is that this diversified participation seems to happen also in early and final stages: in these phases more than 50% of all three types of building professionals are always engaged, with architects and engineers predominantly operating in the early and final stage of the design respectively. During the intermediation with building owners and industries, engineers were the most active.

Design element in work practice

Regarding the design, the participants of the survey were asked to rate the importance of some key design aspects in the work practice. The top of Figure 2 shows that, ‘building form’, ‘façade system’ and ‘energy system’ attained the highest scores (>80% of respondents think these are important or
very important aspects), followed by the ‘internal layout’ (>70%) and ‘interior décor’ (>35%). Also, the frequency of rating for the top-three items by the different professionals was very homogenous with 77–97% of respondents of all profiles attributing approximately the same importance to these aspects of design.

The same question was then asked, but with a specific perspective i.e. with the aim of creating a comfortable and productive office environment (see bottom of Figure 2). In this case, all of the aspects increased in importance, and no statistically significant variance was found in the ratings based on the profession. What is interesting to note is that energy consultants attributed a 14% lower rate to the item ‘energy system’ compared to the previous question, probably as a consequence of a more balanced attribution of the scores. A significant difference emerged in the rating of the ‘building form’ between Temperate and Continental climates ($p = 0.042$). A possible
explanation for this finding is that the nature of the continental climate, with its extreme temperatures and significant annual variation in temperature, compels building designers to rely almost exclusively on mechanical systems to achieve comfortable indoor conditions, and to such an extent that passive strategies related to the building form (such as compactness) become of secondary importance.

Role of the façade

In this section participants were asked to indicate the order of importance of requirements that a façade should fulfill. These features had to be first ranked according to the respondent’s ideal priority list, and then ranked a second time after considering the influence of the client’s priorities. As shown in Figure 3, in the first series of answers the features ‘To minimize building energy consumption and increase thermal comfort’ and ‘To provide adequate daylight levels and amount of view to the outside’ were ranked in first position, clearly ahead of the other features. ‘To be attractive and recognizable from the outside’ and ‘To create a pleasant perception of the interior’ were closely ranked in the 3rd and 4th position followed by ‘To provide safety and privacy’ and ‘To require easy cleaning and maintenance’. This means that the aspects related to comfort and energy were ranked first, the attractiveness and aesthetic came second, while functional requirements were ranked least important.

When asked to re-rank the same items taking into account the influence of the client’s priorities, the order and the score for each option changed significantly. Attractiveness and recognisability from the outside were ranked as the first option, far ahead of the rest of the façade features that were all given approximately the same importance. In this case neither the different employment profiles nor the climates revealed any significant differences in the responses, confirming a commonality of objectives, vision and experience.

Figure 3. Ranking of the features design façades according to participants’ ideal arrangement (top) and their experience accounting the client’s requests (bottom). On the right (top and bottom), the score achieved for each answer according to the profession (ARC = architects; ACA = academics; ENG = engineers; CON = energy consultants) and the climate of reference (TROP = tropical; DRY; TEMP = temperate; CONT = continental). The score is a weighted calculation. Items ranked first are given a higher value. The score, computed for each answer, is the sum of all the weighted values.
**Façade design-goals and attributes**

**Façade performance – quantitative and qualitative goals**

The first question of this part of the survey dealt with the rating of aspects related to the energy and comfort performance of the façade and its appearance. The answers were found to fall into three broad groups of observations (see Figure 4):

1. Features such as ‘optical performance of the windows’ and ‘thermal performance’ followed by ‘blinds operability for glare control’, ‘amount of view to the outside’ and ‘window operability for natural ventilation’ were clearly considered very important or important by the majority of the respondents, with the same level of consensus among different professionals and climates. A homogeneous distribution can be observed with regard to the employment profile, except for ‘windows operability’ where a statistical significant divergence emerged between academics and engineers ($p = 0.0069$).

2. The ‘proximity of the desk to the window’ was considered important by around 60% of participants and moderately important by another 30%. Highest scores were assigned especially by academics (67%) and consultants (71%).

3. Other features like ‘colour of the glazing or of the shading devices’, ‘shape of windows’ and ‘patterns’ showed divergent opinions among respondents, with no clear identification of these aspects as being either important or unimportant. With the exception of the first feature, a statistical significant difference was found in answers given by the environmental consultants and the architects ($p = 0.0164$ for ‘shape of the windows’, $p = 0.002$ for ‘patterns’), highlighting a greater importance attributed by these groups to aesthetic aspects. These features were slightly more valorized in tropical and dry countries, although with no statistical evidence.

**Light-transmitting elements**

Regarding light penetration, the survey participants were asked to provide their opinion on the desirability of conventional and unconventional systems for the light-transmitting part of a façade (Figure 5). ‘Transparent, clear and regular-shaped glazing’ was the system that received the highest amount of positive evaluations (more than 70%), followed by ‘translucent glazing’ and ‘transparent and coloured PV glazing’ ($\sim$60%).

The opinions for the other, probably less common systems (‘silk-screen printed glazing’, ‘electrochromic glazing’, ‘PV glazing with opaque integrated solar cells’, ‘coloured glazing’, ‘transparent, clear,
non-conventional glazing) were rather diversified, which may be attributed to the scant diffusion and adoption of these technologies in contemporary practice, resulting in no clear opinion regarding what is considered appropriate and what is not.

Compared to the consultants and consistent with the previous question, architects expressed the highest desirability towards design features that can also contribute to building aesthetics, i.e. coloured ($p = 0.0356$), silk-screen printed ($p = 0.001$) and translucent ($p = 0.000$) glazing. Conversely, technologies that combined both performance and aesthetics, such as integrated photovoltaic glazing, achieved an unanimously moderate consensus.

Preferences for electrochromic and coloured windows were found to be significantly lower from people working in continental climates compared to the others.

Glazing solutions including patterns, i.e. silk printing or photovoltaic integration, as well as non-conventionally shaped fenestrations, attained a slightly higher evaluation in dry climatic regions, although no statistical evidence was observed in this case.

**Shading elements**

With regard to shading devices the participants were asked to rate some commonly adopted and some uncommon systems for office buildings (Figure 6). Irrespective of the employment profile, around 60% of respondents rated common systems, such as ‘Venetian blinds’ and ‘Permanent louvers’, as very desirable or desirable strategies. In addition, these options appeared to be more desirable in tropical and dry climates than in the other climates, with statistical difference observed between ‘Tropical and Temperate’ climate for the venetian blinds ($p = 0.033$), and between ‘Tropical and Temperate’ ($p = 0.006$) and ‘Tropical and Continental’ ($p = 0.011$) for the permanent louvers.

Widely used ‘Curtains or roller blinds’, were considered very desirable or desirable by just over 15% and 30% of respondents respectively. Here again, new technologies that tend to enhance aesthetic features received a very diverse evaluation and were, again, more welcome by architects and academics. In particular, the influence of the type of profession found statistical evidences as for ‘Expanded metal or wire mesh’ ($p = 0.000$), ‘Perforated metal cladding’ ($p = 0.001$), and ‘Single or multi-layered pattern structure’ ($p = 0.003$).

**Operability of windows and shading devices**

The last set of questions focused on the appropriateness of strategies for window and shading device operability.
In relation to the first question in this set (see top of Figure 7), ‘Manual’ or ‘Automated window opening’ obtained on average the highest rate, as opposed to ‘Non-openable windows’ that was rated positively on average by only 15% of respondents. While the option of automated window showed no variance in responses, the other two systems were always very differently welcomed by academics compared to engineers ($p = 0.005$ in both cases, i.e. ‘Manual window opening’ and ‘Non-openable windows’).

With respect to the shading devices (see bottom of Figure 7), a greater consensus emerged for ‘Fixed or adjustable external with adjustable internal systems’, followed closely by ‘Adjustable external systems only’, while ‘Adjustable internal system only’ and ‘Fixed external system only’ were considered very desirable or desirable by around the 40% of respondents. From a climate point of view, there was no statistically significant difference in answers observed for the window or the operation of the shading device.

Figure 6. Rating of some options for the shading devices in office buildings. On the right, the frequency of answers ‘very desirable’ and ‘desirable’ according to the profession (ARC = architects; ACA = academics; ENG = engineers; CON = energy consultants) and the climate of reference (TROP = tropical; DRY; TEMP = temperate; CONT = continental).

![Figure 6](image)

Figure 7. Rating of some windows (top) and shading device (bottom) operability options. On the right, the frequency of answers ‘very desirable’ and ‘desirable’ according to the profession (ARC = architects; ACA = academics; ENG = engineers; CON = energy consultants) and the climate of reference (TROP = tropical; DRY; TEMP = temperate; CONT = continental).

![Figure 7](image)
Synthesis of results and discussion

This research sought to capture broad trends to delineate the current façade design approach and the survey provided results that can be synthesized and discussed under the two questions stated in the introduction:

1) To what extent is façade design driven by an integrated approach and shared vision established among the professionals involved in its application and development?

In recent years, various programmes and guidelines have suggested that the achievement of global societal and environmental goals requires adopting a more integrated approach to the design process (e.g. AIA National & AIA California Council, 2007; Moe, 2008). Integrated design typically refers to a creative and operational process based on a holistic approach, encompassing aspects ranging from formal to technical and from environmental to economic, and applicable from the early design stages to the construction and management (operation) phase. This translates today into a new generation of professionals that are increasingly encouraged to work in variegate environments operating with a multicriteria approach to produce solutions that are the result of collaborative efforts (Jutraž & Zupančič, 2014; Keeler & Burke, 2009).

Compared to other elements of a building, the building envelope has to meet manifold requirements ranging from privacy to safety and from comfort to aesthetics. Façade design is therefore, by definition, a transdisciplinary multi-objective optimization process (Kim & Han, 2013). Studies that quantify the inter- and trans-disciplinary transition of the design approach are however still very few, and mostly limited to the observation of isolated collaborative work experiences.

This survey provided clear evidence of the increasing involvement of different actors along all the phases of the design process. While the mid-term stage appears to be the phase where most of the multicriteria decisions are taken, there is no doubt that academics, engineers and energy consultants are becoming an active part of the decision-making process from early stage design.

The study confirmed that the drive towards sustainable design solutions is one of the main reasons for the expansion of this team-based approach at different levels. No difference has emerged based on the age of respondents, demonstrating that this trend goes beyond the incorporation of environmental and interdisciplinary principles in the framework of higher education courses attended by recent generations of professionals.

Nevertheless, while, on the one hand, responses to the importance of various building design-factors demonstrated awareness among all professions that comfortable and productive work environments are the result of several complementary factors, with respect to the façade design the findings revealed high diverging opinions from one profession to the other in relation to the key factors that regulate indoor comfort, such as windows operability and some types of shading devices.

In the last segment of the survey we presented common standardized façade design elements and some unconventional customer-oriented designs to gauge their acceptability with the design community at large. While conventional glazing solutions – in terms of colour and shape – obtained a high consensus, less conventional options obtained very different ratings. This is most likely due to the limited diffusion and adoption to date of the technologies that include tinted, patterned or irregular glazing, and this may have resulted in the diverging answers.

With regard to shading, neither the conventional or unconventional options attained high consensus in general, indicating a limited enthusiasm for the available options and the wish for alternative daylight and glare control, alongside a better understanding on how these systems work and can be accepted by the building occupants.

Understandably, architects had a tendency to attribute a higher rating to those façade systems and features that strongly contribute to the aesthetic value and overall appearance of the building envelope, which are for the most provided through custom-made solutions. Façade options that combine promising performance and architectural integration, like electrochromic glazing and BIPV, appeared however to better meet the expectations, irrespectively of the type of profession.
To what extent are there recognizable global trends and/or local preferences in façade design?

Since the ascendancy of Modernist ideals, later identified with the ‘International Style’ (Hitchcock & Johnson, 1932), façade design and architecture in general have not remained exempt from the phenomenon of globalization. Today, design uniformity is fueled by a body of transient design professionals and the sharing of architectural trends and concepts around the globe, and on the other hand driven by the presence of international architectural and engineering firms with branches scattered over the globe, whose ‘… work is almost by necessity strongly conceptual and cannot rely on any detailed study of fine grain or culture of the locality’ (Adam, 2008).

Our survey confirmed the homogenization of preferred façade design choices. This seems to be attributed not only to the constraints due to contemporary working conditions, but also to the actual vision and propensity of the professionals. Overall, the findings appear to confirm the increasingly topical theory by Ricoeur of ‘universal civilization’ (Ricoeur, 1961) as a condition that embraces not only a consumer culture but also a scientific spirit. This would suggest that globalization is driven not only by worldwide esthetical trends but also by sustainable efficiency criteria, aspects that often go hand in hand. Energy performance alongside thermal and visual comfort-related features were found, in fact, to be globally recognized as the main design goals for façade system.

Very few diverging responses were received based on the climate type (climatic differences being a proxy for different geographical location) regarding the use of some types of shadings. There were few instances of local distinctiveness – although often with no statistical evidence – regarding aspects such as irregular geometries, colours or use of patterns in those countries where decorative elements for the façade are recognized to be part of the architectural identity of the place, such as the Middle-East (Eldemery 2009; Artemel 2013; Tabbarah, 2015). The only significant influence of the climate was observed for technologies such as electrochromic or coloured glazing that seem to attract higher attention in dry and tropical climates compared to temperate or continental areas.

Interactive chart

The most relevant findings from the on-line survey were ultimately summarized in an interactive pdf chart that can be visualized through the programme Adobe Acrobat. The chart is available on an online repository for standalone consultation (Pastore & Andersen, 2019). It shows the data according to the same two categories of respondents i.e. based on type of profession and targeted climate. It was developed with a twofold aim. First, to enable the exploration of the ‘type of potential’ that is attributed to building and façade design aspects/technologies applicable in office buildings. In other words, we wanted to identify whether they are already acknowledged to hold a low or high potential in the current professional practice, or if their recognition is uncertain, hence revealing a potential for further research and development. The level of potential was determined on the survey response to their importance or desirability, calculated from the grand mean of the considered category and readable on the y-axis. Second, to enable an immediate visualization of the influence of the type of profession or type of climate on the rating of a certain design parameter displayed along the x-axis of the chart that reports the p-values from the NHST. All the points standing on the left side of the y-axis indicate a statistically significant difference in group answers (p < 0.05), i.e. a significant influence of the type of profession or of the targeted climate, depending on the selected category.

Data can be visualized in two ways. From the legend it is possible to select the category (Profession or Climate) and the section to explore (Figure 8 – top). From the chart, one can click on the points which present an external circle to connect to related items (see middle of Figure 8). Moreover, all the underlined items that appear on the left side of the chart, when hovered over, pops up the distribution of each group’s mean (Architects, Academics, Engineers and Consultants for the category ‘Profession’; Tropical, Dry, Temperature and Continental for the category ‘Climate’, as shown at the bottom of Figure 8).
Figure 8. Interactive chart layout and options for data visualization.
The chart can serve as a tool to further guide professionals operating in the research field and the building industry in the identification of themes and aspects related to façade design that may be worthwhile to probe. As an example, let’s assume that we want to know, as researchers or designers, if ‘window operability’ in office buildings is an important issue and, in particular, which the related aspects worthy of consideration could be. From the chart, we would find that windows operability is considered as quite significant and an acknowledged element of the façade design, but it is not sufficiently established to prevent further research. Considerations on its importance do not vary from one climatic region to another, but do from profession to profession and because of this we may want to adopt a holistic perspective when accounting for this element in our research or in our design practice. Furthermore, we would find that some design option, e.g. non-openable windows, is unanimously recognized as an undesirable solution, which may suggest to us that we need to focus on other options.

Conclusions

Building façade design is a complex process and when examined in detail, can vary to a large extent even from one design practice/office to another. The different nature of involvement and experience of professionals typically involved in façade development and design, as well as the geographical area and climate where they operate, may shape their ultimate understanding of projects and the end-user’s requirements.

Despite the limited scope of the survey, the findings have highlighted the importance of various aspects of building and façade design based on the general understanding and experience of professionals working in different branches of the building and construction field and operating in different world regions. Their opinions indicated a clear trend in the approach to the building design process, which appears to be global and increasingly interdisciplinary. Energy performance, along with indoor visual and thermal comfort, emerged as the common thread for contemporary design, showing alignment with the expected influence that the international regulations on environmental protection and environmental assessment methods exert in conceiving the contemporary built environment. This is also reflected in a homogenization of preferred façade design choices worldwide with few signs of climate distinctiveness. From the survey findings it also emerged that the solutions more suitable to providing customized aesthetic features were often only valued by the architects, which may suggest the need for further scientific research about the influence of design perception on the building occupants.

From the survey findings it was possible to create an interactive chart that should enable researchers, practitioners and façade manufacturers to easily explore how design aspects and technologies are classified according to their level of acknowledged potential. In particular, the chart emphasizes all of the factors and systems that were not distinctively judged as either relevant or irrelevant for contemporary buildings, or factors that attained very diverging ratings. These are the aspects that would justify further research and development efforts. They relate for the most part to technologies with a high propensity for customization, and whose features can entail users’ psychological, behavioural and emotional aspects.

Note

1. The grand mean is the mean of the means of several subsamples. In this case, the subsamples are Architects, Academics, Engineers and Consultants for the category ‘Employment’ and Tropical, Dry, Temperature and Continental for the category ‘Climate’.

Acknowledgements

The authors are particularly grateful to Minu Agarwal for her valuable comments and proofreading.
Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was conducted at the Ecole polytechnique fédérale de Lausanne (EPFL) with additional support from the SECURE project funded by the CCEM (Competence Center Energy and Mobility) [grant number 591187]; and SolAce NEST project funded by EMPA (Swiss Federal Laboratories for Materials Testing and Research) [grant number 563111].

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