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Research on BIPV in Office and Public Utility Buildings in Aesthetic and Utility Context

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Abstract: The idea of the article is to examine the perception of building-integrated photovoltaics (BIPV) by users of buildings in which BIPV has been applied. The study aims at determining the acceptance degree as well as problem areas related to the use of BIPV within façades in the aesthetic and utility context. The article includes survey research conducted among 232 employees working in six office and public buildings with BIPV in Poland. The buildings were selected so that the PV modules within their façades were visible both outside and inside the building. For this reason, two groups of buildings were chosen for the study: those with PV modules as external glazing and with an external PV shelves (three buildings each). The research results indicate differences in the perception of the aesthetic, semantic, and functional roles of BIPV depending on the aforementioned BIPV application method, the observation place (outside or inside the building), and employee characteristics, i.e., groups divided regarding such aspects as their age and time spent in the room with BIPV. The research novelty is in examining the influence of BIPV on users' reactions in their workplace in terms of aesthetic and utility issues. The research includes post-occupancy evaluation method (POE), which is for the first time used in relation to BIPV in office and public utility buildings. The research can prove useful for investors and designers at the planning and design concept stage. The outcomes constitute a practical source of knowledge for BIPV manufacturers.

Keywords: BIPV; PV façades; architectural management; green building; sustainable architecture

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1. Introduction

Currently, no uniform official definition of "building-integrated photovoltaics" exists [1]. This broad term covers technical, functional, and aesthetic integration [2,3]. Generally, the term refers to applying a set of PV cells as a constructional element integrated with the building, such as the façade or roof cladding, external glazing, and shading systems [4,5]. This feature of BIPV is distinguished from monofunctional PV modules applications, defined as building-added photovoltaics (BAPV) [6]. The characteristics of BIPV as a building component increase the role of photovoltaics in construction beyond its primary and fundamental destination, i.e., as a generator of electric current from sunlight [7]. From the architectural point of view, the aesthetic role becomes important, especially the impact on the building's aesthetic function. Additionally, BIPV in the form of external glazing and shading elements exerts a potential impact on the building's functionality in terms of shaping its internal environment (including visual, lighting, and thermal environments) [8].

The multiplication of the role of PV technology as BIPV elements is associated with an increase in their impact on the building user [9]. As a tool likely to increase the social acceptability of PV technology [2], BIPV requires research into how it is perceived. The users of a building where BIPV has been introduced constitute a particularly valuable group.

The article aims to examine the perception of BIPV by users of buildings in which it has been applied. The study seeks to determine the degree of acceptance as well as problem areas related to the use of BIPV within façades in the aesthetic and functional contexts.

The research was conducted among employees of six office and public utility buildings with BIPV in Poland. Although the BIPV phenomenon in Poland is relatively new, its popularity is increasing. The first PV façade was implemented in 2008 within the modernization of the building of the Faculty of Environmental Engineering of the Warsaw University of Technology [10] (p. 10). In the second decade of the 21st century, a significant increase in the application of BIPV occurred [11]. The examined buildings date from that period, but in spite of growing popularity of BIPV in Poland, they represent almost the only "samples" of the PV façades application in office and public utility buildings in their working space (see Section 2).

1.1. State-of–the Art

The research topic is part of the broad subject matter concerning the mutual relationship between photovoltaics, construction, and architecture. This subject matter has been researched since the 1990s [12–14]. Studies on building performance in the field of energy behavior are a vital aspect of research on this relationship [15–17]. Energy issues are often associated with thermal performance [18], visual comfort [19], environmental benefits, and costs [20]. The studies are based on numerical research concerning internal environment but do not refer to human perception.

Another issue concerns various applications of BIPV, including as glass covers [21] and shading systems [22]. Some studies focus on façades [23,24] and others on roof solutions [25]. According to a 2017 study, the market share of these two applications has been dominant, whereas other BIPV applications have been negligible [26]. This kind of research is generally focused on energy issues, i.e., improvements of PV performance.

The rapid development of PV technology resulting in the appearance of third-generation cells has created a new field of research regarding BIPV. In this aspect, perovskite- [27], DSSC- [28], and organic cells [20] are investigated. Together with the second-generation thin-film cells, they offer new possibilities, as they may be combined with other technologies, such as switchable glazing [29]. Moreover, creating innovative material and construction solutions, such as joining PV cells with timber [30] or ETFE foil [31], has become possible.

An important area of research is related to architectural integration focused on aesthetic issues, including texture and color effects [32,33]. The research is conducted on various scales ranging from urban-planning issues [34] to building microscale [33]. This type of research does not refer to the aesthetic and functional PV perception of the building's users either.

Meanwhile, increasingly numerous and diverse methods of PV integration with façades, especially transparent ones, make it necessary to undertake such behavioral research. The impact on both aesthetics [35,36] and functional aspects [10] is indisputable. However, it remains at the level of objective statements, not referring to the perception of users.

The nature of the issues discussed in the article may be seen as part of the qualitative research on façades related to the post-occupancy evaluation (POE) method. The POE method is based on examining the quality of an existing building during its use once it has been occupied for a certain period. It aims to indicate the degree of user satisfaction and to define the building's features that cause dissatisfaction in terms of technical, functional, and behavioral quality. The POE method proves useful especially for building managers and designers, including architects, as it helps in recognizing the design problems that cause the user's dissatisfaction [37]. Research based on POE method has been conducted at the Faculty of Architecture at the Silesian University of Technology in Gliwice, Poland, for many years now. Tymkiewicz [38] conducted extensive research into façades based on the POE method, with consideration of visual perception issues in the aesthetic, symbolic, and functional aspects.

In other qualitative research on façades based on the POE method, the internal space of office buildings was analyzed [39]. In this research, the correlations between aesthetic perception and utility comfort were examined. The study proved significant relationships between the two aspects. The knowledge on the POE method in the discussed area was

thoroughly systematized for adapted façades, i.e., movable shading PV elements [40], which is partially related to the present article's subject.

Research on the assessment of the thermal and visual environment quality is an important part of the POE method. Research on dynamic façades concerning the indoor environment in terms of the user's satisfaction proved the importance of indoor parameters themselves and the way they have been reached [41]. In other research, a survey method has been used to assess the office workers' satisfaction regarding the significance of the relationship between indoor thermal and visual environment quality and spatial characteristics of the workplace [42]. At the Fraunhofer ISE, the survey method was used concerning the switchable window technology; office users assessed the impact of EC glazing on thermal and visual comfort [43]. The IEA has prepared a comprehensive report on the assessment of daylight quality in buildings [44]. The undertaken research based on survey research also concerns aesthetic [45,46] and technical [47] aspects.

1.2. Novelty of the Research

Despite the extensive research in the field of BIPV and qualitative research on façades, such studies are essentially conducted separately. (However, they are rarely undertaken, e.g., in [48]). Therefore, the originality of the present article is based on the use of survey research to assess BIPV in terms of the POE method (Figure 1). This originality can be defined by the following:

- Research on the aesthetic and utility perception of BIPV among employees of the office and public utility buildings that use BIPV;
- Research conducted for BIPV as external glazing and shading systems to serve as façade solutions;
- Comparative studies related to various groups of buildings' users (see Section 3).

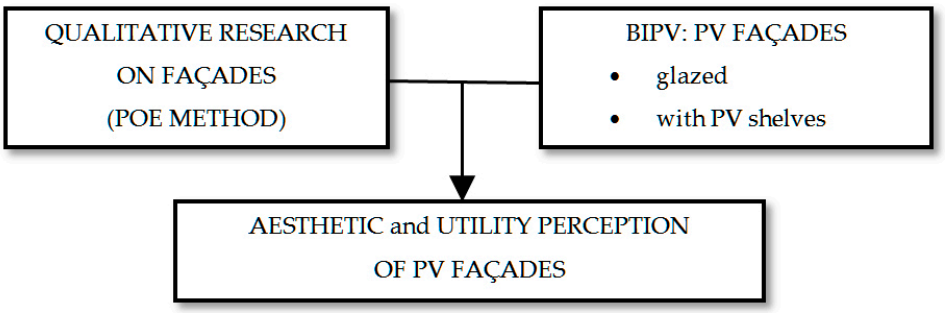


Figure 1. The general study idea.

1.3. Aim of the Study

The idea behind the article is to examine the perception of building-integrated photovoltaics (BIPV) by users of buildings in which BIPV has been applied. The study aims to determine the acceptance degree and problem areas related to the use of BIPV within façades in the aesthetic and utility context.

The detailed targets involve answering the following questions:

- Are PV façades perceived as aesthetically acceptable?
- Are PV façades associated with ecology in a semantic context?
- Are there differences in the perception of PV façades when observed from the outside and from the inside?
- What influence of PV elements is most noticeable in the perception of interiors in aesthetic and utility context?
- Does the age of employees and the type of work (permanent, temporary) affect the perception of PV façade elements?

2. Materials and Methods

A survey research method using the proprietary questionnaire was used in the article. A group subject to the survey comprised 232 respondents employed at the buildings selected for research. The decision that the survey would include exclusively employees who constantly occupy the buildings was dictated by the pursuit of the highest possible credibility of the respondents' observations. These are white-collar workers with higher or secondary education. These employees represent generally an office working group.

The following criteria were used to select buildings for the research:

- The buildings in which the BIPV is used show a potential impact on both the exterior of the building and its internal environment;
- The buildings should represent one of two groups of objects, i.e., buildings with façade PV modules in the form of external shading elements (PV shelves) and as glazed façade partitions (PV glazing);
- The buildings should include working spaces where PV façade elements are visible. Facilities whose operation is related to PV technology (e.g., manufacturing plants) were rejected. This was done to eliminate the risk of the respondents' biased opinions [49].

According to the above criteria, eight buildings were selected. The administrative building of the Rzeszów-Jesionka Airport and the Faculty of Management and Social Communication of the Jagiellonian University in Kraków refused to take part in the research. Thus, the selected six buildings and their characteristics are presented in Table 1 below.

Table 1. Characteristics of BIPV buildings covered by the research (photos: ML System-bldg. no. 1; Eurocentrum-bldg. no. 2; WFOŚiGW Łódź-bldg. no. 5; the remaining photos: author).

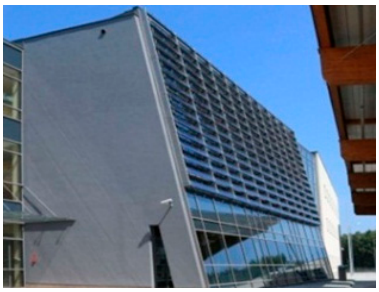
Building Covered with Survey Research		Implementation Year	PV Power	BIPV Type and Place of Its Application
BIPV AS FAÇADE PV SHELVES				
	1. Office building of the PL-UA border crossing, Budomierz	2013	~20 kWp	PV modules as PV shelves on a glass curtain wall oriented towards the south.
	2. Office building–technological park Eurocentrum, Katowice	2013/14	108 kWp	PV modules as large-sized PV shelves in the upper line of windows within the southern façade.
	3. Administrative and office building of the Municipal Roads Authority (ZDM), Gliwice	2012	~15 kWp	PV modules as PV shelves installed on the entire surface of the windows in the southern and eastern façades.

Table 1. *Cont.*

Building Covered with Survey Research		Implementation Year	PV Power	BIPV Type and Place of Its Application
BIPV AS FAÇADE PV GLAZING				
	4. Public utility building WUM, Warsaw	2016	60 kWp	Semi-transparent glass–glass PV modules with thin-film cells (PV glazing) in a curtain south-oriented façade.
	5. Administrative and office building WFOŚiGW, Łódź	2015/16	45 kWp	Semi-transparent glass–glass PV modules with distanced thick-film cells (PV glazing) within the glass roof and south-oriented glass curtain wall.
	6. Administrative and office building WFOŚiGW, Gdańsk	2015/16	40 kWp	Semi-transparent glass–glass PV modules with distanced thick-film PV cells (PV glazing) within the glass roof and south-oriented double glass curtain wall.

The number of respondents in two groups of buildings (three buildings each) is identical, i.e., 116 in each group. The survey was conducted simultaneously for all buildings, and it covers the period from May to early July. The choice of the studied period was important regarding weather conditions. It was decided that the weather should be similar in each studied case. Therefore, the seasonal variation that could impact the responses of the respondents was eliminated.

Regarding BIPV issues, the survey included 14 questions for buildings with PV shelves and 12 questions for buildings with PV glazing. The questions were developed on basis of the method presented by Tymkiewicz [38]. This method (POE) was focused on the behavioral aspect concerning the perception of façades in terms of utility, symbolism, and aesthetics. It concerned the wide façade-perception spectrum of different groups of users. Tymkiewicz demonstrated the effectiveness of this method for this type of research. Following this thought, these survey questions aimed at PV façades are a clarification of the research conducted by Tymkiewicz. They refer to the perception of the building viewed from the outside and its interior as well.

The first seven questions concerned the perception of PV façade, i.e., BIPV seen from the outside. The following set of questions was related to the perception of BIPV in terms of its impact on the internal environment, i.e., the working space inside the building.

The questions cover aesthetic and utility context. The broadly understood aesthetic aspect concerns questions 1–7 (exterior) and 8 and 12 (interior). In order to define the aesthetic perception by the human, the Cohen and Christiansen equation [50] was used, according to which the aesthetic perception of the object (S) is a sum of the three components:

selective information (I_{sel}), semantic information (I_{sem}), and inventive (I_{inv}) as an aesthetic function (F) of the object:

$$S = F\ (_{Isel}, I_{sem}, I_{inv}) \quad (1)$$

Translating it into the language of architecture, the aesthetic perception of a building is influenced by the objective aesthetic function (e.g., color, shape), partially subjective aesthetic function (non-verbal architectural language), and artistic aesthetic function, which is an immeasurable function (e.g., architectural expression). Thus, according to the theory of Cohen and Christiansen, semantic issues were included in the study of the aesthetic aspect (questions 6–7). Questions 1–5 as well as 8 and 12 contain the features of both objective and artistic aesthetic perception (selective and inventive information). However, it was recognized that this division is not crucial for further research—it would also be difficult to introduce in the study since the questions are of a rather general nature.

The remaining questions, which are limited to internal space, concern the utility context. The ecological workplace building model created by Szparkowski [51] (p. 11) was used. According to this model, human reactions and, consequently, the user's states are the result of the impact of the internal environment—in this case, the intangible environment (visual environment created by PV elements) as the one of most strongly influenced by these elements [10].

The questions were formulated as simply as possible; their comprehensibility and the elimination of possible interpretations were the priority [49]. The survey questions were the same for both types of buildings and were intended for an anonymous individual answer. Closed-end questions (with imposed answers) were aimed at defining the degree of aesthetic acceptance as well as the perception of BIPV in aesthetic-semantic terms. Concerning other aesthetic issues, evaluative questions were deliberately used.

This set of questions concerned aesthetic and utility issues related to shaping the visual environment and also included closed-end questions except for the one concerning the perception of the influence on natural lighting. In this case, the openness of the question was aimed at determining whether any other factors than those indicated in the answers (based on literature research, e.g., [51] (p. 59)) can be noticed by users in this regard.

The original survey questions are included in Table 2.

Table 2. Original survey questions regarding the role of BIPV in terms of the perception of its impact on the exterior (questions 1–7) and the internal space of the building (questions 8–14).

Perception Conc. Exterior	Perception Conc. Interior
1. Do you consider the external wall covered with PV modules to be a representative building façade?	**8. When inside the building, do you feel the impact of façade PV elements on aesthetics of the internal space?**
(a) Yes (b) No	(a) Yes, the impact is strong (b) No, but the PV elements are perceptible (c) No
2. Do you think that PV elements within the façade have an impact on the overall appearance of the building?	**9. When inside the building, do you feel the impact of façade PV elements on natural lighting?**
(a) Yes, the impact is significant (b) Yes, but the impact is minor (c) No	(a) Yes, they cast shadow (b) Yes, they limit daylight access (c) Yes, they change daylight tint (d) Yes—other (define the impact) (e) No
3. Do you think that PV elements affect the aesthetics of the façade when viewed from the outside?	**10. When inside the building, yourfeelings related to the influence of PV elements on daylighting are:**
(a) Yes, they have a positive influence (b) Yes, they have negative influence (c) No	(a) Positive (b) Negative (c) Indifferent—I don't feel any influence
4. Do you consider the PV façade to have a modern image?	**11. When inside the building, do you feel the impact of façade PV elements on the view to the outside?**
(a) Yes (b) No	(a) Yes—positive (b) Yes—negative (c) No

Table 2. *Cont.*

Perception Conc. Exterior	Perception Conc. Interior
5. Do you consider the PV façade to be more interesting than the remaining façades of the building?	**12. Façade PV elements seen from the interior of the building, in your opinion . . .**
(a) Yes (b) No	(a) Look better than from the outside (b) Look worse than from the outside (c) Look the same (d) I have no opinion
6. Does the PV façade evoke associations withan ecological building in your opinion?	**13. Do you think that PV shelves should be adjustable?**
(a) Yes (b) No	(a) Yes (b) It makes no difference to me (c) No
7. Do you think that using PV elements within the façade can positively impact the image of the company that occupies this building?	**14. Would you like to have the possibility of individual adjustment of PV shelves?**
(a) Yes (b) No (c) It makes no difference to me (d) I don't know	(a) Yes (b) It makes no difference to me (c) No

Apart from the aforementioned questions related to BIPV, questions were formulated concerning the respondents' belonging to the following groups:

- Age (up to 40 years old and above): it was concluded that PV technology, being a modern technology, may have an impact on its perception depending on the respondents' age.

The assumption was based on medical studies that distinguish two stages of adulthood: early (or emerging) adulthood and mid (or medium) adulthood, which are between 20–40 and 40–60 of age respectively [52,53].

- Related to the time spent in the room with BIPV, it was assumed that the difference in the working place occupancy could provide a factor that may influence the perception of BIPV in terms of shaping the internal environment.

It was proven that the time spent in the room is connected with the internal space perception, which refers to the so-called selective information reaching the recipient, i.e., the room's user [51].

However, the assumed division related to the respondents' gender was abandoned due to significant numerical disproportions between the surveyed employees (men predominance).

The results were compiled and developed in three groups of responses:

- Collective responses: overall responses and responses divided into two groups, depending on the examined types of BIPV—general results (Section 3.1);
- Correlations of selected issues: answers to sets of questions with direct semantic connections with each other (Section 3.2);
- Answers divided according to employee characteristics—detailed results (Section 3.3).

In Sections 3.1 and 3.3, the research was based on the comparisons between two unrelated research groups. In Section 3.1, the groups include the independent users of two types of buildings (who work either in buildings with PV glazing or PV shelves). The juxtaposition of the response distribution of both groups, together with the results of collective one-time answers, was used to illustrate the deviation of the normal distribution (average responses). In Section 3.3, the answers of two unrelated types of respondents are also examined. However, the aggregate results are not provided in this section, as it was decided that they were not required to illustrate the issues under study. The servey research basis assumptions are included in Figure 2.

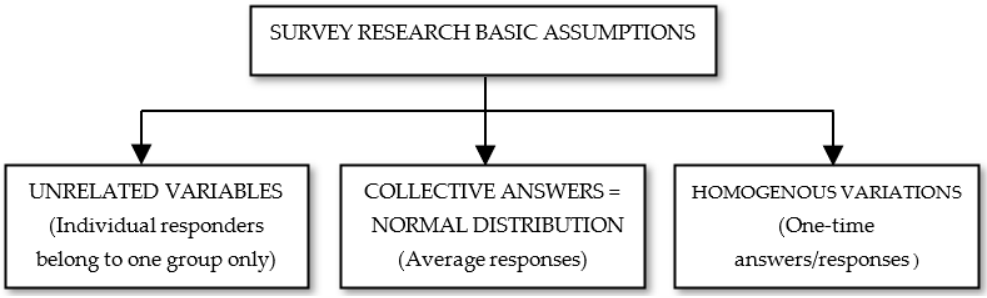


Figure 2. The survey research basic assumptions.

Section 2 presents correlations using elements of the Pearson's chi-square test of independence [54]—theoretical and empirical answer distribution was compared. This allowed for defining correlations (positive or negative). Correlation analysis was used to capture whether there is a relationship between two variables (properties, features). For this purpose, questions were juxtaposed to form pairs with a significative relationship with each other. Calculations were obtained by examining individual respondents' answers to pairs of questions selected for the study. Respondents were unaware of the correlation studied. The research was intended to refine the results obtained in Section 3.1.

3. Results and Discussion

3.1. Overall Results—Collective Answers

The overall results that constitute the collective responses and take account of the division into PV shelves and PV glazing are presented in Tables 3 and 4 The results are discussed separately for the issues related to the building's exterior (Section 3.1.1) and its internal environment (Section 3.1.2).

3.1.1. Group of Questions Concerning the Building's Exterior (Questions 1–7)

In principle, the respondents' answers concerning the aesthetic issues related to the perception of BIPV in the building's external body show a positive reception among the facility's employees (Table 3). Collective answers to questions 1–5 prove that BIPV is perceived as a modern element that influences the building's architecture and is noticeable in creating a façade composition. From the responses to question 1, it is impossible to unequivocally indicate that the use of BIPV makes the façade representative (especially since all of the selected buildings feature the PV façade as the front façade). However, it can be concluded that the PV modules are generally not the element with which the feeling of the façade's representativeness is associated. The following answers show that façade PV elements generally play a positive role in this sense; this is mainly evidenced by the feedback to question 3 and the correlation of questions 3 and 4 (see Section 3.2.1). The respondents' opinion also shows an indirect observation that the general perception of the building's architecture is strongly associated with the aesthetic features of the façade, being a partition exposed to the strongest visual perception. In questions 1–5, the comparisons between PV glazing and PV shelves provide interesting results. The distribution of answers to question 2 can be considered quite surprising. As evidenced by the results, the PV glazing, as an element more strongly exposed in the building's body, exerts a greater aesthetic impact than the PV shelves. This result can be explained by the fact that the PV shelves are often located in the upper parts of the façade (ZDM) or windows (Eurocentrum), out of viewers' sight when observing the building from the ground level, especially while standing near the building. The responses to questions 3 and 5 prove that PV glazing has greater aesthetic acceptance. This may result from the feeling of stronger integration with the building's architecture. However, this is not in line with statistical studies by Prieto and Oldenhave, in which 3D façades were included that are presumably perceived as more aesthetically interesting. Yet, the issue is more complex. As noticed by the authors: "*the strong sentiment expressed in favour of plasticity (texture, depth, and material expression) over*

flat façades, arguably speaks of a higher surface complexity. Furthermore, the appeal of façades with changing expressions, and an overall amazement or originality as conditions to find façades beautiful, also advocate for visually complex experiences as opposed to dull surfaces. In that sense, for the interviewed sample, there seems to be a conscious preference for simplicity, but a subconscious desire for complexity, mixed together to explain their aesthetic preferences" [46] (p. 40). Significant differences are also related to the question concerning the perception of BIPV as a modern element (question 4). The term "modern" was deliberately left undefined to obtain intuitive answers based on the common understanding of the term as opposed to "something old and traditional." The results indicate that smooth glass façades equipped with PV cells are perceived as more modern than façades with PV shelves. This outcome confirms the still-strong connotations of glazed façades with modernity; the era of glass in architecture is, thus, still present. However, a significant difference in the responses favoring PV glazing can be considered quite unexpected, as the PV shelves with exposed support systems and cabling evoke strong associations with the modern technological trends, e.g., the high-tech [55].

Questions 6–7 focus on semantic aspects. The over 82% positive answer response rate to question 6 proves that photovoltaics is strongly equated with ecology. It can, therefore, serve as a powerful weapon in creating a green building image. The answers to question 7 also indicate the importance of BIPV and its positive role in creating the company's image. Therefore, BIPV becomes not only an aesthetic element but also a marketing tool. This conclusion is in line with the previous studies, e.g., [56]. Regarding the comparisons between the PV glass shields and the PV shelves, responses 6–7 (similar to 1–5) the slight advantage of the former. The semantic values can be associated with aesthetic values; i.e., a more noticeable and more aesthetically attractive product tends to be more strongly and more willingly attributed to the company's image. However, it is not obvious whether these features can be associated with the reinforcement of the sense of the relationship between BIPV products and green architecture. However, the responses may suggest such a relationship. Further information is provided by the results of correlating the answers to these questions (see Section 3.2.2).

Table 3. Summary of the percentage of collective responses to questions concerning BIPV in the buildings body (external body).

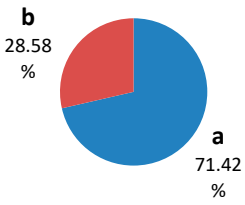
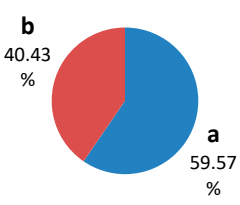
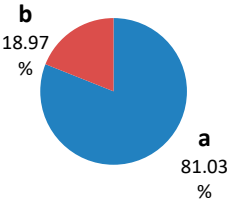
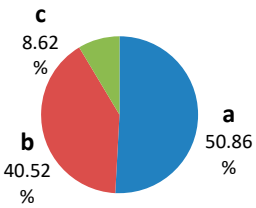
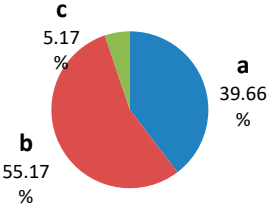
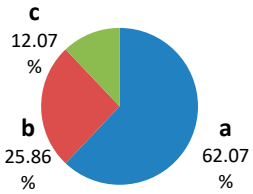
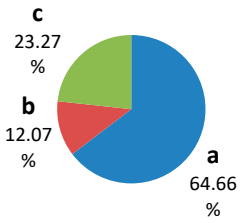
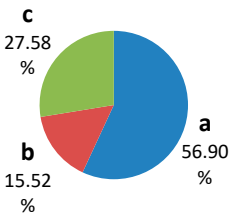
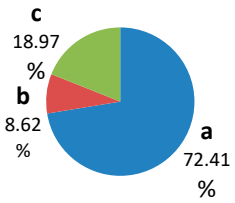
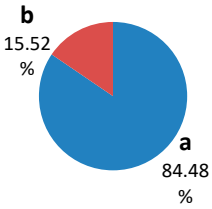
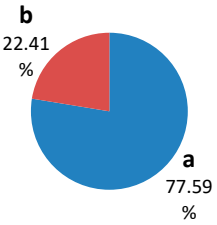
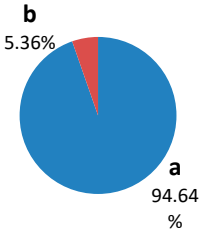
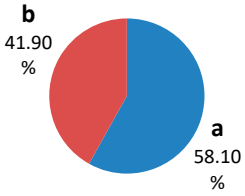
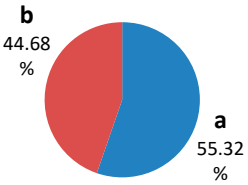
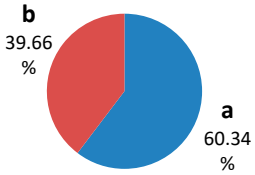
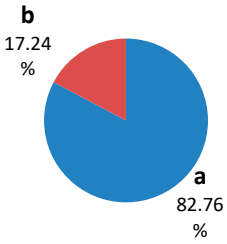
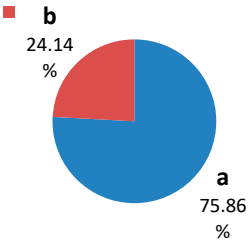
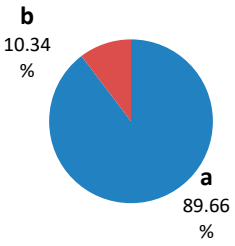
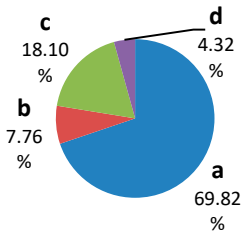
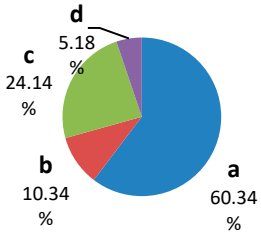
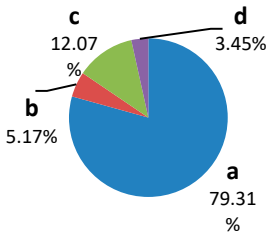
	Collective Answers	Answers Conc. PV Shelves	Answers Conc. PV Glazing
1	QUESTION 1 Do you consider the external wall covered with PV modules to be a representative building façade?		
			
	(a) Yes; (b) No		
2	QUESTION 2 Do you think that PV elements within the façade have an impact on the overall appearance of the building?		
			
	(a) Yes, the impact is significant; (b) Yes, but the impact is minor; (c) No		

Table 3. *Cont.*

	Collective Answers	Answers Conc. PV Shelves	Answers Conc. PV Glazing
3	QUESTION 3 Do you think that PV elements affect the aesthetics of the façade when viewed from the outside?		
			
	(a) Yes, they have a positive influence; (b) Yes, they have negative influence; (c) No		
4	QUESTION 4 Do you consider the PV façade to have a modern image?		
			
	(a) Yes; (b) No		
5	QUESTION 5 Do you consider the PV façade to be more interesting than the remaining façades of the building?		
			
	(a) Yes; (b) No		
6	QUESTION 6 Does the PV façade evoke associations with an ecological building in your opinion?		
			
	(a) Yes; (b) No		
7	QUESTION 7 Do you think that using PV elements within the façade can positively impact the image of the company that occupies this building?		
			
	(a) Yes; (b) No; (c) It makes no difference to me; (d) I don't know		

3.1.2. Group of Questions Concerning the Internal Environment (Questions 8–14)

The answers to questions 8–14 regarding the perception of the impact of BIPV on the internal environment, both in terms of aesthetics and utility, show that the employees' sensitivity to the impact of BIPV is lower concerning the building's interior than in the case of its external body (Table 4). Almost half of the respondents described the impact of BIPV on the aesthetics of the interior as insignificant, while the remaining one-third completely overlooked it (question 8). They feel more influenced by PV glazing than PV shelves. It is important to collate these answers with the BIPV aesthetics seen from the inside (question 12). The responses characterized by a high degree of indifference to this issue are dominant. However, among the remaining opinions, negative responses are prevailing; BIPV seen from the inside is characterized by lower acceptance in terms of the aesthetic aspect. This is especially true for the PV shelves, which were assessed much more critically than the PV glazing. Thus, greater indifference to PV shelves in terms of the impact on the interior aesthetics is juxtaposed with a worse aesthetic assessment of their appearance as seen from the inside. Therefore, it can be assumed that the aesthetics of BIPV, especially the PV shelves, seem to have no significant impact on the perception of their aesthetic function in shaping the interior space.

Answers to questions 9–11 provide knowledge on the users' perceptions regarding the impact of BIPV on shaping the visual environment in terms of providing the interiors with natural lighting and the employee's eye contact with the environment. The responses confirm a significant degree of indifference to the issues of shaping the internal environment by BIPV in this respect; such responses were given by nearly half of the respondents. Among the remaining answers, the aspect of the influence on the lighting environment (question 9) is mostly related to the impact of BIPV on the reduction of daylight. This proves the sensitivity of the office workers to this factor [56]. A smaller impact is noticeable due to the color change and shadow casting; both in the collective and comparative summary, the percentage of both responses is identical. However, the comparison shows that PV glazing influences the natural light supply more greatly. It can, therefore, be concluded that in rooms where the greatest possible share of daylight is required, PV shelves are more acceptable than PV glazing and vice versa; namely, where lower light intensity is required, PV glazing will be more desirable. In addition, nearly none of the respondents answered other than the ones suggested in question 9 (open-ended question). This may indicate the dominant role of the factors defined in this question, or it may point to the difficulties in creative identification of BIPV's impact on daylighting by employees (only 1.45% of the respondents provided other factors that exert impact on daylight, identifying it with visual acuity).

The responses that evaluate the influence of BIPV on daylighting (question 10) indicate a slight dominance of positive opinions over negative ones. This could suggest that the use of BIPV as sun protection can be generally desirable; this applies more to PV glazing than PV shelves. However, detailed comparisons do not confirm the accuracy of this claim (see Section 3.2.3). Concerning the impact of BIPV on eye contact with the environment (question 11), it can be noticed that the respondents' attitudes are not unequivocal. Among employees who provided a positive or negative assessment, the share of the responses is generally modest, with a slight difference in favor of the positive feedback and more pronounced in the case of PV glazing than the PV shelves. Thus, acceptance depends on more specific factors, and it requires further research, including additional factors such as the external view, positioning of the workplace, etc. [38]. Further knowledge is also provided by the study results on the correlation between questions 8 and 11 (see Section 3.2.4).

As part of the research related to the impact of BIPV on internal space use, questions 13–14 were formulated. These were dedicated to users of buildings with PV shelves only. The answers to these questions show that adjustable PV shelves (the ability to change the inclination angle) are highly acceptable. Notably, a low share of respondents expressed negative opinions in this aspect. On the other hand, the negative attitude increases if employees are given the possibility of individual device regulation. This result may

likely contradict the thesis that the office user is willing to directly impact the workplace environment shaping [29]. However, additional research, i.e., into the correlations between answers to questions 13 and 14 (see Section 3.2.5), reveals a slightly different outlook. As indicated by the results, there is an interest in the possibility of adjusting the PV shelves. Yet, the dominant share of indifferent answers (50%) should not be overlooked, as they fit into the general respondents' attitude in relation to the issue discussed in this section.

Table 4. Summary of the percentage of collective responses to questions concerning BIPV in the internal environment; questions 13–14: responses related to the buildings with PV shelves exclusively.

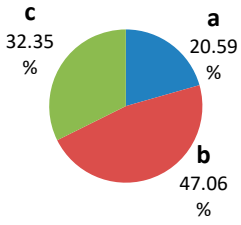
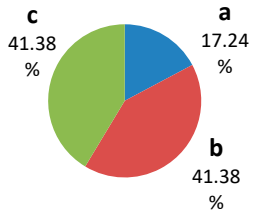
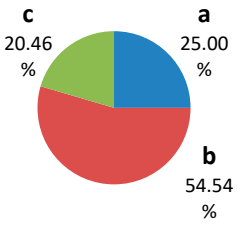
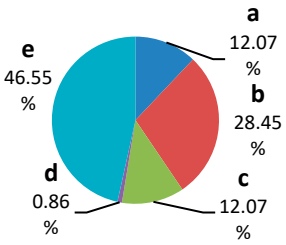
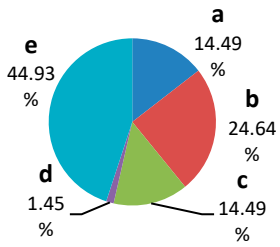
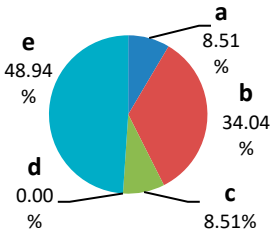
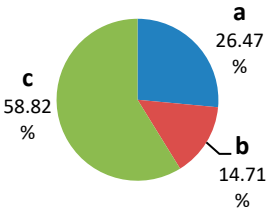
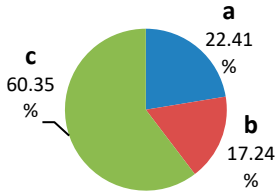
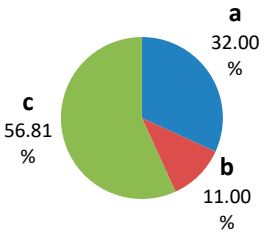
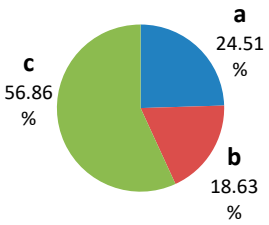
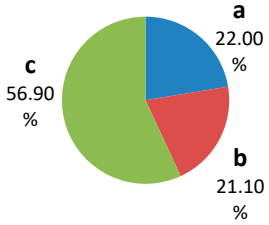
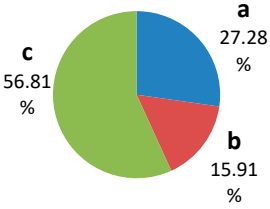
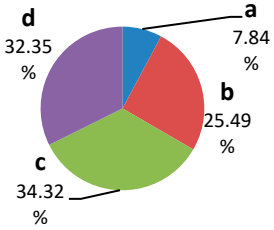
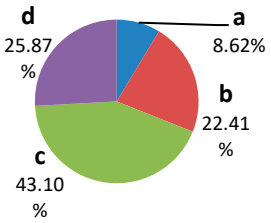
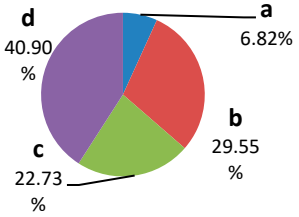
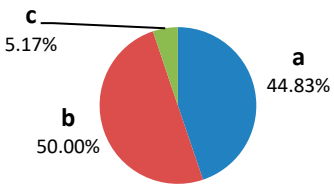
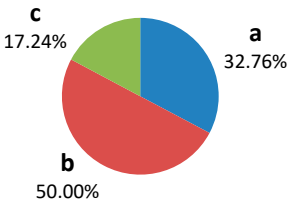
	Collective Answers	Answers Conc. PV Shelves	Answers Conc. PV Glazing
8	QUESTION 8 When inside the building, do you feel the impact of PV elements on aesthetics of the internal space?		
			
	(a) Yes, the impact is strong; (b) No, but the PV elements are perceptible; (c) No		
9	QUESTION 9 When inside the building, do you feel the impact of façade PV elements on natural lighting?		
			
	(a) Yes, they cast shadow; (b) Yes, they limit daylight access; (c) Yes, they change daylight tint; (d) Yes—other; (e) No		
10	QUESTION 10 When inside the building, your feelings related to the influence of PV elements on daylighting are:		
			
	(a) positive; (b) negative; (c) Indifferent (I don't feel any influence)		
11	QUESTION 11 When inside the building, do you feel the impact of façade PV elements on the view to the outside?		
			
	(a) Yes, positive; (b) Yes, negative; (c) No		

Table 4. *Cont.*

	Collective Answers	Answers Conc. PV Shelves	Answers Conc. PV Glazing
12	QUESTION 12 Façade PV elements seen from the interior of the building, in your opinion . . .		
			
	(a) Look better than from the outside; (b) Look worse than from the outside; (c) Look the same; (d) I have no opinion		
	Collective answers		
13 14	QUESTION 13 Do you think that PV shelves should be adjustable?	QUESTION 14 Would you like to have the possibility of individual adjustment of PV shelves?	
			
	(a) Yes; (b) It makes no difference to me; (c) No		

3.2. Correlations of Selected Issues

3.2.1. The Influence of BIPV on External Aesthetics and Modernity

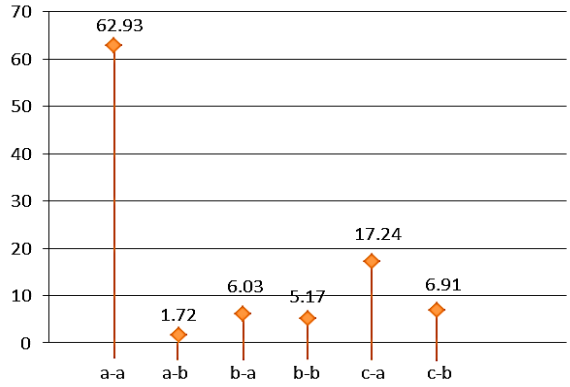
The correlation was studied to determine whether the perception of the impact of BIPV on the building's external image in terms of aesthetic evaluation is related to the perception of PV façades as modern solutions (Table 5). In other words, what issues are related to the modernity associated with a building's aesthetic evaluation? The conducted research demonstrates that the positive aesthetic perception caused by the influence of BIPV on a building's architecture is correlated with the perception of its PV façade as modern. Such correlated answers were provided by almost two-thirds of the respondents and were dominant. The influence of BIPV on the building's "modernity" evokes positive aesthetic feelings in relation to its external image. The second percentage result does not link the influence of BIPV on the building's aesthetics with the modernity of its architecture. However, it still indicates that BIPV is related to this feature. However, a much smaller share of such responses is observed in the obtained results (17.24%). Therefore, the results prove that BIPV is a desirable tool for creating impressions of modernity; thus, BIPV can also be considered a desirable element in this sense of aesthetic creation.

3.2.2. The Impact of BIPV on Associations with Ecology and the Company's

The correlation was studied in order to determine the relationship between the identification of BIPV in green buildings and the perception of the role of BIPV in creating the company's image (Table 6). The research results are quite clear; a vast majority of the surveyed employees (2/3) indicated associative connections between BIPV and ecology as well as the positive impact of BIPV on the company's image. Such reception indicates that BIPV can create a favorable image of the company through the correlation of BIPV with ecology. This result aligns with the general trend for promoting ecological attitudes worldwide. The results confirm that pro-ecological construction and architecture solutions, such as PV façades, can be used not only to achieve pro-environmental goals, such as

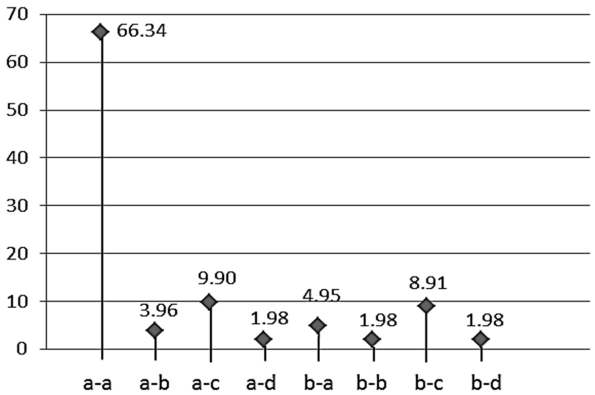
energy savings, but they also constitute a marketing element that creates a positive image of the company through connotations with a pro-ecological attitude [57].

Table 5. Percentage summary of answers to the correlation of questions 3 and 4 (the impact of BIPV on external aesthetics and modernity).

Percentage Summary	Answers to the Correlation of Questions 3 and 4
	BIPV IMPACT ON: 3.EXT.AESTHETICS 4.MODRNITY **a-a**: positive (a) yes (a) **a-b**: positive (a) no (b) **b-a**: negative (b) yes (a) **b-b**: negative (b) no (b) **c-a**: lack (c) yes (a) **c-b**: lack (c) no (b)

	Theoretical distribution	Empirical distribution	Correlation
a-a	16.66%	62.93%	Positive (+46.27%)
a-b		1.72%	Negative (−14.94%)
b-a		6.03%	Negative (−10.63%)
b-b		5.17%	Negative (−11.49%)
c-a		17.24%	Positive (+0.58%)
c-b		6.91%	Negative (−14.94%)

Table 6. Percentage summary of answers to the correlation of questions 6 and 7 (the impact of BIPV on associations with ecology and the company's image).

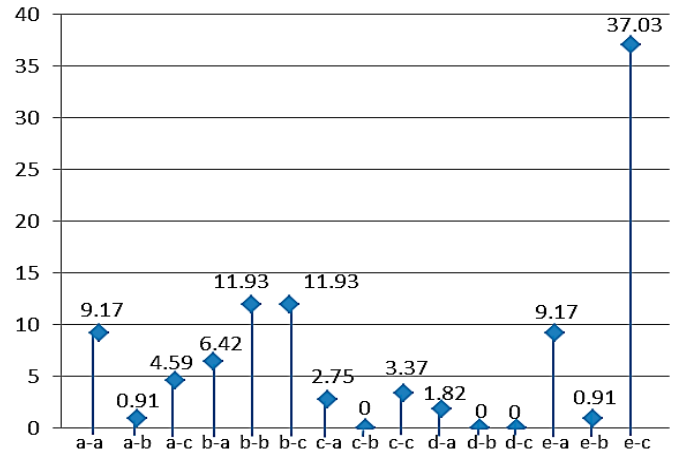
Percentage Summary	Answers to the Correlation of Questions 6 and 7
	BIPV IMPACT ON: 6.ECO-PROFILE 7.COMPANY IMAGE **a-a**: yes (a) yes (a) **a-b**: yes (a) no (b) **a-c**: yes (a) no relation (c) **a-d**: yes (a) no opinion (d) **b-a**: negative (b) yes (a) **b-b**: no (b) no (b) **b-c**: no (b) no relation (c) **b-d**: no (b) no opinion (d)

	Theoretical distribution	Empirical distribution	Correlation
a-a	12.50%	66.34%	Positive (+53.84%)
a-b		3.96%	Negative (−8.54%)
a-c		9.90%	Negative (−2.60%)
a-d		1.98%	Negative (−10.52%)
b-a		4.95%	Negative (−7.55%)
b-b		1.98%	Negative (−14,94%)
b-c		8.91%	Negative (−3.55%)
b-d		1.98%	Negative (−10.52%)

3.2.3. The Impact of BIPV on Natural Lighting and Users' Perception

The correlation was studied to determine the subjective employee perception related to lighting environment shaping—i.e., a juxtaposition of stimuli that shape employees' feelings, with an evaluative assessment of the effects of stimuli impact (Table 7). The results demonstrate the prevalence of indifferent attitudes, which may indicate that BIPV has no significant impact on the issues related to lighting comfort. The remaining responses suggest that the BIPV effect of limiting natural light focuses the greatest attention. In contrast, the feelings associated with this aspect are generally not positive (negative and neutral feelings are equally dominant). The significant difference in the results between the a-a and a-b correlations is noteworthy. Contrary to the daylight aspect, the shadow-casting effect is perceived very positively. Based on this result, it can be assumed that, according to the respondents, chiaroscuro effects are not equated with the reduction of the daylight intensity in terms of positive or negative feelings. In other words, the interior space is perceived differently in terms of its shading than its general level of natural lighting.

Table 7. Percentage summary of answers to the correlation of questions 9 and 10 (the impact of BIPV on daylighting and interior perception).

Percentage Summary	Answers to the Correlation of Questions 9 and 10	
	BIPV IMPACT ON DAYLIGHTING:	
	9.EFFECT	10.PERCEPTION
	a-a: shadow cast(a)	positive (a)
	a-b: shadow cast(a)	negative (b)
	a-c: shadow cast(a)	indifferent (c)
	b-a :daylight reduction(b)	positive (a)
	b-b: daylight reduction(b)	negative (b)
	b-c: daylight reduction(b)	indifferent (c)
	c-a: tint change(c)	positive (a)
	c-b:tint change(c)	negative (b)
	c-c: tint change(c)	indifferent (c)
	d-a: other(d)	positive (a)
	d-b: other(d)	negative (b)
	d-c: other(d)	indifferent (c)
	e-a: lack(e)	positive (a)
	e-b: lack(e)	negative (b)
	e-c: lack(e)	indifferent (c)

	Theoretical distribution	Empiricaldistribution	Correlation
a-a	6.66%	9.17%	Positive (+2.51%)
a-b		0.91%	Negative (−5.75%)
a-c		4.59%	Negative (−2.07%)
b-a		6.42%	Negative (−0.24%)
b-b		11.93%	Positive (+5.27%)
b-c		11.93%	Positive (+5.27%)

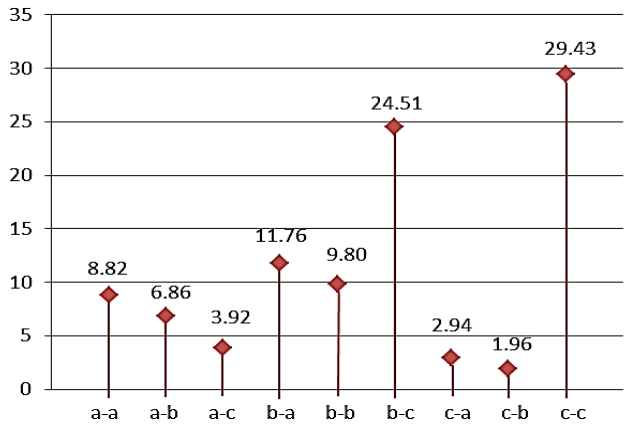
Table 7. *Cont.*

	Theoretical distribution	Empiricaldistribution	Correlation
c-a		2.75%	Negative (−3.91%)
c-b		0%	Non-existent (−6.66%)
c-c		3.37%	Negative (−3.29%)
d-a		1.82%	Negative (−4.84%)
d-b		0%	Non-existent (−6.66%)
d-c		0%	Non-existent (−6.66%)
e-a		9.17%	Positive (+2.51%)
e-b		0.91%	Negative (−5.75%)
e-c		37.03%	Positive (+30.37%)

3.2.4. The Influence of BIPV on the Aesthetics of the Interior and the View Outside

The correlation was studied to answer whether the perceived influence of BIPV on interior aesthetics is related to its impact on eye contact with the environment (Table 8). The results are dominated by responses according to which the interior aesthetics is not associated with the use of BIPV. The respondents describe this influence as weak, whereas the opinions related to the view outside vary. It can therefore be concluded that, according to the majority of respondents (over 50%), the relationship in question does not exist.

Table 8. Percentage summary of answers to the correlation of questions 8 and 11 (the impact of BIPV on the interior aesthetics and the view outside).

Percentage Summary	Answers to the Correlation of Questions 8 and 11
	BIPV IMPACT ON: 8. INT.AESTHETICS 11.VIEW OUTSIDE **a-a:** strong(a) positive (a) **a-b:** strong(a) negative (b) **a-c:** strong(a) lack (c) **b-a:** perceptible (b) positive (a) **b-b:** perceptible (b) negative (b) **b-c:** perceptible (c) lack (c) **c-a:** lack (c) positive (a) **c-b:** lack(c) negative (b) **c-c:** lack(c) lack (c)

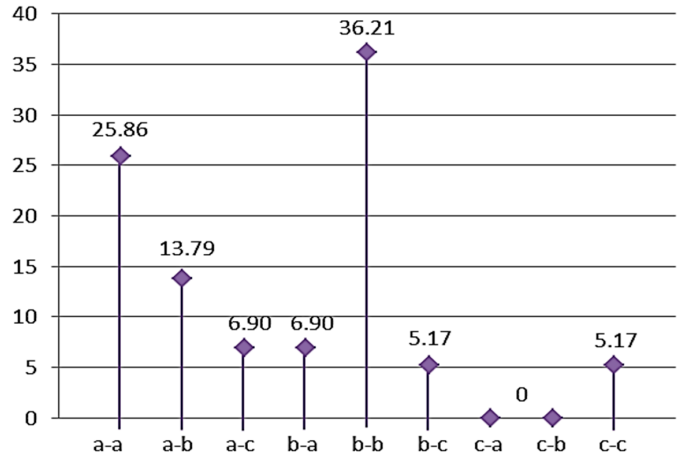
	Theoretical distribution	Empirical distribution	Correlation
a-a	11.11%	8.82%	Negative (−2.29%)
a-b		6.86%	Negative (−4.25%)
a-c		3.92%	Negative (−7.19%)
b-a		11.76%	Positive (+0.65%)
b-b		9.80%	Negative (−1.31%)
b-c		24.51%	Positive (+13.40%)
c-a		2.94%	Negative (−8.17%)
c-b		1.96%	Negative (−9.15%)
c-c		29.43%	Positive (+18.32%)

Some constructive observations may be sought in answers that indicate the strong influence of BIPV on interior aesthetics. However, these responses total only about 20%. The results in this respect (a-a, a-b, a-c) show a slight advantage of the correlation of these responses with positive feelings caused by the influence of BIPV on the view inside. However, the differences in relation to negative feelings are negligible (~2%); thus, formulating an unambiguous statement is impossible in this regard.

3.2.5. Mobility and the Regulation of PV Shelves

The correlation was studied to determine the relationship between the interest among employees in hypothetical mobile PV shelves and the possibility of individual adjustment thereof (Table 9). Apart from the dominant indifferent attitudes to the concept (b-b), positive opinions are significantly at an advantage among the remaining correlated responses (a-a). Movable, individually adjustable PV shelves enjoy a substantial degree of acceptability; they seem to be considered a desirable solution among office workers. This is in line with the study results by Tymkiewicz [38] (p. 246), in which the possibility of façade regulation reduces the sense of stress among employees. The results also confirm tendencies noticed by Pastore and Andersen, who stated that *"in workspaces with comparable measured environmental parameters, the amount of personal control on façade operation was found to correlate with the perception of the indoor environmental quality. More specifically, a higher degree of control on windows opening could be associated with a higher satisfaction with overall comfort"* [39] (p. 14). However, in PV façade research, more positive feelings are associated with mobile solutions than with the possibility of individual regulation, which confirms the results obtained in collective studies. A very small share of negative responses to the use of mobile sun protection shelves is noticeable. Summing up, it can be concluded that movable PV shelves evoke more positive attitudes from users compared to the fixed shelves. However, to a lesser extent, these attitudes are accompanied by an interest in the possibility of individual adjustment of the devices.

Table 9. Percentage summary of answers to the correlation of questions 13 and 14 (mobility and the regulation of PV shelves).

Percentage Summary	Answers to the Correlation of Questions 13 and 14
	PV SHELVES:
	13.MOBILITY — 14.REGULATION
	a-a: yes (a) — yes (a)
	a-b: yes (a) — no difference (b)
	a-c: yes(a) — no (c)
	b-a: no difference (b) — yes (b)
	b-b: no difference (b) — no difference (b)
	b-c: no difference (b) — no (c)
	c-a: no (c) — yes (a)
	c-b: no (c) — no difference (b)
	c-c: no(c) — no (c)

	Theoretical distribution	Empirical distribution	Correlation
a-a	11.11%	25.86%	Positive (+14.75%)
a-b		13.79%	Positive (+2.68%)
a-c		6.90%	Negative (−4.21%)
b-a		6.90%	Negative (−4.21%)
b-b		36.21%	Positive (+25.10%)
b-c		5.17%	Negative (−5.94%)

Table 9. *Cont.*

	Theoretical distribution	Empirical distribution	Correlation
c-a		0%	Non-existent (−11.11%)
c-b		0%	Non-existent (−11.11%)
c-c		5.17%	Negative (−5.94%)

3.3. Detailed Results—Answers Broken down into Employee Characteristics

3.3.1. Perception of BIPV and Time Spent in the Room

The research was narrowed down to questions concerning the inner space (questions 8–14). The surveyed employees were divided into two groups: permanent and temporary/short-term room occupancy (for simplicity defined as occasional in the article). According to the building regulations in Poland [58], permanent users stay in the room for more than 4 h a day, whereas occasional users occupy the room for up to 4 h a day. The timeframe mentioned is contractual and indicative. The surveyed employees defined themselves as belonging to one of the groups. In office buildings, these employees worked mainly in cell and open office rooms as well as used common spaces where BIPV was applied (lobbies, conference room). In the public building, employees of the swimming pool hall were analyzed. The distribution of both groups was 50–50%. The study results have been included in Table 10.

Table 10. Percentage summary of respondents' answers depending on time spent in the room with BIPV (dark bars, occasional users; light bars, permanent users).

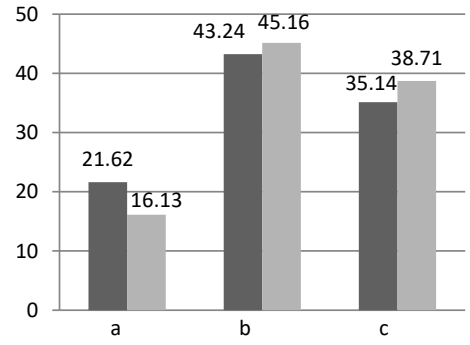
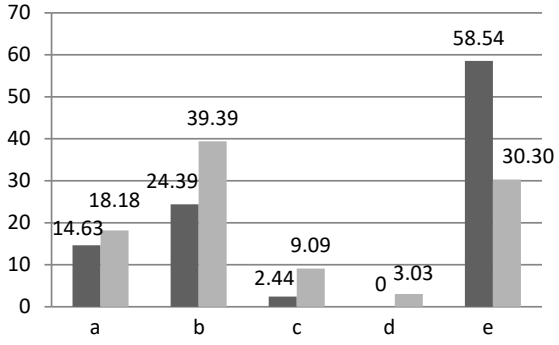
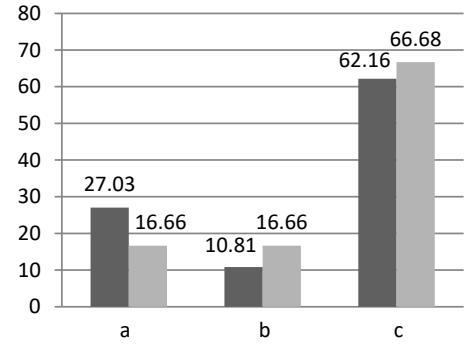
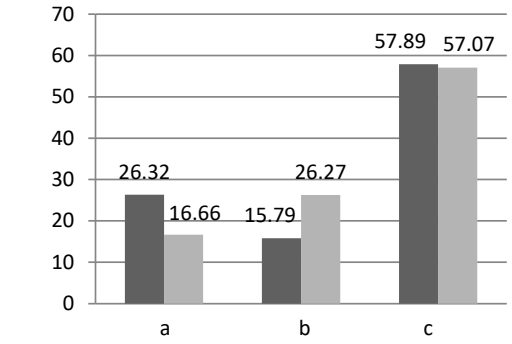
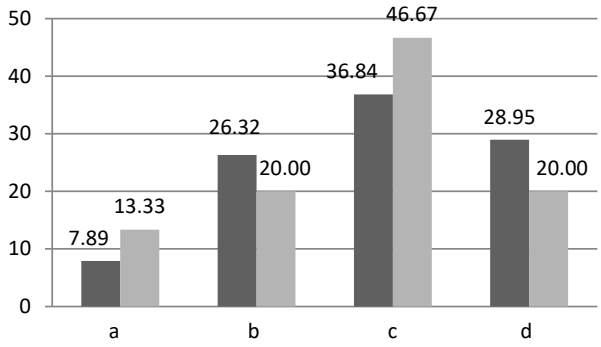
QUESTION 8 When inside the building, do you feel the impact of façade PV elements on aesthetics of the internal space?	**QUESTION 9** When inside the building, do you feel the impact of façade PV elements on natural lighting?
	
(a) Yes, strong; (b) No, but PV is perceptible; (c) No	(a) Yes, cast shadow; (b) Yes, limit daylight; (c) Yes, change daylight tint; (d) Other; (e) No
QUESTION 10 When inside the building, your feelings related to the influence of PV elements on daylighting are:	**QUESTION 11** When inside the building, do you feel the impact of façade PV elements on the view to the outside?
	
(a) Positive; (b) Negative; (c) Indifferent	(a) Yes, positive; (b) Yes, negative; (c) No

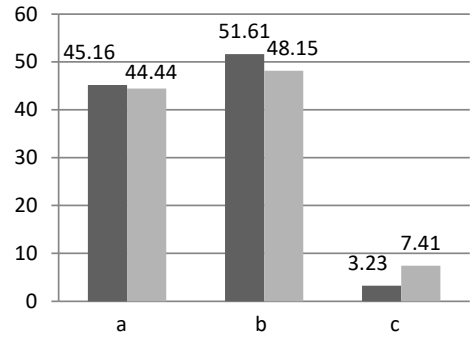
Table 10. *Cont.*

QUESTION 12
Façade PV elements seen from the interior of the building, in your opinion . . .



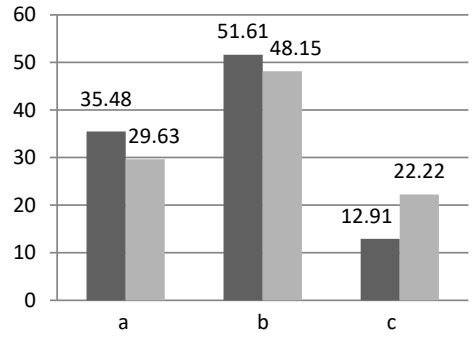
(a) Look better than from the outside; (b) Look worse; (c) Look the same; (d) I have no opinion

QUESTION 13
Do you think that PV shelves should be adjustable?



(a) Yes; (b) It makes no difference; (c) No

QUESTION 14
Would you like to have the possibility of individual adjustment of PV shelves?



(a) Yes; (b) It makes no difference; (c) No

The research results prove no significant differences in the aesthetic perception of the internal space caused by BIPV regarding room occupancy (question 8). However, it is surprising that a strong influence in this aspect is felt by more people staying in it occasionally. It would seem logical that permanent occupants of the rooms should be more sensitive to the interior's aesthetic quality. It can, therefore, be assumed that the aesthetic perception becomes duller over time; users get accustomed to the influence of BIPV; hence, their perception becomes weaker.

This is confirmed by answers b and c (question 8), which show that the perception of the BIPV's impact among permanent employees is more weakened and indifferent. The impact of BIPV on interior lighting varies (question 9). In this case, the attitude of employees who occasionally stay in the room with BIPV is much more indifferent. Among users who notice the influence of BIPV in this aspect, the greatest dissimilarities between the two groups concern the effect on reducing daylight access—the greatest sensitivity to this aspect was noticed among permanent employees. These workers are also more critical of BIPV's effects on daylighting. This may suggest that, among these employees, the light level reduction caused by BIPV elements is perceived rather negatively. This result is interesting because the permanent employees relatively rarely seek a solution to this problem in the possibility of individual adjustment of the sun protection shelves. This, objectively, would enable a better adjustment of the natural light level to the user's current needs (question 14). Permanent workers expressed twice as much dislike of this solution though these answers are the least numerous overall. In both surveyed groups, however, a very small share of respondents expressed negative opinions on mobile PV shelf systems (question 13) although the percentage is two-fold larger among permanent

employees. At the same time, however, almost half of the respondents from both groups (similar results) expressed positive opinions about these solutions. Considering the equally high neutral attitude to the discussed problem in both groups, the acceptance of these solutions, regardless of the time spent in the room, may be suggested.

Regarding the BIPV's impact on eye contact with the environment, both groups are characterized by a generally neutral attitude—more than half of such responses (question 11). Among users who noticed the influence of BIPV, permanent workers express a more negative attitude, which may be related to the aforementioned greater aversion to BIPV in terms of its effect on the natural light level reduction. This aspect requires further, more detailed research for each solution individually because devices objectively differ in the degree to which they obscure the external view. At the same time, the issue is characterized by complexity and a significant degree of subjectification [38]. The aforementioned more negative feelings among permanent employees rather cannot be associated with the aesthetic perception of BIPV seen from the inside. The dominant response was the lack of perceived aesthetic differences between BIPV seen outside and inside (question 12). The share of these answers was additionally higher than the responses by occasional employees. Only every fifth permanent employee perceived the aesthetics with BIPV as worse regarding the external appearance, whereas every fourth occasional employee declared such a ratio. However, it should be noted that positive reactions were the least numerous in both groups even though the responses of permanent employees constituted a slight majority.

3.3.2. Perception of BIPV and the Employees' Age

It was recognized that in terms of the perception of BIPV in the building's external body, respondents' age may be of importance when assessing these solutions that are relatively new in architecture. In turn, the study on the impact of BIPV on the internal environment was based on various needs in terms of widely understood use comfort. The division into two age groups was made: a younger group, i.e., employees up to 40 years old, and an older group, i.e., over 40 years old. The proportion between the older and younger groups was 56.5–43.5%, respectively. The study results have been included in Table 11.

Table 11. Percentage summary of respondents' answers depending on their age (dark bars, younger group; light bars, older group).

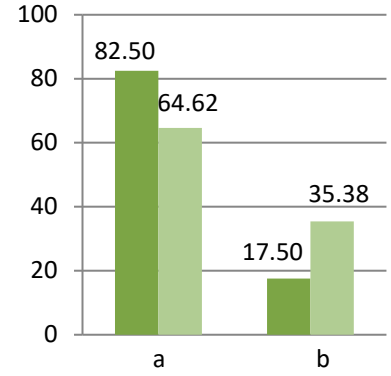
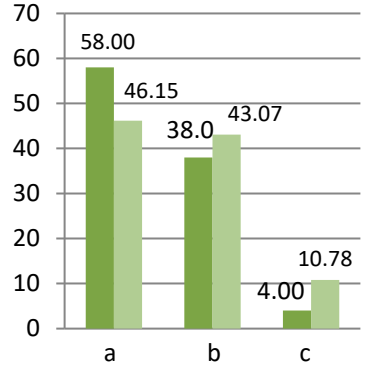
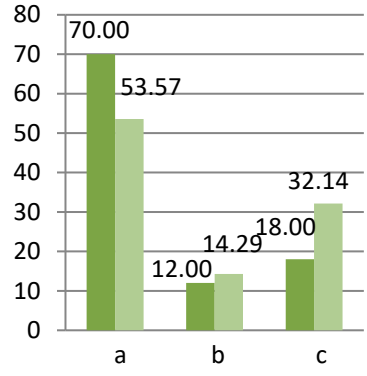
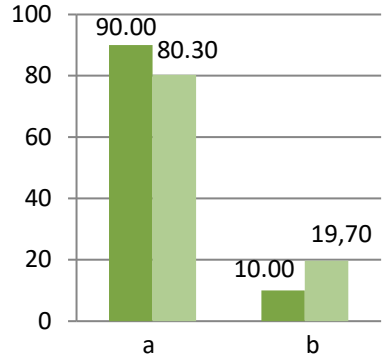
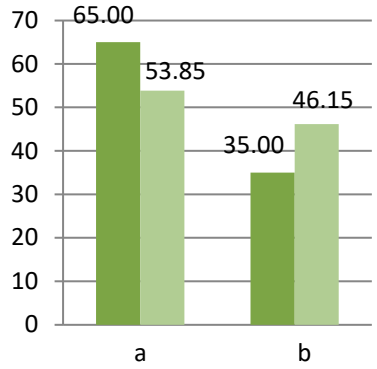
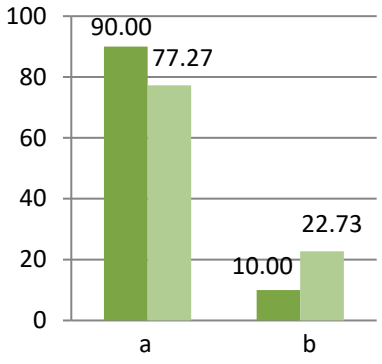
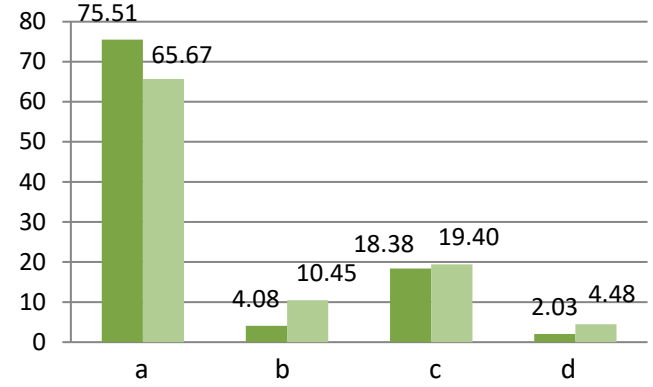
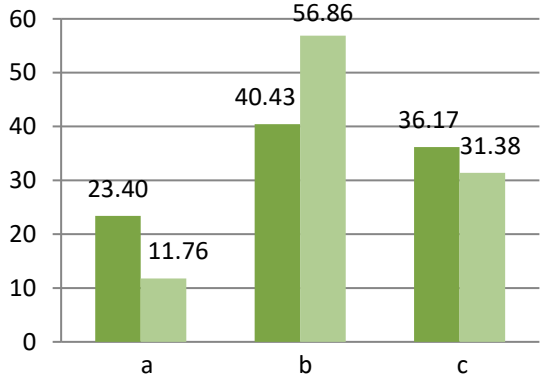
QUESTION 1 Do you consider the external wall covered with PV modules to be a representative building façade?	**QUESTION 2** Do you think that PV elements within the façade have an impact on the overall appearance of the building?	**QUESTION 3** Do you think that PV elements affect the aesthetics of the façade when viewed from the outside?
		
(a) Yes; (b) No	(a) Yes, big; (b) Yes, minor impact;(c) No	(a) Yes, positive; (b) Yes, negative;(c) No

Table 11. *Cont.*

QUESTION 4 Do you consider the PV façade to have a modern image?	**QUESTION 5** Do you consider the PV façade to be more interesting than the remaining façades of the building?	**QUESTION 6** Does the PV façade evoke associations with an ecological building in your opinion?
		
(a) Yes; (b) No	(a) Yes; (b) No	(a) Yes; (b) No

QUESTION 7 Do you think that using PV elements within the façade can positively impact the image of the company that occupies this building?	**QUESTION 8** When inside the building, do you feel the impact of façade PV elements on aesthetics of the internal space?
	
(a) Yes; (b) No; (c) It makes no difference; (d) I don't know	(a) Yes, strong; (b) No, but PV is perceptible; (c) No

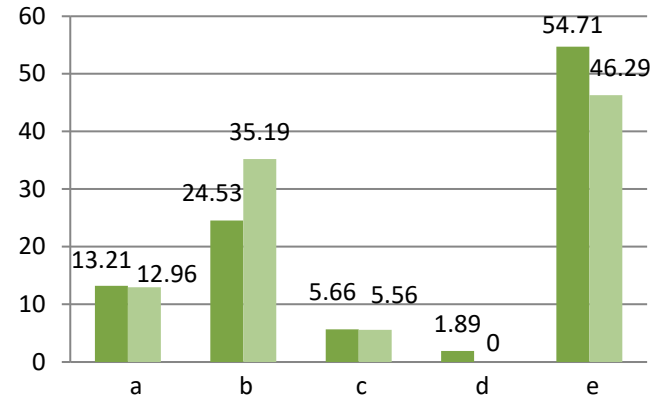
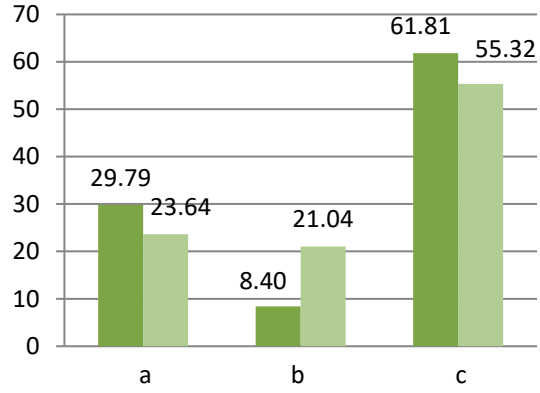
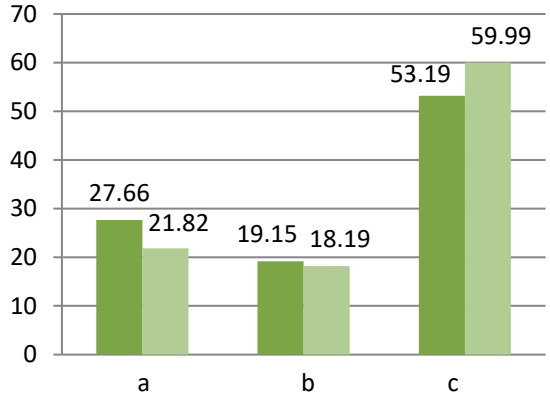
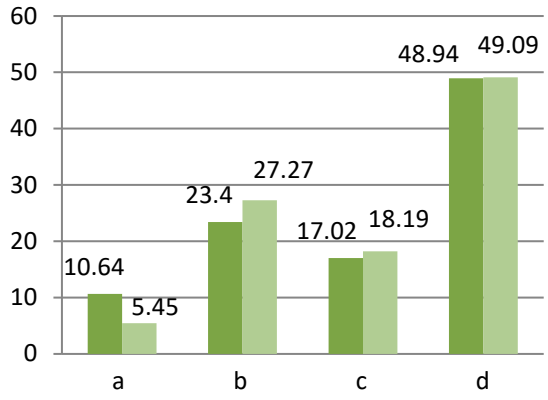
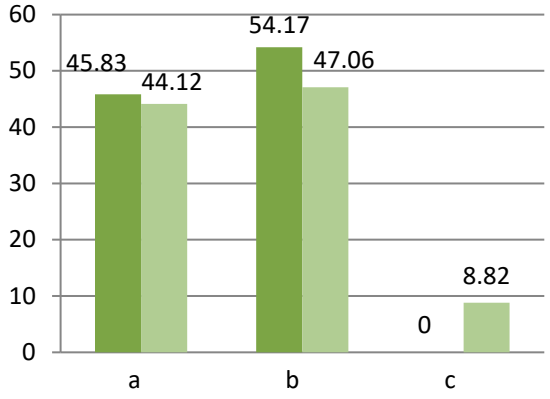
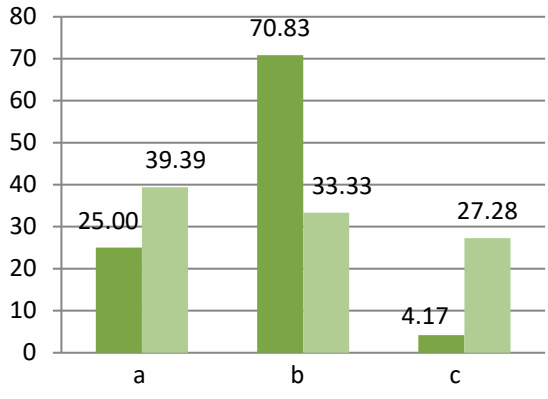
QUESTION 9 When inside the building, do you feel the impact of façade PV elements on natural lighting?	**QUESTION 10** When inside the building, your feelings related to the influence of PV elements on daylighting are:
	
(a) Yes, cast shadow; (b) Yes, limit daylight;(c) Yes, change daylight tint; (d) Other; (e) No	(a) Positive; (b) Negative; (c) Indifferent

Table 11. *Cont.*

QUESTION 11 When inside the building, do you feel the impact of façade PV elements on the view to the outside?	**QUESTION 12** Façade PV elements seen from the interior of the building, in your opinion . . .
	
(a) Yes, positive; (b) Yes, negative; (c) No	(a) Look better than from the outside; (b) Look worse; (c) Look the same; (d) I have no opinion
QUESTION 13 Do you think that PV shelves should be adjustable?	**QUESTION 14** Would you like to have the possibility of individual adjustment of PV shelves?
	
(a) Yes; (b) It makes no difference; (c) No	(a) Yes; (b) It makes no difference; (c) No

Regarding the questions related to the perception of BIPV in the building's body (questions 1–7), differences between the two groups can generally be noticed. Yet, these discrepancies cannot be considered very distinct. Regarding the aesthetic influence of BIPV on the architectural form and façades, the younger group generally perceives this influence more strongly while being more positive about it. In each of the questions related to this issue, this group responded with more positive answers also in terms of perceiving BIPV as a modern solution. This confirms the general trend that skepticism towards novelty increases with age. The answers show that the younger group has a stronger perception of BIPV as an architecturally modern solution that positively and significantly influences the building's representativeness, its architectural form, and façades. Moreover, this group associates BIPV with ecology, thereby influencing the company's image. The younger group is more acceptant of BIPV and expresses less indifference towards it.

Regarding the internal environment (questions 8–14), the conducted research indicates differences between both groups; these can be described as moderate. In terms of the aesthetic impact of BIPV on the inner space, the younger group gave more extreme answers, i.e., either describing the impact as considerable or failing to notice it at all. However, indirect attitudes, i.e., the perception of the minor BIPV influence on the interior aesthetics, constitute the majority of responses. In this case, the responses of the older group dominate.

Regarding the use of internal space, interesting results are provided by answers related to the BIPV influence on daylighting. Unlike in terms of the aesthetic and semantic issues discussed above, the younger group shows greater indifference to the issue. The remaining answers to this question (question 9) are similar, but the greatest share responses point to shadow casting as the main factor of the BIPV's influence on daylighting. Here, the older group is much more sensitive to the aspect. These respondents assessed the BIPV's effect on daylight more negatively, which may result from the greater sensitivity of the elderly to working conditions regarding lighting comfort requirements and related needs. This conclusion is also confirmed by the lower share of neutral responses in this age group. In turn, this group expressed a greater indifference towards the influence of BIPV on eye contact with the environment. However, it should be noted that the answers to this issue (question 11) are similar in both groups; thus, it is difficult to determine whether age has any impact on this aspect. The same applies to assessing the appearance of the BIPV elements from the inside (question 12). The even share of responses and the predominant lack of opinion of the respondents indicate, firstly, that both groups consider this issue to be of little importance and, secondly, that the perception of BIPV is not related to age.

The answers concerning the mobility and adjustment possibilities of the PV shelves prove the regularity that the younger group is more neutral towards functional aspects in the internal space. For over 70% of the younger group, individual regulation does not matter; it is over twice as many responses of this type compared to the answers given by the older group. Unlike in the case of aesthetic issues, the older group is characterized by greater clarity of attitudes in this respect. The older group prevails over the younger group in accepting and denying the individual regulation possibility. This may prove that older employees pay more attention to aspects related to shaping the conditions of the workplace.

In summary, the younger group expresses greater commitment and acceptance in terms of the aesthetic aspects of the BIPV's impact on the building's architecture and internal space. Moreover, it is also more active concerning the impact on semantic issues (questions 7–8). The older group, in turn, cares more about shaping the internal space in terms of utility. The BIPV's impact assessment and the aesthetic aspects are less favorable in this group.

3.4. Research Limitations

The survey research presented in the article is contributory and constitutes a pioneering approach to the issues undertaken above. For this reason, it was not possible to verify the research by comparing its results with analogous behavioral studies on PV façades. A need emerges for further, more detailed research to include more variables concerning the individual issues raised above.

Other basic limitations result from the adopted assumptions and research methods as follows:

- The research included six buildings. The limited number of buildings has a positive effect on a joint research platform creation and, consequently, the reduction of the research variables; on the other hand, it does not cover all possible PV applications (e.g., mobile PV shelves—such solutions have not yet been introduced in Poland in the studied types of buildings);
- The research concerned only building workers. The employees represent varying degrees of interest and even understanding of the BIPV. A large part of the answers is "indifferent", which does not allow to say whether it is a conscious answer or whether it results from a lack of interest in the subject of the research;
- The survey covered late spring and early summer periods. It was decided that the weather should be similar in each studied case to eliminate seasonal variation that could distort research results;
- Thus, the outcomes are limited to the relatively warm and sunny period. It would be a valuable supplement to conduct research for the autumn–winter period; however, this strategy would require the survey to be conducted on the same group of respondents, which was difficult to ensure in this case due to the anonymity of the surveys;

- The basic division into permanent and temporary employees who have access (physical or visual) to façade PV elements was adopted. Due to the length of the study, the spatial features of the workplace and the relationship with PV elements were not defined in detail. Such analyses should be the subject of further, more detailed research;
- The paper does not address the influence of gender on the perception of PV façades although the conducted survey covered this distinction. However, due to the uneven distribution, i.e., a definite predominance of men (approx. 85–15%), the presentation of the research results and a detailed interpretation thereof was abandoned. General observations, which cannot be seen as validated for the above reason, indicate that PV façades are more accepted by women when viewed from the outside and by men when viewed from the inside. However, men are also more indifferent in this case. A significant difference in favor of women was revealed in their interest in the possibility of handling PV shading elements and the connotation of PV façades with ecology. Other issues showed no significant differences. The gender-specific aspect of PV façade perception in aesthetic and utility terms requires separate, more objective research—it seems to provide an interesting and justified field of study.

4. Conclusions

This article examines the opinions of 232 employees on the impact of BIPV on aesthetic and utility issues concerning the external body and internal space of six office and public utility buildings with BIPV. The research covered façade PV modules in the form of PV glazing and PV shelves. The research results based on the POE method broaden the knowledge in qualitative research on BIPV regarding façades. The obtained numerical results (percentages) should not be analyzed literally, as they do not account for the full complexity of the issue (e.g., the individual users' psychological profile and their preferences). The usefulness of the results relates more to outlining the general regularities, tendencies, and dependencies in the perception of particular issues formulated in the survey questions. The following general observations and conclusions emerge from the study:

- PV façades are generally aesthetically accepted; they are perceived as modern solutions, strongly related to the ecology and corporate image. Therefore, they constitute an appropriate aesthetic "tool" for creating such an image of the building's architecture and its user (e.g., company); smooth glass PV façades are assessed more favorably—this result may be regarded as quite surprising in light of previous studies and proves the complexity of the issue described by Prieto and Oldenhave;
- The user's perception is influenced by BIPV more when viewed from the outside. The internal environment evaluation is characterized by a greater degree of indifference as well as negative attitudes. The conclusion is that the development of photovoltaic technology directed towards BIPV must equally account for aspects related to the internal space shaping, including aesthetics of PV modules seen from the inside;
- The perception of the BIPV's impact on the use of internal space is mainly related to the reduction of daylight access. Eye contact with the environment is much less important. Mobile PV shelf systems and their regulation possibilities are accepted, which generally responds to previous research insights concerning individual control over façade operation (e.g., by Tymkiewicz and Pastore and Andersen). For this reason, such solutions seem appropriate in applications wherever it is particularly important to create comfortable natural lighting conditions (e.g., office rooms) even at the expense of the view outside;
- The respondents' characteristics have some importance in perceiving the BIPV's impact. Users from the older group (> 40 years old) are more sensitive to the BIPV's impact in terms of the utilitarian shaping of the internal environment, while the younger group (up to 40 years of age) pay more attention to the aesthetic aspects; they tend to express a more positive attitude towards them.

The knowledge of the employees' personality profile at the planning and design stage can, therefore, be applied to making correct assumptions regarding BIPV as a solution implemented in the pursuit of improving workplace quality and its humanization.

The research can prove useful for investors and designers at the planning and design concept stage. The outcomes constitute a practical source of knowledge for BIPV manufacturers. Apart from newly erected buildings, they can be useful for BIPV refurbished buildings. The results of the research confirm some of the observations related to the general research on façades (e.g., preference for mobile systems). At the same time, they also shed new light and verify the general knowledge about the perception of façades (e.g., greater acceptance of the aesthetics of smooth façades over 3D ones with the use of PV shelves).

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