

Strategic Factors Affecting Green Building Industry

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Abstract

For the last decade, green buildings have created a new industry of ecological buildings. However, this industry is still newly developing and finds limited implementation opportunities when compared with the traditional building industry. Therefore, for a more preferable green building industry, strategic factors that can have significant effects on the industry should be comprehended. Based on this argument, the present study aims (i) to identify these factors, (ii) to determine their importance levels, and lastly (iii) to find out their current levels of impact on the industry. To this aim, a questionnaire survey was conducted for the Turkish green building industry through 32 industrial practitioners who have an official LEED Credentials. Results obtained were evaluated via the relative importance index method. Consequently, a total of 30 strategic factors were identified. Out of them, 28 were found to be significant while only 16 currently have a significant impact on the industry.

Key words: Green building, LEED, PESTEL, relative importance index, Turkey

1. Introduction

In the literature, there are numerous green building studies which have been addressed to transform conventional buildings to those environmentally friendly and sensitive to human health by applying specific assessment systems [1]. In this context, this study differs from past studies as it reveals a sectoral overview of green buildings in the macro level and conducts a strategic assessment in terms of green buildings. Therefore, it seems to be important to comprehend strategic factors that can have significant effects on the industry. The present study aims (i) to identify these factors, (ii) to determine their importance levels, and lastly (iii) to find out their current levels of impact on the industry. To this aim, a questionnaire survey was conducted for the Turkish green building industry through 32 industrial practitioners who have an official LEED Credentials. Consequently, it is expected to attract industrial practitioners' attention to these factors to contribute to the faster development of the green building industry.

2. Materials and Method

In order to analyse the external environment of the green building industry, a PESTEL analysis has been utilized. A questionnaire survey was then sent to 168 professionals, who have an official LEED Credentials and extensive knowledge of the industry, via e-mail. Of these professionals, 32 (19.05%) have accepted to respond the survey. Since this number is bigger than 30 ($n \geq 30$), the sample group can be regarded as statistically sufficient to represent the whole.

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2.1. PESTEL

PESTEL analysis is a method used in market research generally. In other words, it is used to reveal positive and negative factors that can have an impact on an organization by evaluating it in terms of political, economic, social, technological, environmental, and legal aspects.

2.2. Relative Importance Index (RII)

In this study, a total of 30 sub-factors were categorized under six groups of the external environmental factors, such as (i) political, (ii) economic, (iii) social, (iv) technological, (v) environmental, and (vi) legal, to analyse the green building industry. The required data to determine both the importance level and the current level of impact of these factors were then gathered from respondents via a questionnaire survey. The average score of each factor was determined using the following formula of RII where i – category of response, W_i – weight given to i^{th} category ranges from 1 to 5, and X_i – percentage of answers given to i^{th} category.

$$RII = \frac{\sum_{i=1}^5 W_i X_i}{\sum_{i=1}^5 X_i}, (1 \leq RII \leq 5) \quad (1)$$

The obtained results have been subjected to a different classification during the evaluation process of responses. Because, after the evaluation process, a five-point Likert scale of a question is found to be insufficient to reveal the results. Hence, each expression of the five-point Likert scale was defined at specific intervals as $1.00 \leq \text{very low (VL)} \leq 1.80$, $1.80 < \text{low (L)} \leq 2.60$, $2.60 < \text{moderate (M)} \leq 3.40$, $3.40 < \text{high (H)} \leq 4.20$, and $4.20 < \text{very high (VH)} \leq 5.00$. Then, these calculated values were ranked according to their importance indices. If any of these factors have the same scores, percentages of respondents who chose options of 5-4, 3, or 2-1 were determined to rank these factors. These percentages were compared starting from options 5-4 to 1-2, respectively, until determining which factor has a higher percentage.

3. Results

3.1. Political factors

Political factors had a “high” importance level (3.94) and a “moderate” current level of impact (3.37) (Tables 1 and 2). Since subvention’s score was very high for importance level and high for current level of impact, it is one of the most significant factors for the green building construction industry in Turkey. These show that the green building industry in Turkey is in a need of investment and that the industry is a newly emerging market. Although various initiatives to promote the green building investment in Turkey have already been initiated at the industrial and governmental level, main steps, such as tax and duties reduction, bureaucratic process simplification, increase in floor area ratio, grant and low interest loans, have not yet been taken. Thus, the insufficient support of authorities in terms of subvention can be regarded as a factor that slows down the speed of the green building industry.

Table 1. RII and Importance Levels of Political Sub-Factors

No.	Political factors	RII	Importance level	5	4	3	2	1	Overall ranking	Result
1	Subvention	4.53	VH	68.75	21.88	3.12	6.25	0.00	5	√
2	Tax policy	3.93	H	39.39	27.27	21.21	12.13	0.00	20	
3	Political stability	3.77	H	29.03	35.49	22.58	9.67	3.22	24	
4	Customs policy	3.53	H	25.00	31.25	21.88	15.62	6.25	27	
	General Average	3.94	H							

Table 2. RII and Current Levels of Impact of Political Sub-Factors

No.	Political factors	RII	Current level of impact	5	4	3	2	1	Overall ranking	Result
1	Subvention	3.87	H	50.00	15.62	15.62	9.38	9.38	2	√
2	Tax policy	3.45	H	29.03	25.80	19.35	12.91	12.91	15	
3	Political stability	3.27	M	18.18	30.30	24.24	15.15	12.13	24	
4	Customs policy	2.87	M	15.63	18.75	25.00	18.75	21.87	28	
	General Average	3.37	M							

3.2. Economic factors

Economic factors had a “high” (3.77) importance level and a “medium” (3.45) current level of impact (Tables 3 and 4). Although economic factors were composed of five sub-factors with a “high” importance level, they remained in the lower order with respect to sub-factors of other groups. In terms of the current level of impact, exchange rates, real estate prices, and interest rates were sub-factors with the “high” current level of impact. The fact that these three sub-factors had a highly variable structure in Turkey for many years can affect the green building industry negatively by creating a distrust effect on investors.

Table 3. RII and Importance Levels of Economic Sub-Factors

No.	Economic factors	RII	Importance level	5	4	3	2	1	Overall ranking	Result
1	Real estate prices	4.00	H	31.25	43.75	18.75	6.25	0.00	19	
2	Interest rates	3.90	H	37.50	34.38	12.50	12.50	3.12	22	
3	Exchange rates	3.90	H	46.88	15.63	21.87	12.50	3.12	23	
4	Inflation rates	3.59	H	28.13	28.13	25.00	12.50	6.24	25	
5	Average income per capita	3.48	H	22.58	25.80	35.48	9.67	6.45	28	
	General Average	3.77	H							

Table 4. RII and Current Levels of Impact of Economic Sub-Factors

No.	Economic factors	RII	Current level of impact	5	4	3	2	1	Overall ranking	Result
1	Exchange rates	3.72	H	40.63	21.87	12.50	18.75	6.25	6	√
2	Real estate prices	3.63	H	18.75	43.75	25.00	6.25	6.25	8	√
3	Interest rates	3.63	H	31.25	25.00	25.00	12.50	6.25	9	√
4	Inflation rate	3.38	M	15.63	34.38	31.25	9.37	9.37	17	
5	Average income per capita	2.88	M	15.63	21.87	15.63	28.12	18.75	27	
General Average		3.45	H							

3.3. Social factors

The importance level of social factors was “high” (3.79) and the current impact level was “medium” (3.13) (Tables 5 and 6). Considering six sub-factors, the quality of life (comfort) perception was highest in the general ranking with “very high” importance level (4.47) and with “high” current level of impact (3.69). This is because effects of green buildings on (i) the creation of a popular alternative by accelerating the implementation in the last decade, (ii) the use of advanced technology facilities, (iii) the resemblance to intelligent buildings and sometimes the design of intelligent green buildings, and (iv) the higher initial investment cost makes the quality of life (comfort) perception for investors more important and creates an expectation in this respect.

Table 5. RII and Importance Levels of Social Sub-Factors

No.	Social factors	RII	Importance level	5	4	3	2	1	Overall ranking	Result
1	Quality of life (comfort) perception	4.47	VH	53.12	40.63	6.25	0.00	0.00	7	√
2	New customer needs	4.28	VH	37.50	53.12	9.38	0.00	0.00	12	
3	Education level of people	4.09	H	40.62	37.50	15.62	3.13	3.13	15	
4	Customer habits	4.03	H	37.50	34.38	21.87	6.25	0.00	17	
5	Growth rate of population	3.25	M	18.75	21.87	31.25	21.88	6.25	29	
6	Demographic structure of population (age distribution)	2.63	M	6.25	6.25	43.25	31.25	12.5	30	
General Average		3.79	H							

Table 6. RII and Current Levels of Impact of Social Sub-Factors

No.	Social factors	RII	Current level of impact	5	4	3	2	1	General ranking	Result
1	Quality of life (comfort) perception	3.69	H	31.25	37.50	9.38	12.50	9.38	7	√
2	New customer needs	3.53	H	28.13	25.00	28.13	9.37	9.37	12	
3	Education level of people	3.38	M	21.88	28.12	28.12	9.38	12.5	18	
4	Customer habits	3.34	M	25.00	28.13	15.62	18.75	12.5	22	
5	Growth rate of population	2.59	L	12.50	6.25	28.13	34.37	18.75	29	
6	Demographic structure of population (age distribution)	2.25	L	3.12	6.25	34.38	25.00	31.25	30	
General Average		3.13	M							

3.4. Technological factors

The second most important group among six factor groups was found as technological factors with “very high” importance level (4.34) and “high” current level of impact (3.53) (Tables 7 and 8). Within this group, presence of qualified construction contractors, presence of qualified construction materials, and advanced technology (automation) facilities were placed in top rankings with their “very high” importance levels. In terms of the current level of impact, presence of qualified construction contractors and advanced technology (automation) facilities found their places among the top ranking. In fact, qualified contractors, qualified materials, and advanced technology (automation) facilities are essential for the green building industry. Nevertheless, the reduction of the existing impact levels of the same factors reveals that there are shortcomings in practice in Turkey. In other words, sufficient qualified contractors, easily accessible and economical construction materials, and automation facilities in the green building industry in Turkey can be found with difficulty compared to traditional buildings.

Table 7. RII and Importance Levels of Technological Sub-Factors

No.	Technological factors	RII	Importance level	5	4	3	2	1	General ranking	Result
1	Presence of qualified construction contractors	4.50	VH	59.37	31.25	9.38	0.00	0.00	6	√
2	Presence of qualified building materials	4.41	VH	53.13	40.62	0.00	6.25	0.00	8	√
3	Advanced technology (automation) facilities	4.34	VH	46.88	40.62	12.50	0.00	0.00	10	√
4	Innovation possibilities	4.28	VH	43.75	40.63	15.62	0.00	0.00	13	
5	Presence of qualified construction workforce	4.19	H	40.63	40.63	15.62	3.12	0.00	14	
General Average		4.34	VH							

Table 8. RII and Current Levels of Impact of Technological Sub-Factors

No.	Technological factors	RII	Current level of impact	5	4	3	2	1	General ranking	Result
1	The presence of qualified construction contractors	3,75	H	31.25	31.25	25.00	6.25	6.25	5	√
2	Advanced technology (automation) facilities	3,59	H	25.00	28.13	31.25	12.50	3.12	10	√
3	Presence of qualified building materials	3,56	H	25.00	34.38	18.75	15.62	6.25	11	
4	Innovation possibilities	3,43	H	15.62	37.50	25.00	18.75	3.13	16	
5	Presence of qualified construction workforce	3,31	M	15.63	34.37	28.12	9.38	12.50	23	
	General Average	3,53	H							

3.5. Environmental factors

Among six main factors, the top group was found to be environmental factors with “very high” importance level (4.46) (Table 9) and “high” current level of impact (3.45) (Table 10). Given that the purpose of green buildings is to protect the environment, the importance of this factor group can be easily understood. Sub-factors apart from geographical location were in the top five rankings in terms of the importance level and the current level of impact. However, as in all other factor groups, there was a decrease in the current level of impact of sub-factors in this group. The decrease in (i) local, national, and international applications on environment, (ii) energy infrastructure and efficiency, (iii) recycled / converted construction material market, and (iv) waste management points out shortcomings and difficulties in practice. Although there is proper legislation in terms of applications on the environment side, there are drawbacks especially in the control and supervision of such applications. The lack of knowledge and experience observed in design and construction in Turkey is a factor that reduces the efficiency level of renewable energy systems. Given recycled / converted materials, the supply and demand of such materials in the industry is very limited, contractors cannot easily reach them, and these materials generally create weak and poor quality perception on customers. Regarding waste management, although a number of legal regulations have been made in Turkey for the construction industry in recent years, it is known that the industry is still far from good waste disposal and recycling practices. In Turkey, there are only a few facilities that recycle construction and demolition wastes. The decline in ecological sustainability may be due to the perception that it may not bring an economic benefit to investors.

Table 9. RII and Importance Levels of Environmental Sub-Factors

No.	Environmental factors	RII	Importance level	5	4	3	2	1	General ranking	Result
1	Energy infrastructure and efficiency	4.75	VH	78.10	18.70	3.10	0.00	0.00	1	√
2	Local, national, and international applications on environment	4.68	VH	71.90	25.00	3.10	0.00	0.00	2	√
3	Ecological sustainability	4.68	VH	75.00	21.80	0.00	3.20	0.00	3	√
4	Waste management	4.41	VH	56.25	31.25	9.40	3.10	0.00	9	√
5	Recycled / converted construction material market	4.31	VH	53.12	31.25	9.38	6.25	0.00	11	
6	Geographic location	3.93	H	34.37	40.63	12.5	9.37	3.13	21	
	General Average	4.46	VH							

Table 10. RII and Current Levels of Impact of Environmental Sub-Factors

No.	Environmental factors	RII	Current level of impact	5	4	3	2	1	General ranking	Result
1	Local, national, and international applications on environment	3.81	H	37.50	28.13	21.87	3.12	9.38	3	√
2	Energy infrastructure and efficiency	3.78	H	34.38	34.38	15.62	6.34	9.38	4	√
3	Ecological sustainability	3.47	H	28.12	28.12	18.76	12.50	12.50	14	
4	Recycled / converted construction material market	3.34	M	21.87	31.25	18.75	15.63	12.50	19	
5	Waste management	3.34	M	18.75	31.25	25.00	15.63	9.37	20	
6	Geographic location	2.93	M	9.37	25.00	25.00	31.26	9.37	26	
	General Average	3.45	H							

3.6. Legal factors

Legal factors were a group with “high” importance level (4.07) (Table 11) and “high” current level of impact (3.44) (Table 12). Among four sub-factors, environmental regulations, which is ranked fourth in terms of the importance level and first in terms of the current level of impact, is significant. This can be explained by the fact that the concept of environment is the most important component of the green building industry [2] and that legal arrangements to be made in this regard are expected to directly and strongly influence the industry. Although some progress has been achieved in legislation in the context of European Union harmonization in Turkey, there are various difficulties in terms of the implementation and adaption of laws. Also, public and private sectors cannot completely perform their own duties due to several reasons (physical disabilities, financial constraints, etc.).

Table 21. RII and Importance Levels of Legal Sub-Factors

No.	Legal factors	RII	Importance level	5	4	3	2	1	General ranking	Result
1	Environmental regulations	4.59	VH	65.63	28.12	6.25	0.00	0.00	4	√
2	Difficulties in adaptation of the certification system	4.06	H	31.25	56.25	6.25	0.00	6.25	16	
3	Consumer related regulations	4.03	H	31.25	46.88	15.63	6.25	0.00	18	
4	Regulations on import	3.59	H	25.00	34.38	18.75	18.75	3.12	26	
General Average		4.07	H							

Table 32. RII and Current Levels of Impact of Legal Sub-Factors

No.	Legal factors	RII	Current level of impact	5	4	3	2	1	General ranking	Result
1	Environmental regulations	3.90	H	37.50	31.25	18.75	9.38	3.12	1	√
2	Difficulties in adaptation of the certification system	3.50	H	21.87	31.25	28.13	12.50	6.25	13	
3	Consumer related regulations	3.34	M	12.50	37.50	25.00	21.88	3.12	21	
4	Regulations on import	3.00	M	18.75	9.38	34.37	27.12	9.38	25	
General Average		3.44	H							

4. Discussion

Results of the study are shown between Tables 1 and 12. In the Result column, the most significant ten sub-factors were marked with “√”. These were four of environmental factors (with “very high” importance level), three of technological factors (with “very high” importance level), and one from each group of political, social, and legal factors (with “very high” importance level). However, none of sub-factors from economic factors with “very high” importance level was placed in this list (Table 13).

Table 43. A Summary of Results of Importance Levels of Factors Affecting the Green Building Industry

Group of factors	Importance Level	General Ranking
<i>Political factors</i>	High	4
Subvention	Very High	5
<i>Economic factors</i>	High	6
<i>Social Factors</i>	High	5
Quality of life (comfort) perception	Very High	7
<i>Technological factors</i>	Very High	2
Presence of qualified construction contractors	Very High	6
Presence of qualified building materials	Very High	8
Advanced technology (automation) facilities	Very High	10
<i>Environmental factors</i>	Very High	1
Energy infrastructure and efficiency	Very High	1
Local, national, and international applications on environment	Very High	2
Ecological sustainability	Very High	3
Waste management	Very High	9
<i>Legal factors</i>	High	3
Environmental regulations	Very High	4

According to the results presented in Table 14, three of economic factors (with “high” current level of impact), two from each group of technological and environmental factors (with “high” current level of impact), and one from each group of political, legal, and social factors (with “high” current level of impact) are among ten most effective factors.

Table 54. A Summary of Results of Current Impact Levels of Factors Affecting the Green Building Industry

Group of factors	Current level of importance	General ranking
<i>Political factors</i>	Moderate	5
Subvention	High	2
<i>Economic factors</i>	High	2
Exchange rates	High	6
Real estate prices	High	8
Interest rates	High	9
<i>Social factors</i>	Moderate	6
Quality of life (comfort) perception	High	7
<i>Technological factors</i>	High	1
Presence of qualified construction contractors	High	5
Advanced technology (automation) facilities	High	10
<i>Environmental factors</i>	High	3
Local, national, and international applications on environment	High	3
Energy infrastructure and efficiency	High	4
<i>Legal factors</i>	High	4
Environmental regulations	High	1

Conclusions

In this study, among six factor groups, environmental factors were determined as the most important factor according to the importance level. Moreover, this group were ranked as the third most important group regarding its “high” current level of impact. The second most important factor was technological factors with a “very high” importance level. Also, they were found to be in the first place with “high” importance level. Legal factors with “high” importance level and current level of impact took place in third and fourth rankings, respectively. Political factors were ranked fourth and fifth place with their “high” importance level and “moderate” current level of impact. Economic factors was in the sixth place with “high” importance level and second with “high” current impact level. Social factors were ranked fifth with “high” importance level and sixth with “moderate” current level of impact. As a result, it is seen that environment is the forerunner. In addition, the importance of quality materials due to the use of technological elements used in the construction phase of green buildings and the passive systems they contain was revealed by importance indices of technological factors. Economic factors were the least important group although they were in the second rank in terms of the current impact level. Looking at political factors, subsidy (governmental investment incentive) was at the forefront. In terms of social factors, the quality of life (comfort) perception was the forerunner. When legal factors are examined, environmental regulations attract attention. This shows that the most important dynamism of the industry, i.e., the environment concept, is an organic part of the green building industry, and regulations to be made in this regard will further strengthen the industry. In conclusion, it is necessary for industrial professionals to intensify their work on the top ten factors. Similarly, it will be more useful for researchers, who would like to take this topic further, to conduct detailed studies on these ten factors rather than repeating a group and factor analysis.

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