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Analysis of Spatial Organization in Architectural Works of Kemaleddin Bey Using Space Syntax: A Case Study of The 4th Vakıf Han[1]

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Abstract

Architect Kemaleddin was a leading figure in the first modern architectural movement in Turkey, known as the National Architecture movement. He combined Ottoman architectural elements with modern construction techniques to create innovative buildings that reflected the changing social structure of cities during the last periods of the Ottoman Empire.

The 4th Vakıf Han is one of the office buildings designed by Architect Kemaleddin. Its courtyard plan scheme is particularly noteworthy. The aim of the study is to examine the spatial organization of the building, interpret the interaction between the user and space, evaluate the building's positioning within the region, and reveal how users perceive the spaces through spatial analysis.

The study is unique as it contributes to the literature by providing insights into the social and economic structure of the period through space and by measuring how users perceive the space. The Space Syntax method was used to analyze the floor plans of the Fourth Vakıf Han, which provided visual and numerical data for the study. Based on these values, spatial readings were made.

The research findings showed that commercial spaces had the highest user circulation, social interaction, and communication, and that they were located in the right places in the planning. The building's location within the region was designed to increase user-space interaction. This study provides valuable insights into the socio-cultural and economic structure of the period in which the building was constructed.

1. INTRODUCTION

The 1st National Architecture movement emerged in response to the westernization movements that impeded the progress of Turkish architecture and heavily influenced it with foreign styles. Architects Kemaleddin and Vedat Bey were pioneers of this modernization movement. Although this period marks the beginning of Turkish architecture's modernization, it is noteworthy that the buildings of this era still incorporated classical Ottoman traditional architectural elements. The designs of Ottoman architecture were evident in the buildings, while the Western concept of architectural mass was combined with Ottoman architectural features. (Köroğlu,2004). In this era, masonry, reinforced concrete and steel bearing structures were commonly used, blending both new and traditional techniques. (Dabanlı,2021).

Following the 2nd Constitutional Monarchy, there was a pressing need to revamp the state's institutions. This involved restoring and upkeeping various structures, including mosques and social complexes under the purview of the "Evkaf Nezareti" (Ministry of Foundations). To execute this responsibility, the esteemed Architect Kemaleddin was appointed. Drawing from his extensive training overseas, Kemaleddin revolutionized Ottoman architecture by incorporating innovative construction techniques in all his projects. (Yavuz ve Özkan,1985). During this period, a number of Ottoman buildings were repaired. When evaluating the spatial characteristics of the architecture of this era, it becomes apparent

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that the stylistic effects were more evident in the design of building facades rather than the architectural plans. (Sözen, 1984). The architectural designs of a particular era reflect the predominant influence of Western design. However, it is observed that the Ottoman style of spatial arrangement in monumental structures was retained. Consequently, a symmetrical plan and facade design was commonly employed. (Çolak ve Eraslan,2021). During the National Architecture period, European construction techniques were incorporated into national culture, resulting in a unique approach to building. Notably, architect Kemaleddin's foundation office buildings showcase early examples of reinforced concrete and steel being used together in construction. The facades of these buildings exhibit a symmetrical structure, while the ground floors are dedicated to shops and the upper floors to offices. Of these buildings, 4th Vakıf Han stands out as a prime example of architecture being defined by its facade design during this era. (Tekeli ve İlkin,1997). The 4th Vakıf Han is an exemplary building that encompasses all the characteristics of the 1st National Architecture era. This investigation seeks to analyze the spatial arrangement of the 4th Vakıf Han, a creation of the renowned Architect Kemaleddin, which has a significant place in the history of Turkish architecture. Additionally, the aim is to decipher the interplay between the occupant and the space. It was selected as the focal point of the study due to its innovative courtyard plan, a unique spatial configuration that broke new ground in Ottoman architecture. (URL1). The objective of this study is to gain insight into the spatial arrangement of the 4th Vakıf Han, a structure designed by Architect Kemaleddin. Through this investigation, we aim to interpret the interplay between the user and the physical environment, establish the semantic dimension of the building's spaces, and assess the sociocultural infrastructure of the era in which it was constructed, as well as its location within the settlement. To achieve these goals, we utilized the Space Syntax methodology, employing the Syntax 2D and DepthmapX 0.30 software tools.

2. METHOD

The study employed the Space Syntax method, a popular spatial analysis technique utilized in various scientific investigations. This methodology involves a morphological and typological analysis of space, which provides insights into how it is experienced and perceived by users, whether indoors or outdoors. By concentrating on spatial features, it seeks to comprehend design in terms of form, aesthetics, orientation, and context (Zolfagharkhani, M.; Ostwald, M.J. 2021). It allows the dominant social infrastructure and hierarchical order of society to be read through spaces (Hiilier,1984, Peponis, J & Wineman,2002, Memerian 2022). According to Oswalt and Dawes (2018), the arrangement of buildings, specifically the spatial relationships between various spaces, can reveal important insights into the social fabric of a community. This approach was taken in the study to gather both visual and numerical data that could shed light on the cultural, economic, and social aspects of the 4th Vakıf Han during its construction, as well as provide a deeper understanding of user behavior, tendencies, and lifestyles within these spaces. The Space Syntax method, utilizing the Syntax 2D software, was used to obtain integration, connectivity, and mean depth values for the ground and first floors, which formed the basis of the study's database. Other floors were not considered, as their plan schemes were identical to that of the first floor. These three key values were then used to determine how spatial relationships and locations impacted the overall spatial organization. According to Syntax, centrally located spaces within a plan tend to promote greater social interaction and togetherness, with higher integration values. Areas with a high depth value, on the other hand, are typically more private and used for individual purposes. However, these spaces with higher user traffic tend to be the most integrated within the system, indicating a direct link between numerical values and behavioral patterns. (Khaki,2008, Oswald & Dawes,2008). Following an in-depth analysis of the building's interior, axial analysis was conducted using the DepthmapX 0.30 program to assess its placement within the urban landscape. Axial analysis, a method employed in Space Syntax, is commonly used in urban research to predict user mobility and distribution within the city. With the creation of axial maps, the longest viewing distance for pedestrians navigating through the urban space from their current location can be determined. These maps depict the longest and shortest lines passing through open areas within the settlement, indicating mobility and integration values. Streets with long and dense lines suggest high integration values, making them the most integrated areas within the system with intense mobility. (Alemdar ve Özbek,2021). In the axial analysis of the 4th Vakıf Han structure, the study questioned the building's position within the settlement and the correct location of spaces in it, on an urban scale.

3. 4th VAKIF HAN

During the late 19th and 20th centuries, Istanbul became an important trade center. Although it has received criticism for damaging the city's historical texture, the areas between Eminönü, Laleli, and Beyazıt have seen an increase in the number of commercial buildings constructed, making them the most densely built places for business establishments (Köroğlu, 2004) (Figure 1). During the XV and XX centuries, Ottoman foundations operated hans as commercial enterprises to generate income. These hans were typically two-story structures that featured ground floors used as shops and storage areas, while upper floors were designated for offices. Although there were changes in their design, function, and material properties over time, they generally followed a two-story architectural plan with an inner courtyard. (Hakyemez ve Gönül, 2014). During the 15th and 19th centuries, Han architecture progressed and advanced, but later started to slow down. Materials such as steel, glass and cement became more widely used in Turkish architecture. Steel allowed for long spans to be bridged, while glass was used as a cover over open courtyards. The 4th Vakıf Han, which is the subject of this study, consists of ground floor shops for commercial activities and upper floors with administrative offices that were necessary during the period when companies began to form. (Gülenaz, 2010). During this period, it was observed that the residential structures were built vertically with multiple stories instead of horizontally (Fıgure 2).

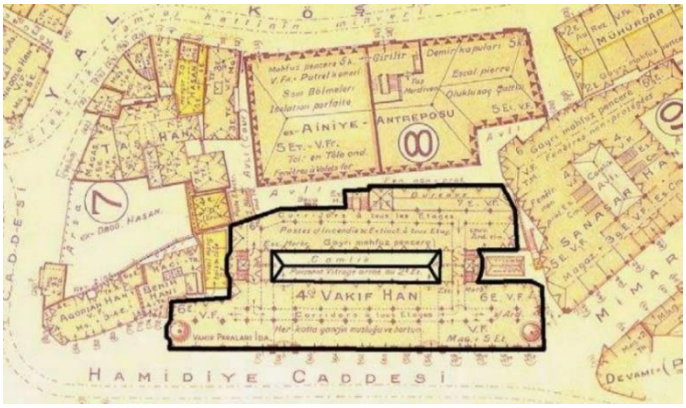

Figure 1. *Plan of 4th Vakıf Han*

Figure 2. *Old View of Vakıf Han*

In 1911, a decision was made to sell the old buildings of the foundations and replace them with new buildings that could generate commercial income. As a result, 4th Vakıf Han was constructed between 1911 and 1926. The new building was built on the site of the almshouse that belonged to the Abdulhamid I Complex, at the intersection of Mimar Kemaleddin and Hamidiye Streets in the commercial center of Istanbul (Erol, 2013). The construction of an office building began in 1912. However, due to the war, the project was left incomplete and finally finished in 1926. The usable area of the building is approximately 1936 m². It was named 'Caserne Victor' and used as a military headquarters by French soldiers for a while, even though its interior was not completely finished. (Ortabağ, 2008). Although initially designed as an office building, it was also utilized as a military barracks and a business center at times. (Hakyemez and Gönül, 2014). (Figure 3, Figure 4).

Figure 3. *4th Vakıf Han Earth View*

Figure 4. *4th Vakıf Han Today*

The building had been in commercial use for several years after 1926. However, it was not utilized for this purpose in 2000. Instead, it was given the function of the Istanbul Courthouse and served as a commercial office and Istanbul Chamber of Commerce and Industry until 1948, undergoing several repairs throughout this period. On June 25, 1983, the Istanbul No. 1 Cultural and Natural Heritage Real Estate Works Board registered the building with decision number 15185 (Istanbul No. IV Cultural Heritage Protection Regional Board Directorate). After remaining idle for many years, the office building was rented from the General Directorate of Foundations and converted into a hotel in 2007, serving in the field of tourism.

3.1. 4th Vakıf Han Spatial Features

The building is unique in that it is designed to take the exact shape of the land on which it is located, resulting in a trapezoidal shape and a courtyard plan. One of its sides is next to another office building. The building's rear part has been gradually expanded over time to match the shape of the land perfectly. The building has six floors above the basement, and one of its facades is adjacent to the building. On the ground floor, there are shops along Hamidiye Street on the front facade and in the inner courtyard shaped as a "U". Offices are located on the upper floors, with stairs and elevators connecting them. The mezzanine floors of the 24 shops on the ground floor are accessed from two entrances on this floor. (Hakyemez ve Gönül,2014). (Figure 5).

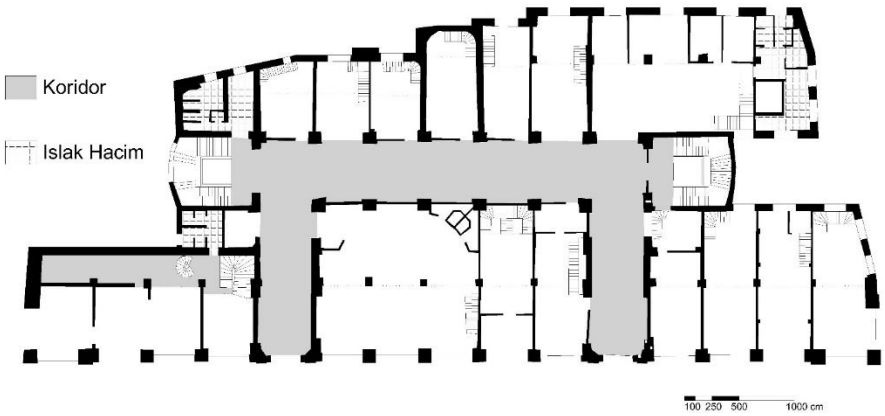

Figure 5. *4th Vakıf Han ground floor plan*

There are a total of 148 offices in the building, where there are 37 offices on each floor ranging in size from 17-28 square meters and interlocking (4th Vakıf Han, 2005, Restitution Report). It is thought that the transition between the offices is due to the corporatization understanding of the period, and the fact that companies work by renting the entire floor instead of renting an office one by one (Hakyemez and Gönül, 2014). In addition, on this floor, apart from the offices, there are service spaces such as stairs, elevators, warehouses, WCs. The staircase at the back is a service staircase. There is also a boiler office and warehouses in the basement of the building. (Figure 6).

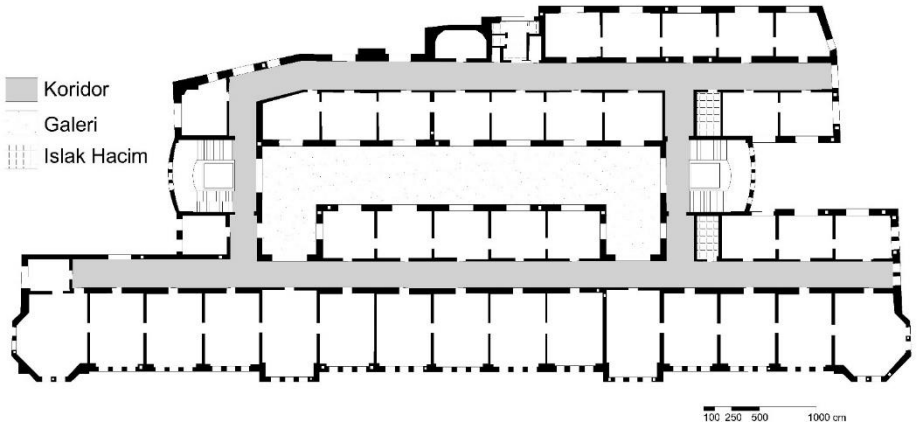

Figure 6. *4th Vakıf Han upper floor plan*

3.2. 4th Vakıf Han Facade Features

A symmetrical setup stands out on the front façade (Batur, 2008). To emphasize the entrances, overhangs carried by stone consoles were placed on the two entrance doors. It is seen that the front façade of the building was designed more carefully and ostentatively compared to the rear façade, and this understanding was also reflected in the interior design. While the back façade is made entirely of brick, the front façade features significant embellishments including cut stone columns, muqarnas, decorative plates between floors, and colored tile decorations. The entire façade consists of 15 modules in the vertical plane, and when evaluated horizontally, it gives the impression that it consists of 3 separate sections passing through the first and fourth floors. The arches on the windows have a character that narrows and becomes thinner as you go to the upper floors. At the corners of the top floor of the building, there are domes that give the dome a monumental effect. (Figure 7).

Figure 7. *4th Vakıf Han Facade Details*

3.3. 4th Vakıf Han Material and Structural Properties

The front façade of the building, which was built with a steel frame, is plastered with cut stone and the back façade is plastered with brick material. The roof form of the building is a hipped roof carried by steel trusses, and the top of this roof is covered with asbestos sheets (Yavuz, 1981). The building, which has 70 cm load-bearing walls, is also the first building in Istanbul with a concrete foundation (Hastaoğlu, Martinidi,2011).

4. FINDINGS

The 4th Vakıf Han's ground floor and 1st floor plans were analyzed using the Syntax 2D program. The program generated integration maps that provided both visual and numerical data. The maps showed color transitions between blue and red, which are illustrated in Figure 8 and Figure 9. Furthermore, the integration values, depth, and connectivity of all areas were obtained and are presented in Table 1 and Table 2.

4.1. 4th Vakıf Han Spatial Analysis

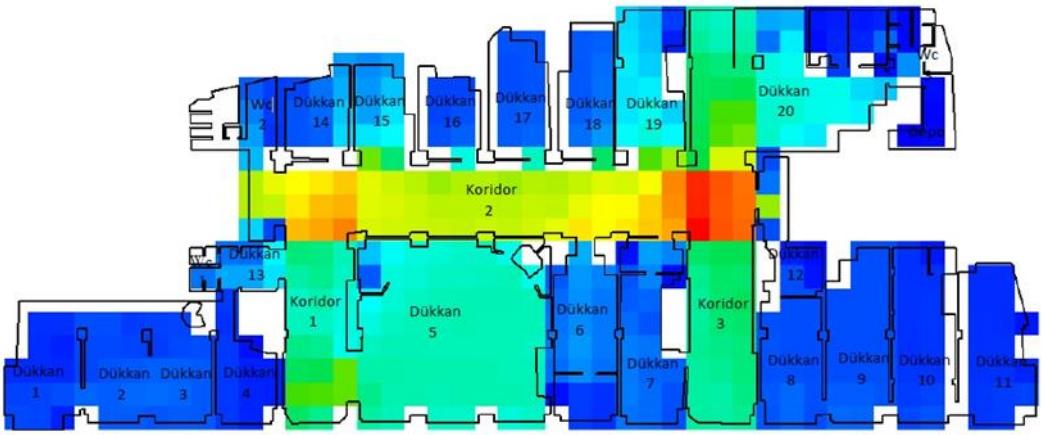

Figure 8. Ground Floor İntegration Map

Figure 9. *1st Floor İntegration Map*

The three values that are used to assess the accessibility and connectivity of a space: depth, connectivity, and integration are shown in Table I and Table II. Depth refers to the degree of accessibility of a space, with a higher value denoting a greater level of difficulty in reaching it and a more pronounced disconnection from the system. Connectivity, on the other hand, quantifies the direct connections between a space and its surrounding areas. Meanwhile, integration pertains to the position and interrelationships of

the space within the system as a whole. A higher integration value indicates that the space is more significant and integrated into the system. In syntactic analyses, the values of depth and cohesion are typically inversely related. (Hillier and Hanson, 1984). The concept of depth and integration values refers to the level of accessibility of a space. A higher depth value means that the space is more difficult to access and less connected to the overall system. On the other hand, the transition to the target space is an important factor. The value of connectivity is also relevant in this context. (Hillier and Hanson, 1984). The importance of connectivity is determined by the direct connections of a space with its surrounding spaces, while the significance of integration is related to the location and relationships of the space within the entire system. The greater the value of integration, the more dominant and integrated the space is within the system. In syntactic analyses, depth and cohesion values typically have an inverse relationship (Hillier and Hanson, 1984).

Table I. *Syntactic Values Obtained From Ground Floor Spatial Analysis*

Venue name	**Depth**	**Connectivity**	**Integration**
Shop 1	5.63	15	757
Shop 2	5.25	25	1444
Shop 3	4.68	29	1691
Shop 4	4.89	8	584
Shop 5	3.76	67	6157
Shop 6	3.38	23	2444
Shop 7	4.20	16	1464
Shop 8	4.09	16	1302
Shop 9	3.26	12	1326
Shop 10	4.91	20	1291
Shop 11	4.97	14	878
Shop 12	3.26	12	1326
Wc 1	3.03	24	2907
Shop 13	3.03	24	2907
Wc 2	3.11	18	2208
Shop 14	3.23	14	1780
Shop 15	3.31	20	2740
Shop 16	3.46	10	1213
Shop 17	3.53	12	1294
Shop 18	3.40	13	1507
Shop 19	3.27	33	4102
Shop 20	3.25	44	5215
Wc 3	4.25	2	181
Depot	5.24	2	131
Corridor 1	3.03	44	5817
Corridor 2	2.63	76	11.483
Corridor 3	2.96	68	8321

Table II. *Syntactic Values Obtained From First Floor Spatial Analysis*

Venue name	Depth	Connectivity	Integration
Office 1	3.45	12	1122
Office 2	3.47	6	507
Office 3	3.44	12	1072
Office 4	2.81	17	1894
Office 5	3.44	13	1191
Office 6	4.41	8	626
Office 7	3.46	7	615
Office 8	4.38	10	777
Office 9	3.43	12	1051
Office 10	3.43	12	1073
Office 11	4.41	10	795
Office 12	3.16	10	1058
Office 13	3.47	6	508
Office 14	3.43	12	1074
Office 15	4.37	12	950
Office 16	3.77	4	318
Office 17	3.44	7	617
Office 18	4.45	3	250
Office 19	3.43	8	658
Office 20	3.44	10	951
Office 21	3.44	10	950
Depot 1	3.49	3	357
Office 22	3.47	6	663
Office 23	3.44	11	1089
Office 24	3.43	8	682
Office 25	3.43	10	924
Office 26	4.12	6	379
Office 27	4.12	6	378
Office 28	4.14	4	276
Office 29	5.13	3	165
Office 30	4.10	9	580
Office 31	4.12	6	411
Office 32	4.11	7	445
Depot 2	5.14	3	181
Office 33	4.13	4	277
Office 34	5.10	5	267
Office 35	5.14	1	65
Wc	4.11	5	346
Office 36	5.09	5	283
Office 37	4.12	6	379
Office 38	3.51	4	341
Office 39	4.12	7	444
Office 40	4.12	6	394
Corridor 1	2.49	85	11775
Corridor 2	3.16	34	3260
Corridor 3	2.79	18	2267
Corridor 4	2.89	11	1350

4.2. 4th Vakıf Han Urban Location Analysis

The road network around the 4th Vakıf Han was created on satellite images and subjected to axial analysis with the DepthmapX 0.30 program. The connectivity values obtained from the spatial layout analysis of the building were ranked from one to six, with one being the lowest and six being the highest. The analysis revealed that Hamidiye Street, located to the south of the building, had a connectivity value of 5, while the side street entered from Yalı Köşkü Street, which the shops in the north overlook, had a connectivity value of 1. This means that the shops facing the south facade have higher connectivity values compared to the northern shops that are accessed through the building, which confirms the findings of the spatial layout analysis at the urban scale. (Figure 10).

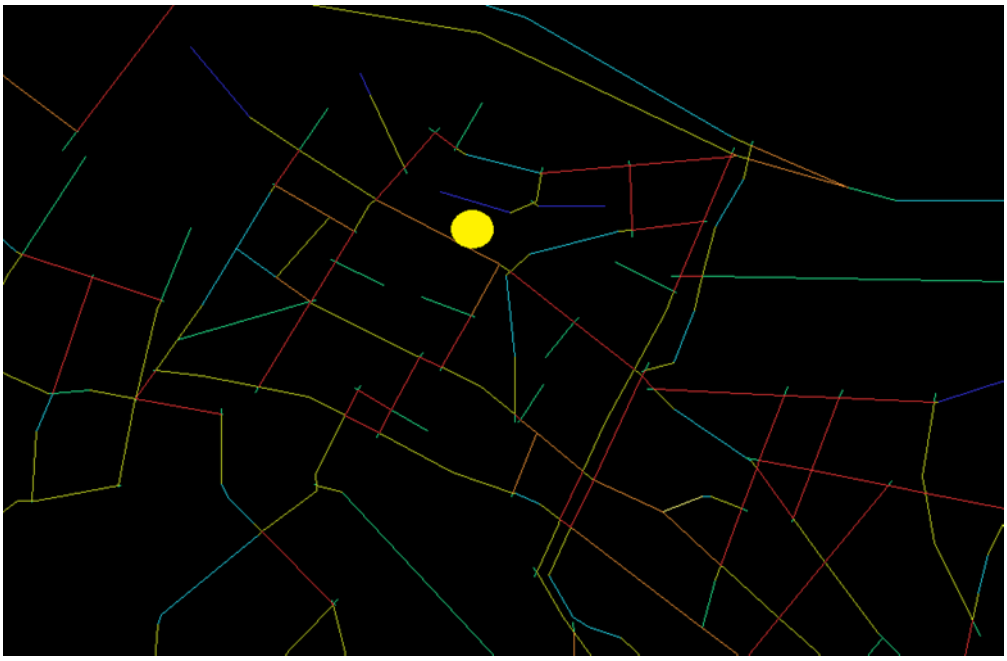

Figure 10. *4th Vakıf Han Axial Analysis Map*

5. DISCUSSION and EVALUATION

- ✓ According to the syntactic results of ground floor spatial analysis, the integration value ranking of the spaces is as follows:

Corridor 2> Corridor 3>Shop 5> Corridor 1>Shop 20> Shop 19> Shop 15> Shop 14

As seen in Table 1, Corridor 2, which is the place with the highest integration value on the ground floor, is located in the courtyard, at the intersection of the shops facing the rear and front facades, and is the area with the highest pedestrian circulation. This location holds the most central and prominent position in the system, with the lowest depth value. By providing access to the back shops through this corridor, the integration value of these shops has increased. Corridor 3, connecting to Hamidiye Street, the axis with the highest integration value in the main street and axial analyses, is the second most integrated area in the system after Corridor 2. The primary entrance into the building along the street being through Corridor 3 aligns with pedestrian movement and direction on Hamidiye Street, confirming the accuracy of this finding. Additionally, shop number 5's position on the integrated axis (Hamidiye Street), right next to the entrance axis of the building (Corridor 1), where access is more frequent, and with its entrance from here, has resulted in high integration values for both Shop 5 and Corridor 1. The shops numbered 7, 8, and 4, despite being located on the main entrance axis, cannot be accessed from Corridor 3. This is due to the dividing walls between them, which have reduced their integration values. On the other hand, shops 20 and 19 have been connected to Corridor 3 and Corridor 2, which has increased their integration values. Shop number 5 has a higher integration value than shop number 20 because it is not divided by any walls.

The more a space is divided, the more its depth value increases. However, since shops 19 and 20 are directly connected to Corridor 2, they have less depth value than shop number 5. Shops 15 and 14, located at the intersections of Corridor 2 and Corridor 1, have high integration values and are on the entrance axis. The shops and toilets numbered 1, 2, 10, and 11 have the lowest integration values and are generally disconnected and isolated from the system. They are located at the corners of the plan scheme and have the highest depth value. The shops facing Hamidiye Street have external entrances and higher circulation, resulting in higher integration values than the shops facing the inverted "U" shaped corridor. Therefore, the shops facing the corridor are identified as deeper spaces.

- ✓ According to the syntactic results of the 1st floor spatial analysis; The integration value ranking of the offices is as follows:

Corridor 1> Corridor 2> Corridor 3>Office 4> Corridor 4>Office 5>Office 1>Office 23

After analyzing the plan scheme values, it was found that the corridors had the highest integration values. Corridor 1 had the highest value because it had more offices on the side of the building facing Hamidiye Street, and it was the most accessible. Corridors 2 and 3 also had high integration values because they connected to all the offices. Office 4 also had a high value because it opened to Corridor 1. Offices 5, 12, and 1 were also highly integrated because they connected to Corridor 1. The integration value of offices on Corridor 1 was higher than those on Corridor 2. Offices 35 and 29 were identified as the deepest and most isolated parts of the system, as they were farthest from the stairs and elevators. As the distance from the stairs increased, the depth of the spaces increased, making access more difficult.

6. CONCLUSION

The 4th Vakıf Han is a significant building that bears witness to its era's architecture, design, and impact on the city. It is a testament to the 1st National Architecture movement and has maintained its unique planning approach, design decisions, façade layout, and workmanship to this day. The building features shops and offices on the ground and upper floors, respectively. Unlike other foundation office buildings designed by Kemaleddin, the bedroom floors have a uniform plan scheme with a skylight space between the corridors. A spatial analysis of the building was conducted using the Space Syntax method, which determined its spatial organization and evaluated the relationships between spaces. The building's location on Hamidiye Street, an important touristic route that connects to the Spice Bazaar and Eminönü Square, was also evaluated. Based on axial analysis, it was determined that the strongest pedestrian axis is in the south direction, and pedestrian movement on Hamidiye Street continues intensively in the east and west directions. The building's positioning parallel to the street has been deemed advantageous in terms of pedestrian accessibility, resulting in a higher value for the property. The shops located on the south side of the building, with entrance points facing the functional street, have facilitated pedestrian access, resulting in increased foot traffic. The shops are situated in the part of the building that dominates the overall spatial organization, emphasizing the interaction between space and user. To optimize the design principle, more shops were placed facing Hamidiye Street, with ground floors reserved for shopping areas and upper floors for offices. The concentration of offices on the upper floors, close to the main street and vertical circulations, further highlights the building's optimal design. Space Syntax principles suggest that areas closer to the most integrated areas in the general system show high integration values. The corridors on both the ground and upper floors of the 4th Vakıf Han have the highest integration values, indicating frequent and easily accessible use by the user.

The 4th Vakıf Han, a hotel designed by the renowned architect Kemaleddin Bey, is a significant piece of our cultural heritage that reflects the architectural style, socio-cultural influences, and economic structure of its time. Analyzing the spatial layout of buildings from the Republican era and the work of Kemaleddin is crucial to gaining insight into the social context of that era. Therefore, it is imperative to increase research in this area and prioritize the conservation of historical buildings.

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